FINANCING STORMWATER MANAGEMENT:

THE UTILITY APPROACH

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FINANCING STORMWATER MANAGEMENT:

THE UTILITY APPROACH

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By

Greg Lindsey

Sediment and Stormwater Administration
Maryland Department of the Environment
2500 Broening Highway
Dundalk, Maryland 21222

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1.0 INTRODUCTION

Urban stormwater runoff is a major source of pollution in the Chesapeake Bay.[1] To achieve targeted reductions in nutrient loadings to the Bay, stormwater management must be improved.[2] Because laws mandating stormwater management are relatively new, most local governments have not yet developed comprehensive programs. Few stormwater programs are well financed [3], and one-third or more of all stormwater management facilities are inadequately maintained [4,5,6]. It is clear that expenditures for stormwater management must increase if water quality goals are to be achieved.

Stormwater management historically has been financed with general revenues from property taxes. Most local officials, however, have considered stormwater management a low priority activity, at least relative to other important local programs. As a result, reliance on property taxes to finance stormwater management has proven inadequate. The best alternative to property taxes appears to be stormwater utility charges, which are "user" charges paid by owners of properties in proportion to some estimate of the amount of runoff from their properties.

The Chesapeake Bay Nutrient Reduction Program (Draft) recognizes that costs to implement urban stormwater controls will increase and that new funding sources will be needed. It proposes a stormwater utilities program.[7]

This guide has been written for local officials so that they can make informed decisions about creating utilities. This guide focuses on the financial, or revenue-generating aspects of utilities. Several of the many political, legal, administrative, and managerial aspects also are addressed, but only in a general way.

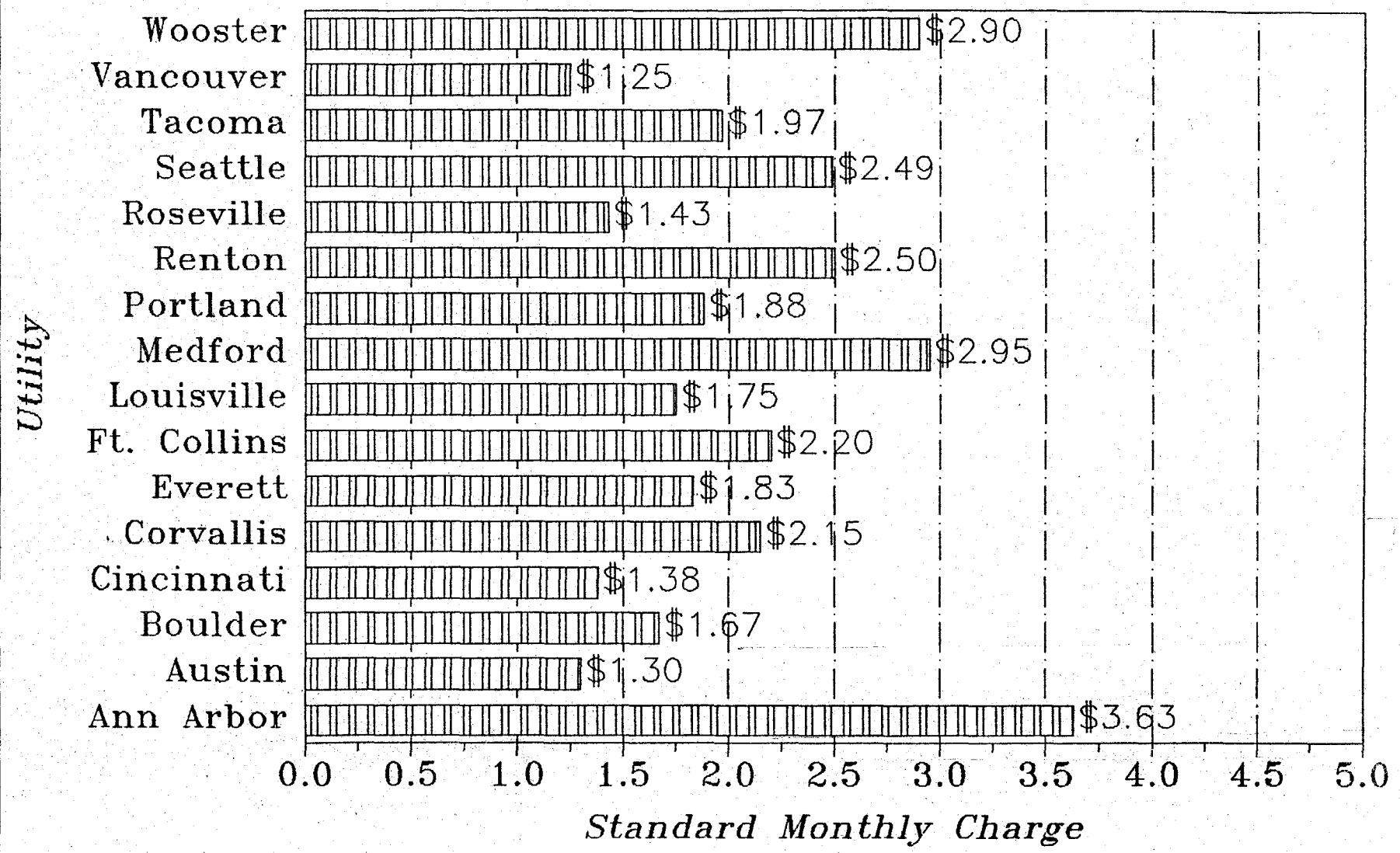
In the following section, stormwater utilities are defined, and their potential for revenue-generation is summarized. Subsequent sections concern the rationale behind the utility approach, general considerations in planning utilities, and details of establishing rate structures and estimating user charges.

This guide is based on the results of a survey of utilities by the Sediment and Stormwater Administration (SSA) [8], on articles published by officials and consultants involved with stormwater utilities, and on various technical reports. The survey, (A Survey of Stormwater Utilities), as well as many of the references, also may be of interest to individuals. Questions concerning the material herein should be addressed to the Sediment and Stormwater Administration, Maryland Department of the Environment.

Table 2.1 Examples of Utility Charges and Revenues [10].

Utility	Service Area Population	Monthly SFR Charge (1987)	Total Revenues from Charges (all categories)	Annual Revenue/ Capita	SFR Charges as % of all Charges	Developed Acreage	Annual Revenue/ Developed Acre	Total Acreage	Annual Revenue/ Gross Acre
Ann Arbor, MI	108,000	$3.63	NA	NA	NA	NA	NA	NA	NA
Auburn, WA	30,000	NA	$818,000	$27.27	NA	NA	NA	NA	NA
Austin, TX	450,000	$1.30	$4,440,000	$9.87	62%	88,000	$50.45	160,000	$27.75
Billings, MT	85,000	NA	$804,831	$9.47	NA	NA	NA	NA	NA
Boulder, CO	90,000	$1.67	$859,453	$9.55	37%	11,401	$75.38	16,762	$51.27
Cincinnati, OH	385,000	$1.38	$3,990,000	$10.36	32%	35,450	$112.55	49,920	$79.93
Corvallis, OR	42,000	$2.15	$546,000	NA	40%	NA	NA	NA	NA
Everett, WA	150,000	$1.83	$1,100,000	$7.33	NA	NA	NA	NA	NA
Ft. Collins, CO	80,000	$2.20	$1,078,219	$13.48	NA	NA	NA	NA	NA
Kent, WA	31,000	NA	NA	NA	NA	NA	NA	NA	NA
Louisville/ Jefferson County, KY	684,565	$1.75	$8,200,000	$11.98	NA	97,344	$84.24	242,079	$33.87
Medford, OR	45,000	$2.95	$850,000	$18.89	NA	NA	NA	NA	NA
Portland, OR	400,000	$1.88	NA	NA	24%	NA	NA	NA	NA
Renton, WA	34,460	$2.50	NA	NA	NA	NA	NA	NA	NA
Roseville, MN	36,000	$1.43	$530,000	$14.72	NA	5,540	$95.67	8,724	$60.75
Seattle/ King Co., WA	NA	$2.49	$7,424,926	NA	51%	NA	NA	NA	NA
Tacoma, WA	160,000	$1.97	$1,821,287	$11.38	40%	14,921	$122.06	23,663	$76.97
Vancouver/ Clark Co., WA	52,000	$1.25	$425,111	$8.18	62%	NA	NA	NA	NA
Wooster, OH	20,000	$2.90	NA	NA	32%	NA	NA	NA	NA

FIGURE 2.1 MONTHLY RESIDENTIAL CHARGES



Data available for 16 utilities.

generating potential for a stormwater utility in Prince George's County range from $4.9 to $23 million (Table 2.2). In this example, both of the estimates of revenues **per acre** are higher than the **per capita** estimate. This result occurs because most of the data on which the estimates are based are for municipalities, not counties. By estimating the charges on a county-wide basis, the acreage to be charged increases more, proportionately, than does the population. As a result, the estimated revenues per acre are greater than the estimated revenues per capita.

Prince George's County presently has one of the most comprehensive flood control and stormwater management programs in Maryland. The County's annual expenditures for these purposes are approximately $11,000,000. [13] Thus, current expenditures are near the mean of the crude per capita estimates, and near the low end of the estimates per acre. Assuming that the amount of revenues raised by other utilities are indicative of the amount that could be raised in Maryland, it appears that Prince George's County could raise additional revenues by establishing a utility. Flood control and stormwater programs in Prince George's County are financed by a dedicated property tax of 13.5 cents per $100 assessed valuation. [14] No other local governments in Maryland spend as much or have such a large funding source. It is likely, therefore, that the relative gain from creating utilities would be greater in other jurisdictions.

Like any governmental entity, the ability of a stormwater utility to generate revenues is governed ultimately by the willingness of people to pay for stormwater management. Revenues generated by existing utilities elsewhere are indicative of people's willingness to pay, but these amounts should not be regarded as absolute bounds. In any given situation, residents may be willing to pay more or less than the amounts cited here. A method for preparing more accurate estimates of the revenue generating potential of a utility, including typical user charges, is described in Section 5.

Table 2.2 Hypothetical Estimates of Stormwater Utility Revenues in Prince George's County.

Units	Range of Total Annual Revenues
Per Capita	$4.9 - 18.1 Million
Per Developed Acre	$9.0 - 21.7 Million
Per Acre	$8.0 - 23.0 Million
From Residences	$2.2 - 7.8 Million

3.0 THE RATIONALE FOR THE UTILITY APPROACH

Many people find it rather strange to be asked to pay user fees to a utility for the stormwater that runs off their property. This is because they are used to thinking about runoff (if they think about it at all) as something that occurs naturally, not something that is at least partially the result of people's decisions. Similarly, most people view stormwater management as a government service to solve a public problem, not a service that they use to manage runoff that they themselves generate. The utility approach thus involves a redefinition of the way in which people think about runoff and stormwater management. The basic perspective is that runoff is a man-made problem, and that owners of property are responsible for it.

Stormwater management historically has been provided by government and financed by property taxes. The rationale for government involvement is that there is a public benefit to the managing runoff. The rationale for the financing mechanism, taxes, is either (1) that higher-valued properties benefit more or (2) that owners of higher-valued properties are able to pay more for a public good, the benefits of which are available to everyone and cannot be quantified.

With the utility approach, the benefits of stormwater management are deemphasized, and emphasis is placed on the cause of the problem. Individual property owners are viewed as generators, and the role of government is to control the discharges. To finance the government's activities, property owners pay user charges in amounts proportionate to their discharges. The rationale for the utility approach, therefore, is the "polluter pays" principle. Neither property values and ability to pay nor perceived benefits and willingness to pay generally are considered.

Three definitions follow from this discussion [15]:

* Users are properties that add runoff to a system;

* Beneficiaries are people or properties that gain from stormwater management (e.g., are protected from flood damage or benefit from improved water quality);

* User charges are dedicated fees paid by generators of stormwater based on the amount of runoff that leaves their property.

The utility approach consists of practical application of these definitions. Care must be taken in the formation of utilities, particularly their rate structures, because utilities frequently are subject to controversy. Four of 19

utilities surveyed by the Administration reported legal challenges; in each case, the rate structure was questioned. Courts, however, have upheld creation of stormwater utilities and user fee systems. Cyre (1986) has summarized the legal standard that has evolved [16]:

> Charges must be fair and reasonable and bear a substantial relationship to the cost of service and facilities.

This standard is important. It says that local jurisdictions must have rational bases for making estimates of runoff and determining charges, but that runoff from parcels need not be measured precisely. Reasonably accurate estimates will suffice. Equally important, the standard does not mention benefits or beneficiaries. Utility rate systems may be based on costs, not benefits. In fact, the user charges imposed by most utilities are cost based and do not take benefits into consideration.

There is a consensus among public works officials that the utility approach is the best way to finance stormwater management. [17] The main reason for their preference is obvious: utilities are a stable, secure source of funds. Another important factor, however, is that many officials believe that the utility approach is more equitable. Many people think that user charges based on one's contribution to the problem are more fair than property taxes. The American Public Works Association (APWA) has concluded [18]:

> The user charge and the utility concept are the most dependable and equitable approaches available to local governments for financing stormwater management.

Planning for a stormwater utility involves determining the best way to apply the concepts discussed above in a particular locale. Various steps in the planning process are discussed in the following section.

4.0 PLANNING STORMWATER UTILITIES

The formation of a stormwater utility involves systematic consideration of a series of political, managerial, financial, and technical issues. These include:

* determination of the best administrative structure for stormwater management;

* estimation of revenue requirements;

* identification of potential sources of revenues and allocation of revenue requirements among sources;

* development of a billing system;

* adoption of a stormwater utility ordinance; and

* implementation of a public information program.

Each of these issues is addressed briefly in this section. The financial aspects of utility planning, including a general approach to estimating user charges, are discussed in detail in the following section.

4.1 Administrative and Managerial Considerations

Stormwater management historically has been inadequate, in part because responsibility for various activities has not been defined clearly. Therefore, planning for a utility often begins with what is sometimes referred to as a "functional requirements study." [19] Such a study involves determination of the scope of activities necessary to manage stormwater and identification of the administrative departments best suited to perform each activity. Functions typically performed by utilities include administration, planning, design and engineering, operations and maintenance, regulation and enforcement, construction, and, sometimes, water quality management. Clear specification of responsibilities for these activities will help solve management problems caused by fragmentation. It also will help a utility meet requirements for fiscal accountability.

Information on institutional structures for 19 utilities is included in the SSA publication, A Survey of Stormwater Utilities. Utilities generally are operated by or within Departments of Public Works, although this is not always the case. In some communities, a variety of Departments are involved, including the Departments of Finance, Utilities, Environmental Regulation, and Planning and Zoning. A common arrangement is for an agency such as the Department of Public Works to have responsibility for planning, design and

engineering, and operations and maintenance, and for the Department of Finance to have responsibility for billing.

At least two jurisdictions in Maryland recently have completed studies to determine how best to organize stormwater management. Prince George's County prepared an analysis when planning how to assume responsibilities for stormwater management from the Washington Suburban Sanitary Commission. [20] Anne Arundel County studied various administrative arrangements for stormwater management as part of a study to determine how best to organize watershed management programs. [21] Although these studies were not prepared as part of efforts to establish utilities, they are good examples of functional analyses. The Prince George's County study is particularly useful because of the tables and figures used to illustrate and evaluate institutional alternatives.

An issue that merits special consideration in a functional analysis is whether stormwater management facilities should be maintained by the public or private sector. A strong argument in favor of private maintenance is that maintenance by the private sector limits the direct public costs of stormwater management. However, recent surveys indicate that private stormwater management facilities are not being maintained as well as public facilities. [22,23] The APWA suggests that maintenance activities are best carried out by the entities with the "greatest interest in the specific benefits associated with each maintenance operation." [24] APWA also has identified factors to be considered in deciding whether detention facilities are to be privately or publicly owned, and notes that [25]:

> there appears to be a preference for and a trend towards public ownership ..... Generally, unless basins are maintained by public agencies, long term adequate maintenance can not be assured.

The Sediment and Stormwater Administration generally agrees with this conclusion.

4.2 Estimating Revenue Requirements

Determination of revenue requirements, or the total costs of stormwater management, is an important step in utility planning and is the first step in preparing the utility financial plan. Cyre (1987) has published ball-park estimates of costs for stormwater management. He reports that in most cities, basic stormwater administration, engineering, and <u>reactive</u> maintenance costs $15 to $25 per gross acre. [26] He also projects that comprehensive management, including drainage master plans, <u>preventive</u> maintenance, and major capital improvements may cost $100 or more per gross acre. Only two

of the six utilities that provided this information to the Administration currently spend more than $100 per developed acre. [27]

Accurate estimation of the costs of comprehensive stormwater management is complicated and time-consuming. Estimates of costs (i.e., revenue requirements) should be developed for all the functions of the utility. In practice, the range of activities financed by utilities varies greatly. Some utilities (e.g., Fort Collins, Colorado) fund both O&M and capital projects with utility revenues. [28] Others (e.g., Austin, Texas) use utility revenues only for planning and O&M and finance capital improvements by issuing general obligation bonds that are repaid with property tax revenues.

Sources of the information necessary to estimate total costs include historic records, old drainage and watershed plans, public works personnel, and unit costs for specific activities that are published in the literature. For example, Grigg (1986) reports costs for mowing, debris removal, and other routine activities. [29]

A current master drainage plan is essential for projecting costs of stormwater management, particularly costs of capital improvements. Accurate identification of capital improvements is necessary because maintenance costs often are projected as a percentage of capital improvements. Master plans are helpful for another reason: contested utilities are more likely to be upheld if charges are based on a master plan that specifies costs associated with a comprehensive stormwater program.

Frequently, maintenance costs are projected as a percentage of debt for capital improvements. King County, Washington, estimates that cost for maintenance of all facilities is 0.43% of total debt. [30] Schueler (1987) estimates that maintenance costs for best management practices range from 3% to 10%, although he notes that few reliable data for estimating costs exist. [31]

4.3 Identification and Allocation of Revenue Sources

Identification of potential sources of revenues and allocation of revenue requirements among sources comprises the remainder of the utility financial plan. Financing methods for each of the utility's functions and the amount to be raised by each should be specified. Table 4.1, in which financing options are grouped according to the purpose for which the funds typically are used, provides a general framework for this process. [32] As is shown, taxes and user charges are the only options for financing capital improvements and operations and maintenance, which are the most

Table 4.1. Financing Methods for Stormwater Management (after Cyre 1982 and 1983 [32]).

Use of Revenues	Source of Revenues	Developer/ User Pays	Taxpayer Pays	Other Pays
Operations & Maintenance				
	General Fund (property tax)		X	
	Utility Fee or Service Charge	X		
	Interfund Loans (for transition to utility)		X	
Major Capital Improvements				
Redevelopment or New Development				
	General Obligation Bonds		X	
	Revenue Bonds	X		
	Taxes on other utilities			X
	Grants (federal or state; e.g., Community Development Block Grants)			X
	Pay-as-you-go Sinking Fund		X	
	Tax Increment Financing		X	
Primarily New Development				
	Subdivision Exactions	X		
	Developer Incentives	X		
	Impact Fees	X		
	System Development Charges	X		
	General Facilities Charge	X		
	In-lieu of Construction Charges	X		
	Latecomer Fees for Extensions	X		
Regulatory Services				
	Plan Review & Inspection Fees	X		
	On-site Facility Inspection Fees	X		
	Penalties and Fines	X		
Special Services & Projects				
	Local Improvement Districts		X	
	Utility Local Improvement Districts		X	
	Area of Special Benefit Financing		X	
	Special Purpose Taxing Districts		X	
	Homeowners' Associations			X
	Voluntary Gifts			X

costly aspects of stormwater management. While other methods of financing exist (e.g., development fees), these are used primarily for financing stormwater management activities associated with new development. Based on survey results, these sources usually account for less than 10% of a utility's revenues. Given the inadequacy of property taxes as a revenue source, it is clear that the major task in this part of the planning process is selection of a utility rate structure and estimation of user charges.

When implementing a utility, planners must decide who will be charged, how they will be charged, and whether there will be any exemptions. Generally, in planning studies, estimates of user charges are developed from basic land use information; it is not necessary to have detailed data concerning the amount of impervious area on individual properties. For implementation, however, most utilities need this information. To obtain the data, it usually is necessary to digitize aerial photos or tax maps. The task of measuring parcels, if undertaken, is done during development of the billing system. It is one of the most time-consuming and expensive tasks in the creation of a utility.

4.4 Billing Considerations

Options for billing systems include:

1. Adding stormwater charges to other utility bills (e.g., water and sewer bills);

2. Adding stormwater charges to property tax bills;

3. Creating a new, separate billing system.

Advantages and disadvantages of alternative methods are presented in Table 4.2.

In practice, most utilities modify existing billing systems, adding new components as necessary to accommodate information needs or to include users not already on existing systems. Only four of 19 utilities surveyed by the Administration created entirely new billing systems. [33] Two of these were utilities that serve multiple jurisdictions. Most utilities use information from tax files and water accounts to construct billing systems; less than half of those surveyed digitized photos during implementation. Most utilities bill users monthly; some bill classes of users (e.g., commercial, industrial) with different frequencies.

In Maryland, if utilities were established, they most likely would be on a county-wide basis that would serve, at least nominally, multiple jurisdictions. Depending on the

Table 4.2. Options for Developing a Stormwater Utility Billing System.

Option	Frequency	Advantages	Disadvantages
Add to existing utility bill	usually quarterly or bimonthly	account structure is basically in place may minimize cost of new system benefits from local experience and expertise minimizes problem of adjusting to turnovers more frequent billing may improve cash flow reinforces idea that charge is a service fee and not a tax	existing system may not include all parcels to be charged may not have control over billing system existing system may not include parcel size or land use data costs could be high if cost of meter reading is not factored out of cost-sharing equation more frequent billing may cost more people may confuse sewer charge and stormwater charge
Add to property tax bill	usually annually, may be semiannually	tax assessor's files usually include parcel size and land use annual billing may minimize cost of billing most parcels to be charged will be in system may minimize cost of new system	may not be legal data in tax assessor's file may not be accurate enough for computation of charges annual billing results in poor cash flow people may confuse stormwater charge with property tax complicates problems associated with turnover on parcels
Create new system	as determined	complete flexibility in designing system to meet needs complete control over modifications to the system	probably highest cost to develop and maintain costs of billing are not shared data for development of system may be more difficult to obtain

current scope of county services and existing billing systems, it is likely that new systems would have to be created.

A useful document for understanding aspects of creating a billing system is the publication by URS Corporation, Surface Water Management, The Utility Approach: Drainage Utility Service Charge, Customer Account Development Process. [34] The development of a billing system consists of the preparation of a master account file, a billing file, and, in some cases, a transactions file. The MAF is a complete list of all properties (users) to be charged and includes information necessary to calculate the charge (e.g., parcel address, land use code, exemption code, impervious area, relevant map numbers). The billing file contains data used to prepare bills, including owner name, address, account number, billing dates, and current balance. Programs may be written so that certain information needed in the billing file is "looked up" in the MAF.

Cyre (1987) reports that the costs to develop and implement the MAF, billing file, and support systems can range from $50,000 to $150,000 for professional services plus $3 to $10 per account. [35] His data are somewhat higher than data collected by the SSA indicate: utilities reported costs to develop billing systems ranging from $0.05 to $7.82 per account. [36] The 19 stormwater utilities surveyed by the Administration report annual billing costs per account ranging from $1.00 to $8.64. The data show that the cost of billing can account for anywhere from 1.4% to 16.3% of total revenues from charges. The cost of billing apparently accounts for more than 5% of total revenues for seven of the 11 utilities for which these data are available. Estimates of the percentage of delinquent accounts range from approximately 0.2% to 10%. Nine of the 10 utilities reporting this information have delinquency rates less than five percent.

4.5 Stormwater Utility Ordinances

Prior to implementation of a utility, local governments must adopt legislation (ordinances or resolutions) that specifies the scope of the utility's activities, its rate structure, details of billing, and other items. This usually involves modification of existing ordinances. In Maryland, most local stormwater ordinances are patterned after a model ordinance written by the SSA. [37] The model ordinance, however, contains no references to stormwater utilities. The SSA, therefore, has prepared a supplemental publication, "Sample Stormwater Utility Ordinance," as a guide for local officials interested in establishing utilities. [38] It is based on a review of utility ordinances adopted by 19 local governments, and is available on request from the SSA.

4.6 Public Information Programs

Sixteen of the 19 utilities surveyed by the SSA reported that public information programs were undertaken prior to implementation. [39] Most local officials stated that public information program were helpful and, in some cases, critical to successful implementation, although some utilities apparently have been established without informational programs. Public information programs typically include public meetings, slide shows, and mailings of informational brochures to residents. Some governments enlist the support of established citizen's organization, create formal citizen's advisory committees, and mail sample bills to residents. Details concerning the public information programs conducted by various utilities are included in A Survey of Stormwater Utilities. Examples of informational materials developed by various utilities also are available from the SSA.

4.7 General Considerations

Most utilities have been formed to fund operations and maintenance and flood control programs; funding of water quality programs has not been as important. Nearly one-third of the utilities surveyed were formed in response to severe flooding. [40] Only two cited concern over poor water quality.

Creation of a utility typically requires a substantial amount of time. Utility representatives report planning periods prior to authorization ranging from seven to 12 months to more than 2.5 years. [41] The planning period reported most frequently was 1.5 to 2.0 years. Implementation generally proceeds rapidly. Most (75%) of the utilities surveyed were implemented within six months after authorization; one required between two and two and one half years.

Eleven utilities report that consultants were retained to assist in the development of the utility. Most retained engineering firms; some used management or financial consultants. Consultants typically performed tasks such as the development of billing systems and the preparation of master plans.

5.0 ESTIMATING USER CHARGES

This section presents a methodology for estimating typical stormwater user charges based on data readily available in Maryland. The approach suggested here, which involves estimating charges based on general land use data, should provide accurate enough information about potential revenues for local officials to determine whether a utility should be created. However, because the approach does not involve estimation of the actual amount of impervious area on individual parcels, it is not sufficient for implementation.

5.1 Data Needed to Estimate Charges

Information needed to determine typical charges includes:

1. Land use data;

2. Rate factors derived from runoff coefficients for all land uses;

3. Revenue requirements for stormwater management.

Land Use Data

The land use data needed to estimate charges include land use categories (not zoning information), total acreage in each category, the total number of parcels in each category, and parcel area data (average parcel area is sufficient for initial planning studies).

In Maryland, these data are available from the Department of Assessments and Taxations, which maintains a uniform parcel file for 19 of the State's major jurisdictions. Data for five other jurisdictions also are available, but in a different format. The Department of State Planning has analyzed the taxation parcel files and summarized its findings in the Development Planning Series -- '85, Report 2: Residential Land Use in Maryland, 1985, An Analysis Based on Assessments and Taxation Parcel Files. [42] This report includes average parcel size data for improved and unimproved parcels for all jurisdictions except Baltimore City. Updated data based on 1987 tax files are available for individual counties from the Department of State Planning. [43]

Tables 5.1 and 5.2 are excerpts from the 1985 report that show how the data are presented for the standard land use categories. Table 5.3 is a condensation of Table 5.2 in which residential acreage categories have been re-grouped to correspond to residential acreage categories for which rate factors are available.

Table 5.1. Land Use Data for Prince George's County [42].

GEOGRAPHY: PRINCE GEORGE'S COUNTY-SUMMARY

TAPE DATE APR 85

	IMPROVED					UNIMPROVED					TOTAL	
LAND USE	NO. OF PARCELS ACRES SPEC.	ACRES	AVERAGE ACRES	NO. OF PARCELS ACRES NOT SPEC	TOTAL ACRES	NO. OF PARCELS ACRES SPEC.	ACRES	AVERAGE ACRES	NO. OF PARCELS ACRES NOT SPEC	TOTAL ACRES	PARCELS	ACRES
RESIDENTIAL	141156	55636	.4	0	55636	29051	35743	1.2	55	35810	170262	91446
COOPERATIVE	0	0	.0	0	0	0	0	.0	0	0	0	0
APARTMENT	2159	3745	1.7	36	3833	972	1518	1.6	8	1523	3175	5356
CONDOMINIUM	8940	444	.0	0	444	16	9	.6	0	9	8956	453
MOBILE	11	218	19.8	0	218	1	23	23.0	0	23	12	241
GROUP QUAR	148	231	1.6	0	231	6	39	6.5	0	39	154	270
HOTEL	53	276	5.2	0	276	4	3	.8	0	3	57	279
INDUSTRIAL	278	2605	9.4	0	2605	1239	4887	3.9	0	4887	1517	7492
EXEMPT	1190	27751	23.3	0	27751	6449	23861	3.7	0	23861	7639	51612
COMMERCIAL	4418	10074	2.3	2	10078	2171	8931	4.1	17	8959	6608	19037
AGRICULTURAL	1389	69106	49.8	0	69106	1835	20807	11.3	0	20807	3224	89913
OTHER	146	7179	49.2	16	7219	1190	14469	12.2	0	14469	1352	21688
DISTRICT TOTAL	159888	177265		54	177397	42934	110290		80	110390	202956	287787

Table 5.2. Residential Land Use Data for Prince George's County [42].

GEOGRAPHY: PRINCE GEORGE'S COUNTY-SUMMARY
LAND USE CODE: RESIDENTIAL

TAPE DATE APR 85

	IMPROVED PARCELS(ACRES SPECIFIED)				ACREAGE					
ACREAGE INTERVALS	NUMBER OF PARCELS	PERCENT OF TOTAL PARCELS	CUMULATIVE NUMBER OF PARCELS	CUMULATIVE % OF TOTAL PARCELS	NUMBER OF ACRES	PERCENT OF TOTAL ACRES	CUMULATIVE NUMBER OF ACRES	CUMULATIVE % OF TOTAL ACRES	AVERAGE ACREAGE	CUMULATIVE AVERAGE ACREAGE
0 - .5	128882	91.30	128882	91.30	26372	47.40	26372	47.40	.20	.20
>.5 - 1.0	7216	5.11	136098	96.42	5249	9.43	31621	56.84	.73	.23
>1.0 - 1.5	1390	.98	137488	97.40	1687	3.03	33308	59.87	1.21	.24
>1.5 - 2.0	950	.67	138438	98.07	1750	3.15	35058	63.01	1.84	.25
>2.0 - 3.0	855	.61	139293	98.68	2114	3.80	37172	66.81	2.47	.27
>3.0 - 5.0	812	.58	140105	99.26	3306	5.94	40478	72.76	4.07	.29
>5.0 - 10.0	735	.52	140840	99.78	4791	8.61	45269	81.37	6.52	.32
>10.0 - 15.0	140	.10	140980	99.88	1678	3.02	46947	84.38	11.99	.33
>15.0 - 20.0	50	.04	141030	99.91	881	1.58	47828	85.97	17.62	.34
>20.0 - 30.0	53	.04	141083	99.95	1268	2.28	49096	88.25	23.92	.35
>30.0 - 40.0	19	.01	141102	99.96	658	1.18	49754	89.43	34.63	.35
>40.0 - 50.0	11	.01	141113	99.97	493	.89	50247	90.31	44.82	.36
>50.0 - 75.0	18	.01	141131	99.98	1107	1.99	51354	92.30	61.50	.36
>75.0 - 100.0	8	.01	141139	99.99	696	1.25	52050	93.55	87.00	.37
>100.0 - 150.0	7	.00	141144	99.99	887	1.59	52937	95.15	126.71	.38
>150.0 - 200.0	7	.00	141153	100.00	1410	2.53	54347	97.68	201.43	.39
>200.0 - 300.0	0	.00	141153	100.00	0	.00	54347	97.68	.00	.39
>300.0 - 500.0	3	.00	141156	100.00	1289	2.32	55636	100.00	429.67	.39
>500.0 - 750.0	0	.00	141156	100.00	0	.00	55636	100.00	.00	.39
>750.0 - 1000.0	0	.00	141156	100.00	0	.00	55636	100.00	.00	.39
>1000.0 - 10,000	0	.00	141156	100.00	0	.00	55636	100.00	.00	.39
>10,000	0	.00	141156	100.00	0	.00	55636	100.00	.00	.39

	UNIMPROVED PARCELS (ACRES SPECIFIED)				ACREAGE					
0 - .5	23920	82.34	23920	82.34	4769	13.34	4769	13.34	.20	.20
>.5 - 1.0	2161	7.44	26081	89.78	1501	4.20	6270	17.54	.69	.24
>1.0 - 1.5	568	1.96	26649	91.73	690	1.93	6960	19.47	1.21	.26
>1.5 - 2.0	370	1.27	27019	93.01	665	1.86	7625	21.33	1.80	.28
>2.0 - 3.0	485	1.67	27504	94.67	1193	3.34	8818	24.67	2.46	.32
>3.0 - 5.0	505	1.74	28009	96.41	2031	5.68	10849	30.35	4.02	.39
>5.0 - 10.0	456	1.57	28465	97.98	3184	8.91	14033	39.26	6.98	.49
>10.0 - 15.0	169	.58	28634	98.56	2081	5.82	16114	45.08	12.31	.56
>15.0 - 20.0	97	.33	28731	98.90	1693	4.74	17807	49.82	17.45	.62
>20.0 - 30.0	126	.43	28857	99.33	3065	8.58	20872	58.39	24.33	.72
>30.0 - 40.0	55	.19	28912	99.52	1925	5.39	22797	63.78	35.00	.79
>40.0 - 50.0	27	.09	28939	99.61	1223	3.42	24020	67.20	45.30	.83
>50.0 - 75.0	48	.17	28987	99.78	2921	8.17	26941	75.37	60.85	.93
>75.0 - 100.0	25	.09	29012	99.87	2093	5.86	29034	81.23	83.72	1.00
>100.0 - 150.0	24	.08	29036	99.95	2751	7.70	31785	88.93	114.62	1.09
>150.0 - 200.0	13	.04	29049	99.99	2623	7.34	34408	96.27	201.77	1.18
>200.0 - 300.0	0	.00	29049	99.99	0	.00	34408	96.27	.00	1.18
>300.0 - 500.0	0	.00	29049	99.99	0	.00	34408	96.27	.00	1.18
>500.0 - 750.0	2	.01	29051	100.00	1335	3.73	35743	100.00	667.50	1.23
>750.0 - 1000.0	0	.00	29051	100.00	0	.00	35743	100.00	.00	1.23
>1000.0 - 10,000	0	.00	29051	100.00	0	.00	35743	100.00	.00	1.23
>10,000	0	.00	29051	100.00	0	.00	35743	100.00	.00	1.23

NO. OF IMP. PARCELS, ACREAGE SPECIFIED 141156 (100.0)
NO. OF IMP. PARCELS, ACREAGE NOT SPEC. 0 (.0)
TOTAL 141156

NO. OF UNIMPROVED PARCELS, ACREAGE SPECIFIED 29051 (99.8)
NO. OF UNIMPROVED PARCELS, ACREAGE NOT SPEC. 55 (.2)
TOTAL 29106

Table 5.3. Acreage Estimates for Residential Land Use, Prince George's County.

Residential Acreage Category	Total Parcels	Total Acres	Average Acreage
0 - 0.5	128,882	26,372	.20
> 0.5 - 1.0	7,216	5,249	.73
> 1.0	5,058	24,015	4.75

As will be illustrated in the following example, these average parcel size data are useful for quickly preparing estimates of charges for typical parcels given different rate structures. The data must be interpreted with caution, however, because of the assumptions in the Department of State Planning's classification system. For example, any parcel with an improvement with a market value of more than $10 was classified as "improved." [44] Thus, parcels in improved and unimproved classifications may not correspond with the categories of developed and undeveloped that typically are used in the calculation of stormwater charges. To actually establish a utility, therefore, the parcel data must be refined.

Similarly, the land use categories that are used in the files are not entirely suitable for determining charges. For example, the "exempt" category in the files includes parcels that are exempt form property tax. These parcels may or may not be exempt from a utility charge. For example, a non-profit, tax-exempt hospital most likely would be liable for a stormwater utility charge, while other tax-exempt uses (e.g., a state forest or park), might not be.

In practice, the actual size of all parcels to be charged must be determined. Most utilities use the exact size of parcels (e.g., acres or square feet) in the billing algorithms. Others (e.g., Cincinnati, OH) assign parcels Area Range Numbers (ARNs) which represent categories that include all parcels with areas in a certain range. [45] The Cincinnati algorithm assigns an ARN of 1 to parcels with areas of 1 to 2000 feet, and ARN of 2 to parcels with areas of 2001 to 4000 feet, and so on, in 2000 square foot increments.

Rate Factors

Rate factors are numbers based on standard runoff coefficients which are assigned to parcels so that charges reflect actual runoff and the respective burden each property places on the stormwater system. Theoretically, to reflect runoff precisely, rate factors should include total area, percentage of impervious area, soil type, slope, and other factors.

However, impervious area is the only factor that usually is used. This is because the calculations necessary to incorporate all relevant factors are not warranted economically.

For planning studies, rate factors generally are based simply on land use categories. Land use categories typically vary by jurisdiction; therefore, matching land use categories with rate factors requires some judgement. Rate factors generally are derived from runoff coefficients in the Rational Method. [46] In practice, the specific rate factors used by utilities vary greatly. Because of the potential for variability, rate factors must be chosen carefully. Analyses by the Administration indicate that estimated charges to users in a given land use category could vary by as much as 60% depending on the rate factors and structure that are used.

For initial planning studies in Maryland, the SSA recommends use of the rate factors presented in Table 5.4. The SSA computed these factors based on estimates of the average amount of impervious area for parcels in different land use categories included in the Soil Conservation Service's publication, "Urban Hydrology for Small Watersheds" [47] and, to a lesser degree, in the Rational Method.

The rate base is defined as all categories of users to be charged. Thirteen standard and five nonstandard land use categories are included in Table 5.4. Under the utility concept, every parcel should pay to the extent it generates runoff. In practice, however, it is common for certain categories of parcels to be exempt by edict rather than because they generate no runoff. Land uses sometimes considered for exemptions include public parcels such as government office complexes and street rights-of-way, tax-exempt parcels such as hospitals and churches, and agricultural and undeveloped land. A useful planning exercise to determine the effect of removing various land use categories from the rate base.

During implementation, when the data used to determine charges must be refined, there are no hard and fast rules for selecting rate factors and choosing the rate base. To derive rate factors, many utilities measure the amount of impervious area on all nonresidential parcels and on a statistically significant sample of residential parcels. Rate bases frequently are determined for political as much as technical reasons. For example, public office complexes and institutional, tax exempt users frequently are large generators of stormwater. The utility approach is attractive in part because these types of uses, which do not generate revenues under a property tax system, often pay stormwater charges. Charging these uses, however, can be very controversial.

Table 5.4. Recommended Rate Factors for Stormwater Utility Planning Studies.

Land Use Category	Average Percent Impervious	Rate Factor
Agriculture	-	.10
Commercial	.85	.82
Commercial Residential	.70	.68
Exempt		.26
Parks	.07	.11
Playgrounds	.13	.17
Schools	.50	.50
Industrial	.72	.70
Apartments	.65	.64
Not Perc	-	.00
Residential		
Acreage ≤ 1/8 (town houses)	.65	.40
1/8 < A ≤ 1/4	.38	(.40 is average for Acreage < 1/2)
1/4 < A ≤ 1/3	.30	
1/3 < A ≤ 1/2	.25	
1/2 < A ≤ 1	.20	.23
1 < Acreage	.12	.16
Res Agr	-	.16
Res Comm	-	.64
Condominium	-	.64
Condo Comm	-	.68
Marshland	-	.00
Other Nonstandard Categories		
Cooperative	-	.64
Mobile	-	.64
Group Quar	-	.64
Motel	-	.82
Other	-	.50

Note: Estimates of the average percentage of impervious area are from SCS TR-55 or the Rational Method. The estimate of .65 for apartments was taken from the TR-55 estimate for town houses. A "-" in the average impervious column means that no estimate corresponded directly with the land use category. The rate factors were determined by selecting figures for a comparable use (e.g., Res Agr was assigned the same rate factor as Residential [1 < Acreage]).

Hospitals and churches have been involved in suits against utilities, arguing that they should be exempt from any payments to local government. Property owners have argued that charging public properties makes them pay twice: property taxes for the public parcel, and stormwater charges for their own properties.

Similarly, although some utilities charge agriculture and undeveloped land, these practices also are controversial. Owners of undeveloped land have argued successfully in court that they should not be charged since they have not altered natural conditions. In any real case, the issue of the rate base must be resolved by the city council or county board through a public forum.

Revenue Requirements

Section 4 describes considerations in estimating costs or revenue requirements for stormwater management. In practice, the scope of activities funded with utility revenues varies. The rate structure should be designed so that the sum of charges for all parcels is equal to the revenue requirements.

In Maryland, no two jurisdictions will have the same revenue requirements. Costs will have to be estimated from a variety of sources. For example, in Prince George's County, one source of information about revenue requirements is the "transfer" study prepared by the County prior to its assumption of stormwater management activities from the Washington Suburban Sanitary Commission (WSSC). In 1986 the WSSC generated approximately $10.5 million from an ad valorem property tax dedicated for purposes of stormwater management. [48] The County projects that tax revenues will increase gradually through 1991 to $14.2 million. These estimates are sufficient for planning purposes. Any jurisdiction planning a utility must obtain or prepare comparable estimates.

5.2 A General Approach for Planning Studies

A general approach to developing a utility rate structure involves two steps:

1. Estimation of a charge per "equivalent runoff unit";

2. Determination of the charge per individual parcel.

Equivalent runoff units (ERUs) are used to represent runoff from a parcel. They are the units for which stormwater charges are levied, and they are calculated by multiplying a rate factor times a parcel area.

Estimation of Charge per Equivalent Runoff Unit

The charge per equivalent runoff unit (ERU) is determined by:

1. Assigning a rate factor to each general land use category;
2. Determining the total acreage in each category;
3. Multiplying the rate factors times the total acreage in each category to obtain the number of ERUs per category;
4. Selecting categories to be included in the rate base;
5. Summing the ERUs for all categories in the rate base; and
6. Dividing the revenue requirements by the total ERUs.

A general equation for computing the charge per ERU is:

$$C/ERU = R / [\Sigma (F \times A)] \qquad (a)$$

where

C/ERU = the charge per ERU
R = revenue requirement for the utility stormwater programs
F = the rate factor for each land use category
A = the total acreage for each land use category in the rate base
F x A = the ERUs for a given land use category.

Estimation of Parcel User Charges

Typical parcel user charges can be estimated after a charge per ERU has been determined. To obtain the charge per parcel, the individual parcel area is multiplied times its rate factor and the charge per ERU. Some utilities also add surcharges or provide credits depending on the particular features of the parcel.

A general equation for calculating stormwater user charges is:

$$PC = [PA \times F \times (C/ERU)] \pm CR;SC \qquad (b)$$

where

PC = the charge for a parcel
PA = the area of the parcel
F = the rate factor for the parcel land use
C/ERU = the charge per equivalent runoff unit
CR;SC = a credit or surcharge (e.g., for on-site retention or location in a floodplain).

These equations frequently are referred to as billing algorithms. In practice, the algorithms used in different communities vary.

5.3 Worksheet

The SSA has developed the worksheet presented in Figure 5.1 to assist Maryland counties and cities in evaluating options for stormwater utilities. Use of the worksheet essentially involves application of the two equations presented above. Steps in using the worksheet are explained below in the context of an example for Prince George's County. The data needed to complete the worksheet are an estimate of revenue requirements, land use categories for all parcels, and total area (acreage), average parcel size, and rate factors for each category. The SSA recommends that the worksheet be completed using a spreadsheet software program for a personal computer. Use of a spreadsheet permits planners to analyze the effects of excluding different land use categories from the rate base very efficiently. The example presented below includes this type of sensitivity analysis.

5.4 An Example: Estimating Typical User Charges For Prince George's County

An example of the use of the worksheet will be completed using data for Prince George's County. To complete the worksheet, one must:

1. Obtain Revenue Requirements. Data from the Prince George's County transfer study will be used. It will be assumed that the revenue requirement for the County in 1988 will be $11 million.

2. Select Rate Factors. The rate factors presented in Table 5.4 will be used in this analysis.

3. Obtain Land Use Information. Tables 5.1 and 5.3 present average parcel size and total acreage per category for all land use categories in Prince George's County.

Figure 5.1. Worksheet for Calculation of Stormwater User Charges.

	1	2	3	4	5	6	7	8	9	10	11	12
	Land Use	Rate Factor	Total Acreage	ERU	Revenue Requirement ($)	Cost/ ERU ($)	Average Acre/ Parcel	Annual Charge ($)	Monthly Charge ($)	Number of Parcels	Total Revenues ($)	% of Total Revenues
1	Agriculture											
2	Commercial											
3	Comm Res											
4	Exempt											
5	Park											
6	Playground											
7	School											
8	Industrial											
9	Apartments											
10	Not Perc											
11	Residential											
12	0 - 0.5 Acres											
13	>.5 - 1.0 Acres											
14	> 1.0 Acres											
15	Res Ag											
16	Res Comm											
17	Condominium											
18	Condo Comm											
19	Marshland											
20												
21	Non-standard											
22												
23	Cooperative											
24	Mobile/Trailer											
25	Group Quar											
26	Motel											
27	Forest Cons											
28	Detached S-F											
29	0 - .5 Acre											
30	> .5 - 1 Acre											
31	> 1 Acre											
32	Attached S-F											
33	Garden Apt.											
34	High Rise											
35	Other											
36												
37	Subtotal (Dev.)											
38												
39	Unimproved											
40												
41	Grand Total											

STEPS FOR USING WORKSHEET TO CALCULATE USER CHARGES

1) Enter land use categories to be charged in column 1. (Use data from Dept. of State Planning or local data.)

2) Enter rate factors in column 2. Use factors in Table 5.4 or data consistent with local practices.

3) Enter total acreage in each land use category in column 3. (from Dept. of State Planning or local source)

4) Compute ERUs. Multiply column 2 times colum in column 4. Subtotal ERUs for developed p Sum ERUs for all categories in row 41 (column 4).

5) Enter revenue requirements in column 5, row 41.

6) Compute charge per ERU in column 6, row 41, by dividing column 5, row 41, by column 4, row 41.

7) Enter average parcel sizes in column 7 (from Dept. of State Planning).

8) Compute annual charge for all categories in column 8 by multiplying column 2 times column 7 times charge per ERU (column 6, row 41).

9) Compute monthly charge in column 9 by dividing column 8 by 12. Enter total number of parcels in each category in column 10.

10) Compute total revenues per category by multiplying column 8 times column 10.

11) Compute percentage of total revenues paid by user category in column 12 by dividing values in column 11 by total for column 11.

4. Determine rate base. In this example, sensitivity analyses will be done to evaluate effects of including various land use categories in the rate base. In the initial example, it will be assumed (A) that all categories of land will be charged, including exempt, agricultural, other, and unimproved (i.e., undeveloped). Other scenarios considered are (B) no charges to agriculture or unimproved; (C) no charges to agriculture, unimproved, or exempt; and (D) no charges to agriculture, unimproved, exempt or other.

5. Compute ERUs and Charge Per ERU. The total number of ERUs for each land use category is determined by multiplying each category's total acreage times its rate factor. The charge per ERU is determined by dividing the revenue requirement by the sum of the ERUs for all categories to be charged.

If a spreadsheet is being used, all one need do is enter the land use data, rate factors and the appropriate equations as specified in Figure 5.1. If the example is being completed by hand, equation (a) from above:

$$C/ERU = R / [S (F \times A)]$$

becomes:

$$\begin{aligned} C/ERU = 11{,}000{,}000 \,/\, [&.40(26{,}372) + .23(5{,}249) + \\ &.16(24{,}015) + .64(0) + .64(3{,}745) + .64(444) + \\ &.64(218) + .64(231) + .82(276) + .70(2{,}605) + \\ &.50(27{,}751) + .82(10{,}074) + .10(69{,}106) + \\ &.50(7{,}179) + .10\ (110{,}290)] \end{aligned}$$

Solving this equation gives:

$$C/ERU = 190.90$$

The charge per ERU necessary to generate $11 million for stormwater management in Prince George's County would be $190.90, assuming that all parcels would be charged.

6. Determine of Typical Charges Typical charges for an average parcel in each land use category can be computed by multiplying the average parcel size times the rate factor times the charge per ERU. A spreadsheet does this quickly, or, as above, equation (b) could be used and the charges could be determined by hand. Typical charges for average sized parcels in each land use category in Prince George's County are presented in Table 5.5.

Table 5.5. Calculation of Stormwater Utility Charges for Prince George's County: Case A.
(Charges to agriculture, exempt, and unimproved.)

Land Use	Rate Factor	Total Acreage	ERU	Revenue Requirement ($)	Cost/ ERU ($)	Average Acre/ Parcel	Annual Charge ($)	Monthly Charge ($)	Number of Parcels	Total Revenues ($)	% of Total Revenues
Agriculture	0.10	69,106	6,911			50	951	79	1,389	1,320,501	12.0%
Commercial	0.82	10,074	8,261			2	360	30	4,418	1,590,649	14.5%
Comm Res	0.68		0				0	0		0	0.0%
Exempt	0.26	27,751	7,215			23	1,156	96	1,190	1,376,205	12.6%
Park	0.11		0				0	0		0	0.0%
Playground	0.17		0				0	0		0	0.0%
School	0.50		0				0	0		0	0.0%
Industrial	0.70	2,605	1,824			9	1,256	105	278	349,203	3.2%
Apartments	0.64	3,745	2,397			2	208	17	2,159	448,424	4.1%
Not Perc	0.00		0				0	0		0	0.0%
Residential			0				0	0		0	0.0%
0 - 0.5 Acres	0.40	26,372	10,549			0	15	1	128,882	1,968,291	18.0%
>.5 - 1.0 Acres	0.23	5,249	1,207			1	32	3	7,216	231,289	2.1%
> 1.0 Acres	0.16	24,015	3,842			5	145	12	5,058	733,837	6.7%
Res Ag	0.16		0				0	0		0	0.0%
Res Comm	0.64		0				0	0		0	0.0%
Condominium	0.64	444	284			0	6	1	8,940	54,613	0.5%
Condo Comm	0.68		0				0	0		0	0.0%
Marshland	0.00		0				0	0		0	0.0%
			0				0	0		0	0.0%
Non-standard							0	0		0	0.0%
			0				0	0		0	0.0%
Cooperative	0.64	0	0				0	0		0	0.0%
Mobile/Trailer	0.64	218	140			20	2,419	202	11	26,610	0.2%
Group Quar	0.64	231	148			2	195	16	148	28,931	0.3%
Motel	0.82	276	226			5	814	68	53	43,142	0.4%
Forest Cons	0.50		0				0	0		0	0.0%
Detached S-F			0				0	0		0	0.0%
0 - .5 Acre	0.40		0				0	0		0	0.0%
> .5 - 1 Acre	0.23		0				0	0		0	0.0%
> 1 Acre	0.16		0				0	0		0	0.0%
Attached S-F	0.64		0				0	0		0	0.0%
Garden Apt.	0.40		0				0	0		0	0.0%
High Rise	0.64		0				0	0		0	0.0%
Other	0.50	7,179	3,590			49	4,696	391	146	685,638	6.3%
							0	0			
Total (Dev.)		177,265	46,593				0	0	159,888	8,857,332	80.8%
							0	0			
Unimproved	0.10	110,290	11,029			3	49	4	42,934	2,106,403	19.2%
Grand Total		287,555	57,622	11,000,000	190.90				202,822	10,963,735	100.0%

Sensitivity Analysis

Actual charges, of course, would vary with the size of individual parcels and, more importantly, depend on the categories included in the rate base. In Case A (Table 5.5) all parcels are charged. In practice, it is likely that some of these parcels (e.g., agricultural, unimproved, exempt) would not be charged. Tables 5.6, 5.7, and 5.8 present typical charges based on alternate rate bases. In Case B (Table 5.6), agricultural and unimproved parcels are removed from the rate base. In Case C (Table 5.7), agricultural, unimproved, and exempt are removed from the rate base. In Case D (Table 5.8), the "other" land use category, in addition to the agricultural, unimproved, and exempt categories, is removed.

The effect of removing categories from the rate base is to increase the charges for parcels in other categories. In this instance the charge per ERU doubles from $190.90 to $380.92 when the categories of agriculture, unimproved, exempt, and other are removed. Consequently, the charges for parcels in categories remaining in the rate base (e.g., residential, commercial, industrial) also double (Figure 5.2). For example, residential charges (0 -.5 acres) increase from $15 to $30 dollars annually as the rate base shrinks. The distribution of total revenues from user charges by land use category for these data (Cases A through D) is shown in Figure 5.3. It is clear from these data that decisions about properties to be included in the rate base must be made very carefully.

Observations

The results of this example are useful for decision makers who must weigh the impact of a utility on the public. In this case it was shown, given the limitations of the data, that annual residential charges could vary as much as 100% per year depending on the categories included in the rate base.

It is instructive to compare these estimates of charges to current stormwater tax levies. Presently, parcels in Prince George's County are assessed at a rate of 13.5 cents per $100 assessed valuation. Homes are assessed at 50% of market value. Hence, an owner of a home valued at $50,000 and assessed at $25,000 presently pays $33.75 annually in stormwater taxes. Similarly, the owner of a home valued at $100,000 would pay $67.50 annually. In this case, it appears that replacement of property taxes with user charges as the principal source of revenues would have distributional impacts favorable to residential users.

Table 5.6. Calculation of Stormwater Utility Charges for Prince George's County: Case B.
(No charges to agriculture and unimproved.)

Land Use	Rate Factor	Total Acreage	ERU	Revenue Requirement ($)	Cost/ ERU ($)	Average Acre/ Parcel	Annual Charge ($)	Monthly Charge ($)	Number of Parcels	Total Revenues ($)	% of Total Revenues
Agriculture	0.00	69,106	0			50	0	0	1,389	0	0.0%
Commercial	0.82	10,074	8,261			2	523	44	4,418	2,309,755	21.1%
Comm Res	0.68		0				0	0		0	0.0%
Exempt	0.26	27,751	7,215			23	1,679	140	1,190	1,998,365	18.3%
Park	0.11		0				0	0		0	0.0%
Playground	0.17		0				0	0		0	0.0%
School	0.50		0				0	0		0	0.0%
Industrial	0.70	2,605	1,824			9	1,824	152	278	507,072	4.6%
Apartments	0.64	3,745	2,397			2	302	25	2,159	651,149	5.9%
Not Perc	0.00		0				0	0		0	0.0%
Residential			0				0	0		0	0.0%
0 - 0.5 Acres	0.40	26,372	10,549			0	22	2	128,882	2,858,123	26.1%
>.5 - 1.0 Acres	0.23	5,249	1,207			1	47	4	7,216	335,850	3.1%
> 1.0 Acres	0.16	24,015	3,842			5	211	18	5,058	1,065,592	9.7%
Res Ag	0.16		0				0	0		0	0.0%
Res Comm	0.64		0				0	0		0	0.0%
Condominium	0.64	444	284			0	9	1	8,940	79,302	0.7%
Condo Comm	0.68		0				0	0		0	0.0%
Marshland	0.00		0				0	0		0	0.0%
			0				0	0		0	0.0%
Non-standard							0	0		0	0.0%
			0				0	0		0	0.0%
Cooperative	0.64	0	0				0	0		0	0.0%
Mobile/Trailer	0.64	218	140			20	3,513	293	11	38,640	0.4%
Group Quar	0.64	231	148			2	284	24	148	42,011	0.4%
Motel	0.82	276	226			5	1,182	98	53	62,646	0.6%
Forest Cons	0.50		0				0	0		0	0.0%
Detached S-F			0				0	0		0	0.0%
0 - .5 Acre	0.40		0				0	0		0	0.0%
> .5 - 1 Acre	0.23		0				0	0		0	0.0%
> 1 Acre	0.16		0				0	0		0	0.0%
Attached S-F	0.64		0				0	0		0	0.0%
Garden Apt.	0.40		0				0	0		0	0.0%
High Rise	0.64		0				0	0		0	0.0%
Other	0.50	7,179	3,590			49	6,819	568	146	995,604	9.1%
							0	0			
Total (Dev.)		177,265	39,682				0	0	159,888	10,944,108	100.0%
							0	0			
Unimproved	0.00	110,290	0			3	0	0	42,934	0	0.0%
Grand Total		287,555	39,682	11,000,000	277.20				202,822	10,944,108	100.0%

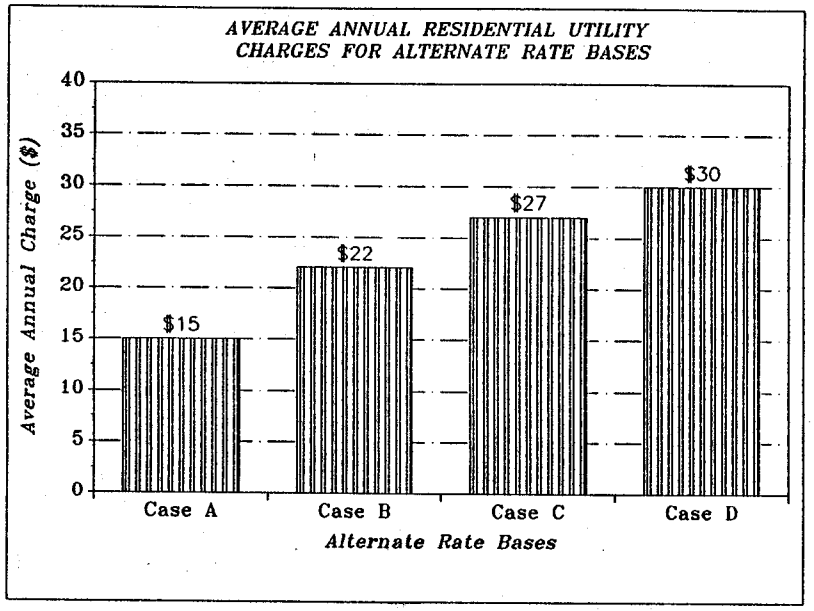
Table 5.7. Calculation of Stormwater Utility Charges for Prince George's County: Case C.
(No charges to agriculture, unimproved, and exempt.)

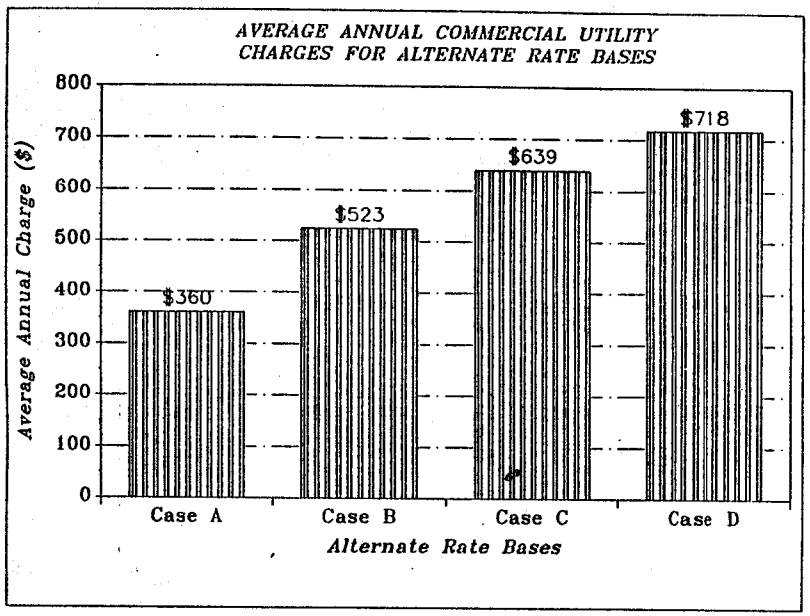
Land Use	Rate Factor	Total Acreage	ERU	Revenue Requirement ($)	Cost/ ERU ($)	Average Acre/ Parcel	Annual Charge ($)	Monthly Charge ($)	Number of Parcels	Total Revenues ($)	% of Total Revenues
Agriculture	0.00	69,106	0			50	0	0	1,389	0	0.0%
Commercial	0.82	10,074	8,261			2	639	53	4,418	2,823,064	25.8%
Comm Res	0.68		0				0	0		0	0.0%
Exempt	0.00	27,751	0			23	0	0	1,190	0	0.0%
Park	0.11		0				0	0		0	0.0%
Playground	0.17		0				0	0		0	0.0%
School	0.50		0				0	0		0	0.0%
Industrial	0.70	2,605	1,824			9	2,229	186	278	619,761	5.7%
Apartments	0.64	3,745	2,397			2	369	31	2,159	795,857	7.3%
Not Perc	0.00		0				0	0		0	0.0%
Residential			0				0	0		0	0.0%
0 - 0.5 Acres	0.40	26,372	10,549			0	27	2	128,882	3,493,298	31.9%
>.5 - 1.0 Acres	0.23	5,249	1,207			1	57	5	7,216	410,488	3.8%
> 1.0 Acres	0.16	24,015	3,842			5	257	21	5,058	1,302,404	11.9%
Res Ag	0.16		0				0	0		0	0.0%
Res Comm	0.64		0				0	0		0	0.0%
Condominium	0.64	444	284			0	11	1	8,940	96,926	0.9%
Condo Comm	0.68		0				0	0		0	0.0%
Marshland	0.00		0				0	0		0	0.0%
			0				0	0		0	0.0%
Non-standard							0	0		0	0.0%
			0				0	0		0	0.0%
Cooperative	0.64	0	0				0	0		0	0.0%
Mobile/Trailer	0.64	218	140			20	4,293	358	11	47,227	0.4%
Group Quar	0.64	231	148			2	347	29	148	51,347	0.5%
Motel	0.82	276	226			5	1,445	120	53	76,568	0.7%
Forest Cons	0.50		0				0	0		0	0.0%
Detached S-F			0				0	0		0	0.0%
0 - .5 Acre	0.40		0				0	0		0	0.0%
> .5 - 1 Acre	0.23		0				0	0		0	0.0%
> 1 Acre	0.16		0				0	0		0	0.0%
Attached S-F	0.64		0				0	0		0	0.0%
Garden Apt.	0.40		0				0	0		0	0.0%
High Rise	0.64		0				0	0		0	0.0%
Other	0.50	7,179	3,590			49	8,335	695	146	1,216,862	11.1%
							0	0			
Total (Dev.)		177,265	32,467				0	0	159,888	10,933,801	100.0%
							0	0			
Unimproved	0.00	110,290	0			3	0	0	42,934	0	0.0%
Grand Total		287,555	32,467	11,000,000	338.81				202,822	10,933,801	100.0%

Table 5.8. Calculation of Stormwater Utility Charges for Prince George's County: Case D.
(No charges to agriculture, unimproved, exempt, and other.)

Land Use	Rate Factor	Total Acreage	ERU	Revenue Requirement ($)	Cost/ ERU ($)	Average Acre/ Parcel	Annual Charge ($)	Monthly Charge ($)	Number of Parcels	Total Revenues ($)	% of Total Revenues
Agriculture	0.00	69,106	0			50	0	0	1,389	0	0.0%
Commercial	0.82	10,074	8,261			2	718	60	4,418	3,173,976	29.1%
Comm Res	0.68		0				0	0		0	0.0%
Exempt	0.00	27,751	0			23	0	0	1,190	0	0.0%
Park	0.11		0				0	0		0	0.0%
Playground	0.17		0				0	0		0	0.0%
School	0.50		0				0	0		0	0.0%
Industrial	0.70	2,605	1,824			9	2,506	209	278	696,798	6.4%
Apartments	0.64	3,745	2,397			2	414	35	2,159	894,783	8.2%
Not Perc	0.00		0				0	0		0	0.0%
Residential			0				0	0		0	0.0%
0 - 0.5 Acres	0.40	26,372	10,549			0	30	3	128,882	3,927,521	36.0%
>.5 - 1.0 Acres	0.23	5,249	1,207			1	64	5	7,216	461,513	4.2%
> 1.0 Acres	0.16	24,015	3,842			5	290	24	5,058	1,464,295	13.4%
Res Ag	0.16		0				0	0		0	0.0%
Res Comm	0.64		0				0	0		0	0.0%
Condominium	0.64	444	284			0	12	1	8,940	108,974	1.0%
Condo Comm	0.68		0				0	0		0	0.0%
Marshland	0.00		0				0	0		0	0.0%
			0				0	0		0	0.0%
Non-standard							0	0		0	0.0%
			0				0	0		0	0.0%
Cooperative	0.64	0	0				0	0		0	0.0%
Mobile/Trailer	0.64	218	140			20	4,827	402	11	53,098	0.5%
Group Quar	0.64	231	148			2	390	33	148	57,730	0.5%
Motel	0.82	276	226			5	1,624	135	53	86,085	0.8%
Forest Cons	0.50		0				0	0		0	0.0%
Detached S-F			0				0	0		0	0.0%
0 - .5 Acre	0.40		0				0	0		0	0.0%
> .5 - 1 Acre	0.23		0				0	0		0	0.0%
> 1 Acre	0.16		0				0	0		0	0.0%
Attached S-F	0.64		0				0	0		0	0.0%
Garden Apt.	0.40		0				0	0		0	0.0%
High Rise	0.64		0				0	0		0	0.0%
Other	0.00	7,179	0			49	0	0	146	0	0.0%
							0	0			
Total (Dev.)		177,265	28,877				0	0	159,888	10,924,773	100.0%
							0	0			
Unimproved	0.00	110,290	0			3	0	0	42,934	0	0.0%
Grand Total		287,555	28,877	11,000,000	380.92				202,822	10,924,773	100.0%

Figure 5.2. Comparison of Average Annual Utility Charges for Residential, Commercial, and Industrial Users.





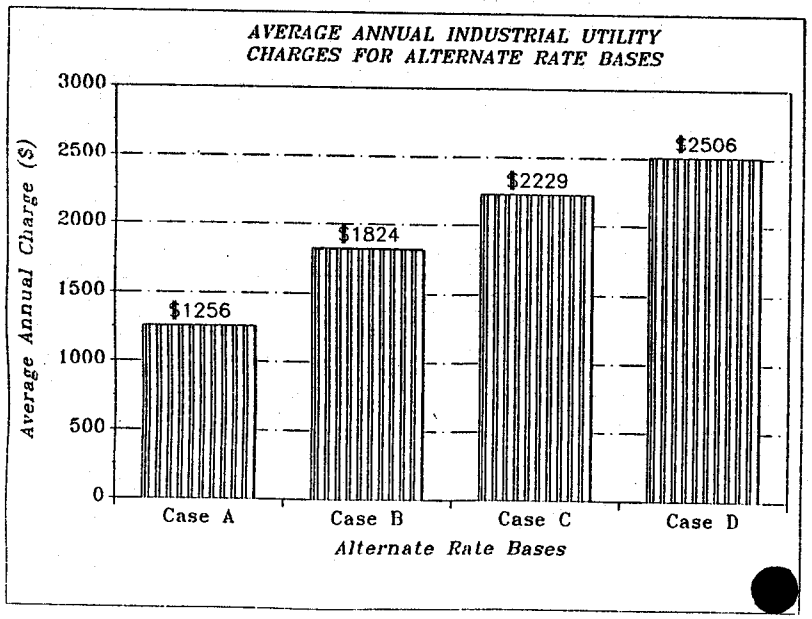
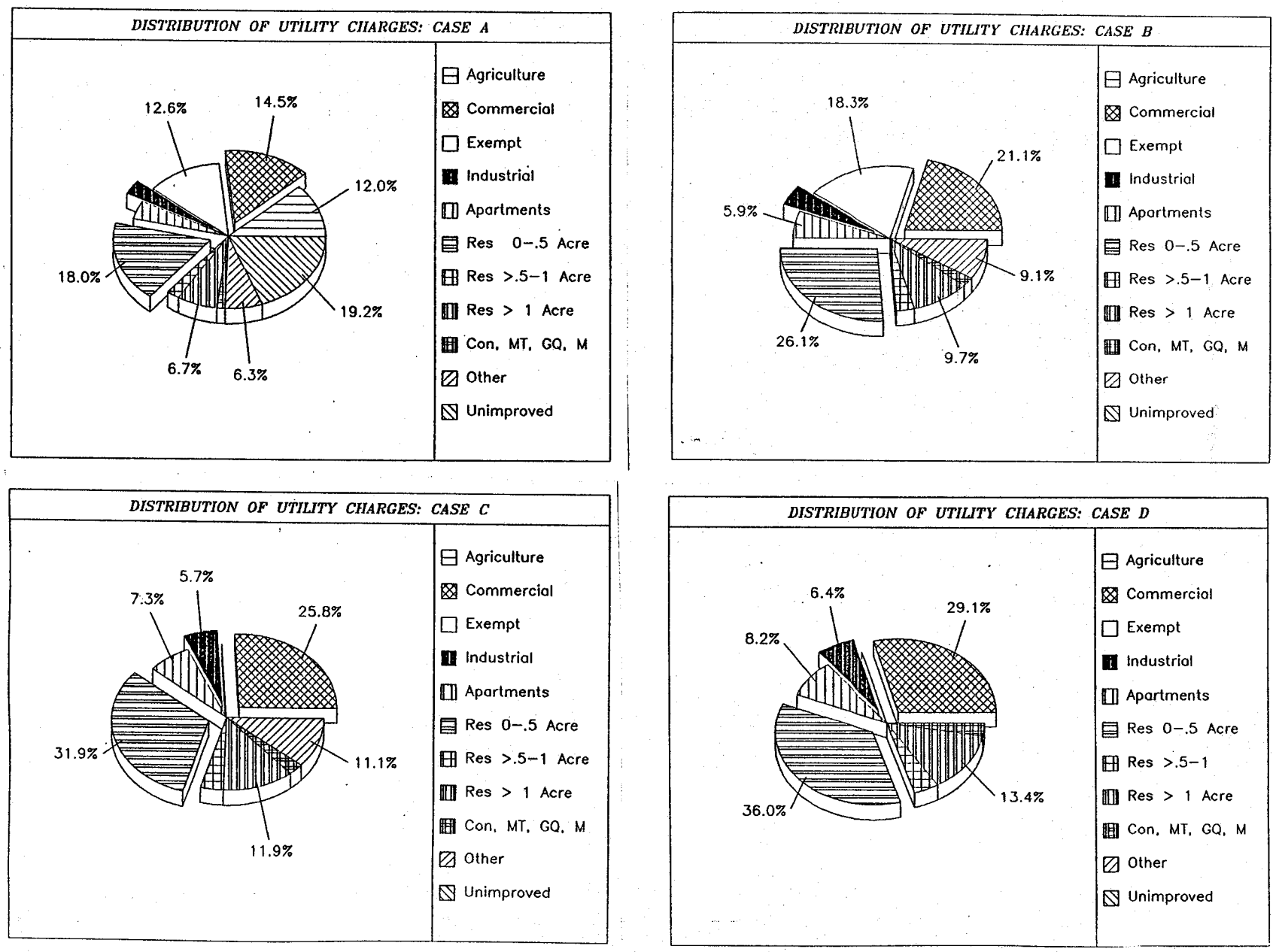


Figure 5.3. Distribution of Utility Charges Under Different Rate Bases.



Strengths and Weaknesses of the Example

The basic strength of the preceding example is that it provides decision makers with a good understanding of the financial implications of establishing a stormwater utility at a minimum cost. The major weaknesses relate to the quality of data that was used in the analysis.

There are three major sources of error in the data:

1. Land uses for parcels may be misclassified (e.g., in this example, the classification of parcels considered improved in the Tax Assessor's files as "developed" may be misleading[1]);

2. The area of the parcels may be inaccurate;

3. The rate factors may be inappropriate.

As long as people understand that this example is a planning exercise meant to show typical charges given average parcel size and general rate factors, these sources of error are not significant. These sources of error could be significant, however, in the actual implementation of a utility.

Another limitation of the data, not the approach, concerns the way in which data are computerized by the Department of State Planning. Generally, the land use data available from Department are for an entire county, including all political jurisdictions within it. In certain counties, some municipalities may have responsibility for their own stormwater programs. In these situations, the potential rate base for the county should exclude land within the municipalities. The Department cannot provide land use data for counties exclusive of municipal data without undertaking additional, expensive computer runs. People planning utilities at the local level must assess the data in specific cases to determine whether this poses a problem.

5.5 Considerations in Implementation

The preceding section raised a number of issues that must be considered during the actual creation of a utility. These and others are reviewed briefly in this section. In general, all the details of the rate structure must be worked out.

[1] In the tax files, any property with an improvement worth more than $10 is classified as "improved". Inspection of files indicates, however, that most (e.g., 95%) improved properties include structures.

Credits and Surcharges

Many utilities issue credits or add surcharges to utility bills depending on special characteristics of a parcel. There is no single, correct rationale for determining credits or surcharges. Some utilities (e.g., Fort. Collins, CO) provide credits for on-site retention of stormwater. Boulder, Colorado imposes surcharges on parcels located in floodplains because these parcels receive additional benefits. On the other hand, the City of Portland, Oregon exempts parcels from stormwater charges if the parcels drain directly to receiving waters. Portland's rationale is that these facilities make no use of storm drainage systems and therefore should not have to pay. As is evident from these examples, parcels granted exemptions in Portland quite possibly would be surcharged in Boulder.

Table 5.9 lists special features that have been included in rate structures of different utilities. Although consideration of credits or surcharges is not critical during initial planning studies, these must be determined during implementation.

Table 5.9. Special Features of Utility Rate Structures.

* Separate charges for capital improvements and operations and maintenance
* Credits for on-site management
* Surcharges for parcels in floodplains
* Exemptions for parcels that drain directly to receiving waters
* Rebates for elderly
* In kind payment by schools that provide education about stormwater management
* Procedures for appealing charges

Considerations in Setting Charges

Most stormwater utilities establish a single charge per ERU that is applied regardless of land use. At least one, however (Denver, Colorado), has devised a progressive rate structure that charges properties which are intensively developed higher unit rates than properties that are less developed. The Denver rates correspond to ranges of impervious area: the greater the percentage of impervious area, the higher the unit rate.

Many utilities assign a uniform charge or flat rate to all single family residential parcels below a certain size. This eliminates the need to determine and use the actual acreage

(and imperviousness) for most residential parcels (which typically account for 60% to 80% of all parcels).

At least eight of the utilities surveyed by the SSA have designed rate structures so that the equivalent runoff units are scaled to represent single-family equivalents (SFEs). [49] SFEs are computed in one of two ways:

1. By adjusting all factors equally so that the product of the average residential area and the residential rate factor is one; or

2. By dividing the amount of impervious area on all non-single family residential parcels by the average amount of impervious area on single family residential parcels.

In either case, the ratios between residential rate factors and factors for other land uses remain the same, as do relative payments.

SFEs have been used mainly because planners believe that people can understand the user charge concept easier when runoff is expressed in terms of the amount generated by a typical single family residence. Also, the use of SFEs rather than ERUs facilitates billing because the base charge is then the single family residence charge. Between 60% and 80% of all parcels are single family residences.

Appeal Procedures

Almost all utilities have some procedure for appealing charges. Appeal procedures are necessary to provide users with opportunities to contest charges that they believe have been calculated inaccurately.

In fact, errors in new billing systems are common. Sources of data (e.g., Tax Assessor's files) commonly used for construction of utility billing files often contain large numbers of errors, both in parcel size and land use classification. Even if parcels have been measured specifically for the creation of the utility billing system, errors should be expected. The sheer volume of information that is processed is a factor in the introduction of error to the system.

5.6 Criteria for Evaluating Rate Structures

This section is a discussion of criteria for the evaluation of rate structures. Eight criteria are presented. The criteria were developed and used by Camp, Dresser, & McKee, Inc. and Priede Sedgwick, Inc. in an evaluation of alternative rate structures for the City of Tampa, Florida. [50]

Two criteria concern sources of error that can affect the calculation of charges. These are:

1. The charge should be based on a reasonably accurate, technically defensible measure of runoff;

2. The data base used to determine charges and prepare the billing system should be accurate.

The use of average rate factors for a land use category rather than measurements of the amount of impervious area on a site ignores the variability that exists among parcels within a given classification. Use of average factors eliminates the need to measure impervious area of parcels, but does so at the cost of a departure from the main principle of the utility, (i.e., that people should pay in relation to their specific contribution) and the associated loss of equity. Decision makers must evaluate this trade-off between equity and efficiency when planning for the utility.

Errors in the data base include errors in the measurement of total parcel area and total impervious area, as well as in land use classification. Sampling of alternative data bases for use in the rate structure can help planners and decision makers determine whether the amount of error is too great and whether corrective measures (e.g., re-measurement of parcels with digitizing equipment) are warranted. Quantitative standards for levels of accuracy can aid in the decisions whether certain databases should be used (e.g., 95% of all parcels in files must be classified and measured correctly).

Additional criteria concern equity:

3. Users in different classes should pay in proportion to the runoff their classes generate relative to others,

4. Users within a class should pay in proportion to their contribution to the total runoff generated by the class.

In general, calculation of a charge per ERU as described above will help ensure equity among classes of users. Use of a progressive rate structure like the one in Denver, however, departs from this criterion.

The use of average rate factors significantly affects equity among users within a given class. CDM suggests use of statistical test for evaluating Criterion 4 (e.g., the contribution of the smallest and largest parcels should be within two standard deviations of the mean; 60% of the parcels should fall within one standard deviation of the mean).

Other criteria are:

5. The structure should be legal and politically acceptable;

6. The structure should be flexible;

7. The structure should generate adequate revenues;

8. The initial costs of implementing the structure should not be exorbitant.

The acceptability of a rate structure depends on the attitude of citizens towards additional charges and the size of the charge. Flexibility refers to whether it is easy to modify the structure to accommodate changes in it (e.g., can the rate for a given class of users be modified without having to reprogram the entire structure). Revenue adequacy is assured if the charge per ERU has been computed in the manner described above. As noted, greater equity can be achieved, for example, if the amount of impervious area on all parcels is measured during implementation. However, costs for this may be excessive.

5.7 Concluding Comments on User Charges

Criterion 5 in the preceding section states that the rate structure should be legal and politically acceptable. While this criterion seems intuitively obvious, the importance of it cannot be stressed too much. The bottom line is that for any utility proposal to be successful, people must be willing to pay the charges. Though the professional journals carry many examples of utility success stories, there are enough examples of failed attempts that officials should not take the decision to create a utility lightly.

Regardless of other considerations, the major factor that seems to influence the response of people to a utility proposal is the size of the proposed charge. Proposals for utilities with fees in the range of $1 to $2 per month for single family residences seem to have been accepted, while proposals for higher fees seem to have been rejected. In Tampa, Florida, for example, a proposal for a utility with monthly residential fees in excess of $4 was stopped by public opposition despite a concerted education program.

Cyre (1986) suggests that users seem to be willing to pay from one-third to one-half as much as they pay for water or sewer bills, whichever is lower, and that there "seems to be a psychological ceiling on stormwater charges of $3 per month for residences." [51] The City of Bellevue, however, which

has increased fees gradually over time, now charges single family residences $4.40 per month. [52]

Eight of the 19 utilities surveyed by the SSA report that they have increased rates. [53] Portland, Oregon, for example, has increased rates eight times. Thus, experience suggests that the best approach to implementing a utility is to begin with relatively low charges and to increase them over time.

6.0 SUMMARY

The State of Maryland has made a commitment to implement new programs to control the quantity and quality of urban stormwater runoff. It is clear that new programs will require new sources of funding. Experts agree that the best way to finance stormwater management is the utility approach, and many communities recently have created stormwater utilities. The rationale for the utility approach is simple: people should pay for the stormwater management in relation to their use of the service. In practice, this means that people pay according to the amount of runoff from their property.

Stormwater utilities throughout the United States are raising substantial amounts of money for stormwater management. Charges to single family residences are relatively modest: they range from $1.25 to $4.40 monthly. No utilities currently exist in Maryland. Thus, creation of utilities, even with charges at the low end of this spectrum, would greatly increase funds available for stormwater management.

Planning for a utility involves systematic consideration of a variety of technical, administrative, financial, and political issues. However, even with efficient planning and management, new facilities cannot be constructed and maintained, and stormwater management cannot be provided, if people are not willing to pay. It seems, therefore, that in most cases, the financial issues are the critical ones. The experience of other utilities seems to indicate that people will accept utilities if charges are not too high. While this experience is helpful, whether a utility will be accepted in any particular case depends on the amount of the proposed charges and other specifics of the proposal. Local officials must use their judgement to determine whether the utility approach is appropriate for their situation.

This guide outlines a brief, general approach to estimating user charges that local officials in Maryland can use in utility planning studies. With this approach, officials can easily assess the effects of a variety of factors on user charges. While this approach should yield enough information for local officials to determine whether to establish a utility, officials should recognize that significant effort is required to actually implement a utility. As noted, the time required to plan a utility easily can approach or exceed two years, and implementation can be expensive.

The Sediment and Stormwater Administration can provide technical assistance to local officials interested in establishing a utility. Inquiries are encouraged.

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FINANCING STORMWATER CONTROLS IN HARFORD COUNTY: A PRELIMINARY INVESTIGATION

FINAL REPORT

August 8, 1991

Prepared By:

Jim George
Greg Lindsey

Sediment and Stormwater Administration
Maryland Department of the Environment
2500 Broening Highway
Baltimore, Maryland 21224

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1.0 INTRODUCTION

The State of Maryland passed the Stormwater Management Act in 1982. Regulations promulgated in 1983 required all incorporated counties and municipalities to adopt stormwater management ordinances by 1984. The local programs are to provide controls that will "maintain after development, as nearly as possible, the predevelopment runoff characteristics." In addition, local governments must manage programs to implement provisions of the State's Sediment Control Program, and Maryland's Critical Areas Laws where applicable.

In 1987 Congress passed the Water Quality Act, a comprehensive overhaul of the Clean Water Act. Section 319 of the Act requires all states to develop assessment and management reports that outline strategies to control nonpoint source pollution. In response, Maryland's primary goal has been to implement the Chesapeake Bay Nutrient Reduction Plan for which quantitative goals already were in place (i.e., a 40% reduction in nutrient loadings to the Chesapeake Bay by the year 2000).

These statues, regulations, and policies reflect concerns about the negative impacts of stormwater runoff on the quality of streams and rivers in Harford County that are tributaries of the Chesapeake Bay. A number of stormwater policies, programs, and projects have been identified to control the quantity and improve the quality of runoff. This report focuses on options available for financing these activities.

Contents of Report

This report begins with a description of administrative and managerial considerations for collection and management of stormwater in Harford County. County departments responsible for various aspects of stormwater management are identified. This description is followed by a discussion of revenue requirements for stormwater controls. Costs are estimated for existing and proposed activities, including expanded maintenance programs. To the extent possible, costs are presented by administrative department and function.

Next, current and potential sources of revenue are described. Two major potential sources, property taxes and user charges, are evaluated against several criteria including ease and cost of administration, and fairness. Legal requirements, options for billing, and other issues related to the formation and implementation of a user charge system are reviewed in the appendices.

Definitions

The stormwater control system includes structures and natural waterways used for the collection, conveyance, storage, treatment, and disposal of stormwater runoff in a manner that prevents accelerated channel erosion, increased flood damage, and/or degradation

of water quality. The stormwater control system conventionally has comprised two distinct elements: (1) storm drain systems and (2) stormwater management structures.

The storm drain system, which includes facilities used primarily to collect and convey runoff, includes two basic elements:

(a) open systems consisting of natural watercourses, and

(b) closed systems consisting of pipes and other structures constructed specifically for the purpose of transporting runoff.

The Harford County Stormwater Management Ordinance provides a specific definition of stormwater management, which distinguishes it from stormwater drainage or conveyance. This definition of stormwater management also includes two basic elements:

(a) for Quantitative control, "a system of vegetative and/or structural measures which ... control the increased volume and rate of surface runoff caused by man-made changes to the land."

(b) for Qualitative control, "a system of vegetative and structural measures which... control water pollutants which are transported by and contained in stormwater runoff."

In this report, the terms stormwater control systems, stormwater controls, and stormwater system are used to refer to both stormwater management and storm drainage. The term flood control occasionally is used interchangeably with quantity control and refers mainly to control of the peak and duration of runoff flows. Consistent use of these definitions will help avoid confusion. In general, the discussion of financing options that follows applies to stormwater management controls (i.e., to both drainage and management).

2.0 ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITIES

The Harford County Department of Public Works (DPW) bears primary responsibility for both storm drain systems and stormwater management. Data on current policies are limited because the County has failed to return the Department of Environment's data form mailed in 1990 as part of the administrative component of the triennial review of the Harford County stormwater program.

The DPW Division of Environmental Affairs has primary responsibility for stormwater management. Environmental Affairs is divided into two offices: the Office of Engineering and the Office of Enforcement, which were created in place of the Division of Stormwater Management in FY 1989-90. The Division of Environmental Affairs, Office of Enforcement issues grading permits, inspects construction sites for compliance with sediment control plans, performs inspections of stormwater management facility construction and conducts follow-up maintenance inspections. In addition, the Enforcement investigates sediment control and water drainage complaints. The Office of Enforcement also works closely on programs administered by the DPW Division of Planning and Zoning, and manages public education programs on environmental issues.

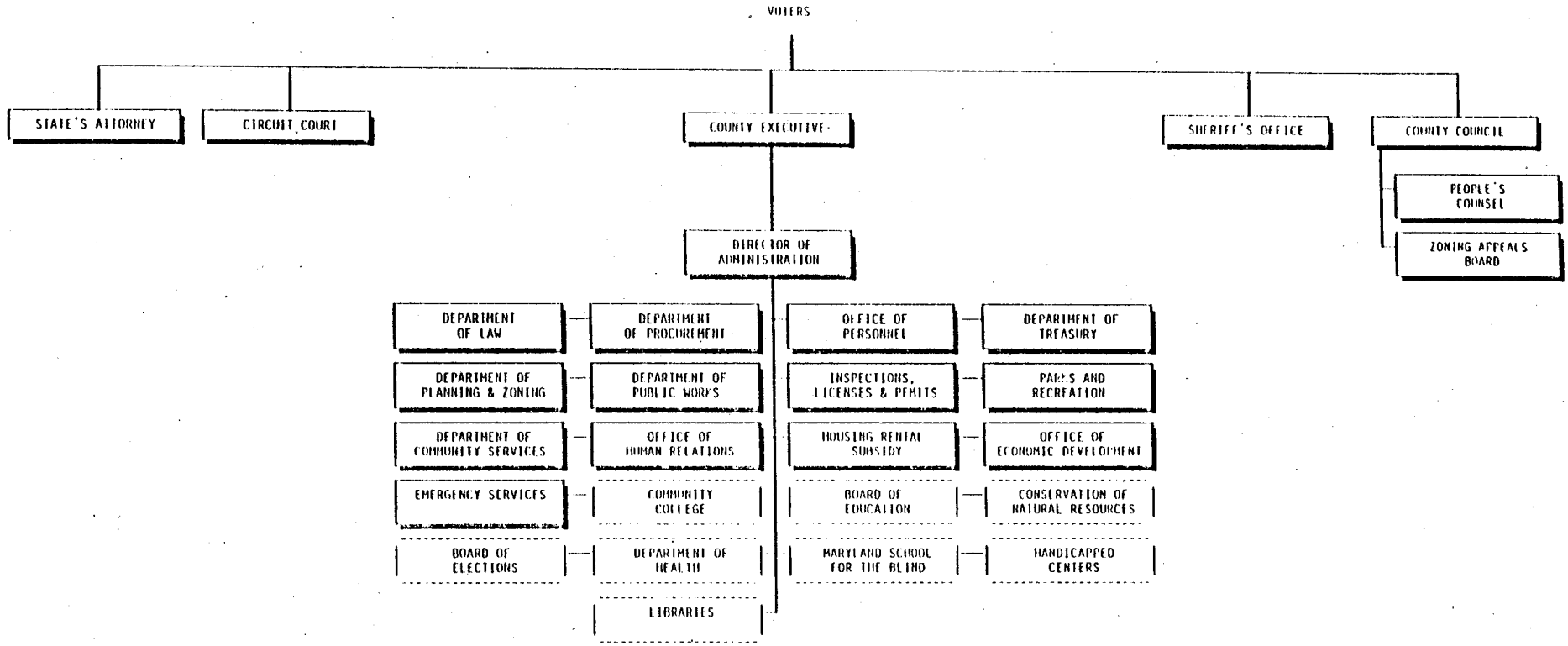
The Division of Environmental Affairs, Office of Engineering supports the Office of Enforcement by performing design reviews and issuing stormwater management permits. In addition, the Office of Engineering is conducting a study to evaluate the viability of a stormwater management fee in Harford County. Storm drain inlet maintenance and pipe replacement is managed by the DPW Division of Highway Maintenance and Operations.

The DPW Division of Planning and Zoning administers several grant-funded stormwater management projects. One is the Urban Forestry Grant and the another is the Coastal Zone Management Grant. Both of these activities build upon the recognition that forested lands provide water quality benefits. In the case of the coastal management, the intent is to preserve, renovate and enhance forested lands to provide buffer areas along the Chesapeake Bay. In addition, work on the Chesapeake Bay Critical Area Plan is administered by Planning and Zoning.

The Department of Natural Resources, Soil Conservation District works closely with DPW in areas concerning stormwater management. The District approves erosion/sediment control plans prior to construction, reviews small pond designs for dam safety, and serves on the Harford County Development Advisory Council and Environmental Task Force.

An organization chart of the Harford County Government is provided in Figure 1.

HARFORD COUNTY GOVERNMENT
ORGANIZATION CHART



POSITIONS WITH BROKEN BOX OUTLINE ARE DEPARTMENTS UNDER STATE LAW PARTIALLY OR WHOLLY FUNDED BY COUNTY APPROPRIATIONS

Fig. 1

3.0 REVENUE REQUIREMENTS

Revenue requirements are the costs of all stormwater control programs and functions. This study considers two basic components of revenue requirements: (1) the cost of existing programs and functions and (2) the cost of potential programs considered necessary for achieving stormwater control objectives. These two components can include both operating and capital costs. A good estimate of the total costs is necessary to establish priorities for financing and to determine the amount of revenues from different sources necessary to pay for the programs.

A difficulty in determining the cost of existing stormwater control programs is that costs generally are reported by administrative unit (department), not by program or function. The Harford County Budget is very detailed and provides line items for many stormwater management items. The budget does not delineate stormwater drainage development and maintenance activates as thoroughly as it does stormwater management activities. Hence, an accurate estimation of stormwater control costs is not available. Costs reported here provide an indication of the order of magnitude of control costs.

The challenge in estimating costs of potential functions not currently performed by the County is that few data are available on which to base such cost estimates. The cost estimates for new functions were developed from a variety of data sources and are considered accurate only within an order of magnitude. A rough cost estimate for maintenance of structures can be performed based on recent site-survey information compiled by MDE and general engineering formulas.

3.1 Current Operating Costs

Direct Operating Costs

Direct operating costs are those incurred by operating agencies that provide direct services to County residents. The costs include salaries, consultant costs, and other budgeted expenses not funded by capital funding mechanisms. The FY 1990 operating expenses for stormwater controls, summarized in Table 1, were estimated to be $990,492.

The Highway Division costs are assumed to be associated with primarily storm drainage activities such as ditch maintenance. These operating expenses for storm drainage systems development and maintenance do not include costs for storm sewers, hence, this is only a partial estimate of the storm drainage costs. The cost of road drainage ditch maintenance is estimated, arbitrarily, to be one third of the $300,000 for road shoulder maintenance or $100,000 plus $5,200 for sediment control repairs after highway maintenance work has occurred totaling $105,200. In addition, within the Highway Fund, the County budget lists $70,905 under an entry entitled "Dir DPW-Stormwater".

The funds not used by the Highway Division are assumed to be for stormwater management. These include $57,645 for the Soil Conservation District, $624,892 for the Environmental Affairs Division of the DPW, and $131,850 the Department of Planning and Zoning activities.

Indirect Operating Costs

Indirect operating costs are those incurred by County agencies that provide support services (e.g., Legal, Financial, etc.) to operating agencies. As a rule-of-thumb, indirect operating costs may be estimated as 20 percent of total payroll costs of the operating agencies. In turn, payroll costs account for roughly anywhere from 75% to 95% of total direct operating costs related to controlling stormwater.

An estimate of the total payroll costs for current programs is $841,918 or 85% of the total costs. Using the rule-of-thumb estimate of 20 percent of total payroll costs leads to an estimated indirect operating cost of $168,384. These costs are summarized in Table 1.

Table 1 - Estimated Costs of Stormwater Programs in FY 1990-91

Operating Costs

		Department Subtotal
DEPARTMENT OF CONSERVATION OF NATURAL RESOURCES		
Soil Conservation District	$ 57,645<<	
Department Indirect Costs	$ 9,800	$ 67,445
DEPARTMENT OF PUBLIC WORKS		
Environmental Affairs Division		
• Office of Engineering	$106,703	
• Office of Enforcement	$437,601	
• Office of Administration	$ 80,588<<	
(Division Subtotal)	$624,892	
Highway Division[1]		
• Dir DPW-Stormwater	$ 70,905	
• Maintenance and Operations	$105,200<<	
(Division Subtotal)	$176,105	
Department Indirect Costs	$136,169	$ 937,166
DEPARTMENT OF PLANNING AND ZONING		
• Critical Area Plan	$ 50,000[2]	
• Urban Forestry Grant	$ 19,150	
• Costal Zone Management Grant	$ 62,700	
(Division Subtotal)	$131,850	
Department Indirect Costs	$ 22,415	$ 154,265

Capital Costs - (Not Currently Available)

Current Program Total	$ 990,492
Proposed Program Total	$ Not Estimated
Indirect Cost Total	$ 168,384
Capital Cost Total	$ Not Available
Grand Total	$1,158,876

NOTE: The symbol '<<' indicates uncertainty associated with the estimate. All cost estimates are extracted from the FY 90-91 County Budget.

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[1] The Highway Division funds are managed as a separate budgetary/accounting entity.

[2] Low estimate based on past figures.

3.2 Costs of Proposed and Potential Programs

As discussed below in Section 3.4, the general trend in Harford County is toward increased stormwater management activities. Activities that may be warranted in the future include watershed planning, improved maintenance of facilities, and retrofit projects.

Watershed Planning

Watershed planning is necessary to establish water quality goals and to identify actions that can be taken to achieve the goals. A major component of a watershed plan is the identification of retrofit projects that can reduce pollution from areas of existing development. Due to physiographic differences, objectives and projects will vary by watershed. The cost of watershed planning can vary significantly depending on the problems that exist within a given watershed and the level of detail needed in the plans.

No watershed-specific estimates of the costs to prepare plans are available for this report; however, the following rough estimate may be used as a guideline. Prince George's County estimates that a watershed plan for an area approximately 100 square miles in size costs approximately $500,000. There are 448 square miles in Harford County. Based on Prince George's County rule-of-thumb, the cost of completing watershed plans for all of Harford County could be about $2,240,000. Because Harford County is more rural than Prince George's County, this rule-of-thumb may over estimate the cost of watershed planning.

Given current expenditures on stormwater programs, these costs, if accurate, seem extremely high. The State has not mandated the preparation of watershed plans, and, given the high costs of such planning activities, it is unlikely that they would be undertaken by the Counties voluntarily. Nevertheless, this estimate provides a reasonable indication of the magnitude of costs that could be incurred if watershed planning was required. Given the potential magnitude of such costs, it is clear that costs would have to be phased in over time.

Improved Maintenance

The County has two basic responsibilities with respect to maintenance:

(1) the County must inspect private facilities and use its regulatory authority to enforce necessary maintenance; and

(2) the County must inspect and maintain facilities that the County constructs or has assumed ownership of.

State regulations require that all existing facilities be inspected for maintenance at least once every three years[3]. Recent investigations by the Sediment and Stormwater Administration show that maintenance of structures in Harford County is inadequate. The County's computerized inventory contains 259 facilities. In 1990, SSA randomly selected 101 sites for inspection. The DPW staff was able to provide plans for only 52 of the 101 facilities in the sample. While the County's inventory indicated that 47 of the sites in the sample had received as-built approval, approval dates were found on only eight of the plans that SSA obtained.

SSA inspectors were able to locate and visit 95 of the 101 sites selected for inspection, but were able to inspect only 70 of them. Most of the remaining 25 sites still were in the construction phase. SSA concluded that the County's system for tracking project reviews and implementation was poorly organized and out-of-date.

Inspectors found that 60% of the sites were functioning hydrologically, and that about 67% were providing water quality benefits. Routine maintenance was needed at 71% of the facilities and about 44% of the dry basins and dry wells warranted immediate enforcement action (i.e., there were major repairable problems that prevent proper function, lesser repairable problems that influence function, or problems that are hazards to human safety or property). In general, improvements in the inspection and maintenance program is needed if these facilities are going to function over time. To the extent that these deficiencies are due to a lack of funds for personnel to maintain the inventory, this problem may reflect the need for additional funds.

An accurate estimation of the costs of maintaining stormwater facilities in Harford County would require historical information on the costs of different maintenance activities. While these are not available, rough estimates of maintenance costs can be developed either from inventory data, from the Maryland Department of Environment (MDE) inspection data, or from generalized estimates of maintenance costs in the engineering literature. For example, Schueler (1986) has suggested that three to five percent of construction costs for stormwater management facilities be allocated annually for routine and nonroutine maintenance. This latter approach is appropriate for rough planning purposes, and is most appropriate for this report, although for reasons noted below, a complete estimate cannot be obtained with this crude approach.

A rough estimate of the cost to maintain wet and dry basins in Harford County was developed using data from Cecil County because drainage area data for basins in Harford County were not available. In Cecil County it was determined that, on average over fourteen wet and dry basins, annual maintenance costs were about $1,730 for each basin. It is assumed that this average cost is a reasonable estimate for Harford County as well. The number of wet and dry basins in Harford County was determined by extrapolating from the

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[3] COMAR 26.09.02.10

70 sites inspected by MDE in 1990. About 48% of the sites inspected were dry and wet basins, which translates to an estimate of 124 of the 259 sites in Harford County being wet or dry basins. The estimated cost for maintaining 124 basins is about $212,000 per year. Maintenance costs for vegetated swales, dry wells, underground storage, and infiltration trenches were not estimated and are excluded from this maintenance cost estimate.

In some counties, local officials have found that private homeowner's associations frequently are unable to maintain facilities adequately. Hence, some jurisdictions are considering assuming responsibility for maintaining privately-owned structures. SSA is uncertain as to whether this is an issue in Harford County. If so, and if County staff and officials believe that acceptance of maintenance responsibilities by the County would improve conditions, costs would be expected to be roughly $212,000. Because the County is only responsible for a fraction of the sites in the County, the cost of maintaining wet and dry basins may be a fraction of this estimated cost.

3.3 Current and Projected Capital Costs

Currently no known capital costs are incurred for stormwater management activities[4]; however, retrofitting of existing stormwater management structures is likely to be an area requiring future funding. Estimates of the costs of retrofitting watersheds for the purposes of stream restoration or achievement of Chesapeake Bay nutrient reduction objectives depend on results of future watershed planning activities. No attempt will be made here to estimate the cost of retrofitting watersheds in Harford County to achieve water quality goals. As watershed plans are developed, retrofitting projects can be identified and the costs can be estimated.

3.4 Trends in Costs for Stormwater Controls

Few data are available to forecast trends in costs for potential programs, which include watershed planning, retrofitting, and improved maintenance. Past trends show an increase in stormwater management activities, and these trends are likely to continue. Harford County is growing rapidly: in 1990 it ranked seventh out of 23 counties in the State for annual population growth (1.76 percent)[5]. In addition, between 1984 and 1988, County staff supporting stormwater management activities grew from five to twelve persons.

Regulations governing stormwater management are becoming more strict and are expected to require additional staff and cost more to administer. Maryland, in coordination with other states in the Chesapeake Bay watershed, has mandated more

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[4] Anticipated capital costs for "flood prop. acquisition" were noted in the FY 90-91 budget in the amounts of $559,000 (FY 92-93) and $360.000 (FY 94-95).

[5] Maryland Association of Counties

stringent stormwater management practices and set ambitious nutrient reduction goals. In addition, recent Federal amendments to the Clean Water Act will require NPDES permits for counties and municipalities. Although Harford County is not presently required to obtain a permit for its municipal storm sewer systems, it may have to in the future. In addition, the County must now obtain permit coverage for its activities that are considered industrial (e.g., landfills, and vehicle maintenance depots).

Lands continue to be developed by the private and public sectors; this will result in additional infrastructure maintenance requirements in the future. Alternative options for financing stormwater controls are discussed below in Section 4.0.

3.5 Cost Summary

Current annual direct operating costs are approximately $990,492 for stormwater controls. Using rules-of-thumb, indirect operating costs associated with current programs are estimated to be $168,384. Hence, total current costs are estimated to be about $1,158,876. The County has not established any new objectives for its stormwater programs, but activities and trends at the State level suggest that eventually, maintenance of facilities may need to be improved, and watershed planning and retrofit activities may be required. While the former (improved maintenance) would not represent a significant increase in costs, the latter two (watershed planning and stormwater retrofit activities) could. Capital costs for stormwater controls for FY 1991 are presently not available.

This study makes only rough attempts to estimate annual costs associated with potential new programs ($212,000 for stormwater facility maintenance, and some fraction of $2,240,000 as a phased-in watershed planning effort). Although few data are available for projecting future operating and capital costs, it is certain that needs will increase. Trends discussed above indicate a qualitative upward trend in stormwater management activities, and increased development suggests an increase in stormwater drainage activities, but it is difficult to determine from readily available data what the actual trend in stormwater control costs have been. In general, it is reasonable to believe that revenue needs will grow at rates higher than inflation.

The anticipated growth of stormwater management revenue needs has several implications. The first is that revenues sufficient to cover present costs will be insufficient in coming years. When additional revenues are needed, decision makers will have to consider several options. First, the general revenues could be increased through increased tax and fee rates. Second, changes could be made in priorities to shift resources from other programs to stormwater management programs. Third, decision makers could choose to ignore stormwater management problems at the risk of violating State and Federal regulations and triggering political and public repercussions. Finally, new sources of revenues, such as the one discussed in this report, could be developed.

4.0 OPTIONS FOR FINANCING STORMWATER CONTROLS

This chapter examines options for financing stormwater control programs in Harford County. Current sources of revenues are described, and alternatives for financing different activities are evaluated.

4.1 Current Sources of Revenues

Operating funds for stormwater programs come primarily from the County General Fund, the Highway Fund, and Grants Fund. In most cases, a revenue subcategory (e.g., property taxes) is not identified as being the specific source of a particular stormwater control program. Where it is possible, however, have identified the specific sources.

The FY 1990-91 General Fund amounted to $144,111,331. The General Fund revenues are classified into seven categories:

- Property Taxes 44%
- Income Taxes 35%
- Retained Earnings 9%
- Other Revenue 5%
- Intergovernment & State 4%
- Investment & Rental 2%
- Permits & Licenses 1%

The FY 1990-91 Highways Fund amounted to $18.216,364. The source of these funds are classified as follows:

- Property Taxes 48%
- Intergovernment & State 31%
- Interfund Reimbursement 14%
- Investment & Rental 3%
- Other Revenue 2%
- Income Tax 1%
- Permits & Licenses 1%

In general it is not possible to state that any specific activity such as stormwater control is financed primarily by a specific type of tax or fee. In one case, the County Operating Budget indicates that $70,905 in Highway Fund revenues was set aside for "Dir DPW-Stormwater"[1], and that this money came from interfund reimbursement. However, in general, detailed sources for the funding of other highway activities, such as drainage ditch maintenance, are not provided. This was also the case for the General Fund.

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[1] It is not clear exactly what this funding is for, but it may be the DPW, Office of the Director's expenditures on stormwater control.

In addition, within the General Fund (FY 90), the following sources of revenues are listed, but the specific activities that they support are not described. These are

- Sediment Control Licenses and Permits $ 12,000
- Stormwater Management Permits $ 45,000
- Grading Permit Fees $110,000
- Stormwater Management Grant (MDE) $ 72,000

Grant revenues are better documented in the County budget. Funding sources and disbursements for many, but not all of the grants associated with stormwater controls are provided in the County Budget. For instance, the Department of Planning and Zoning received a $19,150 grant from the Maryland Forest, Park and Wildlife Service for Urban Forestry BMPs, and $62,700 from the Maryland Department of Natural Resources for Costal Zone Management. It is unclear whether all grants are consistently managed under the Grant Fund because several grants, such as the Stormwater Management Grant listed above ($72,000) and Critical Area Plan Grant, are not mentioned in the Grant Fund section of the County Budget. It is possible that State funds, which are not managed under the Grant Fund are classified as an "Intergovernment & State" revenue source.

Because information about funding sources is incomplete, and the disbursement of funds is not always apparent, it is difficult to make the connection between the funding sources and program budgets. Consequently, the current picture of stormwater control funding is incomplete.

4.2 Potential Sources of Revenues

MDE has summarized methods for financing stormwater controls in Table 3. A wide variety of options are available; however, only two sources of revenues are adequate for major cost items such as operation and maintenance, and debt service on general obligations or revenue bonds issued to finance retrofit and other capital projects. These two sources are General Fund tax revenue (primarily property taxes) and user charges.

While property taxes are based on the value of property (land and improvements), user charges are based on some surrogate measure that correlates with or is representative of the amount of runoff that leaves a property. Usually this surrogate is the percentage of impervious area on a property. In the following subsections, the methods used in this study to calculate property tax-based stormwater revenues and user charge-based revenues are illustrated. Both the tax-based and user charge-based approaches impart costs according to different land uses (e.g., industrial, residential, and commercial), but the distribution of the costs varies between the two approaches. These distributions are compared and discussed.

In the following illustrations, revenue requirements for stormwater management in Harford County are estimated to be $1,500,000. This number was selected arbitrarily. It is sufficient to cover current stormwater management costs, some unknown fraction of costs for storm

drain systems, and/or potential costs for maintenance, watershed planning, and retrofit activities. The figure is illustrative only, and should be replaced with more accurate estimates if or when they become available.

Table 2 Financing Methods for Stormwater Controls (MDE 1988).

Use of Revenues	Source of Revenues	Developer/ User Pays	Taxpayer Pays	Other Pays
Operations & Maintenance				
	General Fund (property tax)		X	
	Utility Fee or Service Charge	X		
	Interfund Loans (for transition to utility)		X	
Major Capital Improvements				
Redevelopment or New Development				
	General Obligation Bonds		X	
	Revenue Bonds	X		
	Taxes on other utilities			X
	Grants (federal or state; e.g., Community Development Block Grants)			X
	Pay-as-you-go Sinking Fund	X	X	
	Tax Increment Financing		X	
Primarily New Development				
	Subdivision Exactions	X		
	Developer Incentives	X		
	Impact Fees	X		
	System Development Charges	X		
	General Facilities Charge	X		
	In-lieu of Construction Charges	X		
	Latecomer Fees for Extensions	X		
Regulatory Services				
	Plan Review & Inspection Fees	X		
	On-site Facility Inspection Fees	X		
	Penalties and Fines	X		
Special Services & Projects				
	Local Improvement Districts		X	
	Utility Local Improvement Districts		X	
	Area of Special Benefit Financing		X	
	Special Purpose Taxing Districts		X	
	Homeowners' Associations			X
	Voluntary Gifts			X

4.2.1 Estimating Revenues from Property Taxes

Ad valorem taxes levied on the assessed value of real property (i.e., property taxes) are the largest single source of revenues in the County budget. The way in which a property tax works is straight forward: assessors estimate the market value of properties and then determine assessed value at a rate established by law. Currently, properties are assessed at approximately 45% of market value. For example, if a residential property is valued at $100,000, its assessed value is about $45,000. The tax rate is levied per $100 of assessed valuation. If the tax rate were $1.00 per $100 assessed valuation, the annual tax on a property with an assessed value of $45,000 (market value of $100,000) would be $450. The tax on any parcel can be determined from data in the County's tax assessment files.

Table 3 is a worksheet developed to illustrate how potential revenues from property taxes can be estimated for all of Harford County. The worksheet uses 1990 data from the Assessments and Taxation Files. Because some cities may manage separate stormwater programs, a correction could be used to make the estimate more accurate. To implement this correction, parcels within the nonparticipating jurisdiction could be subtracted from the rate base. This type of procedure was not used in this study; however, an illustrative example drawn from Cecil County is presented in Appendix B.

<u>Column C1</u> is the list of land use categories that Harford County and the State Department of Assessments and Taxation use to record data about properties.

<u>Column C2</u> contains the number of parcels in each land use category. For example, there were 103 parcels classified as industrial land use in Harford County in 1990 (these data are for actual land use, not zoning).

<u>Column C3</u> contains estimates of the average value of a parcel in each land use category. The average value of the 103 industrial parcels in 1990 was $1,552,784 per parcel.

<u>Column C4</u> contains estimates of the average assessed value of a parcel in each category. The values in C4 were computed by multiplying the values in C3 by 0.45 (e.g., the average assessed value of an industrial parcel is $698,753 = $1,552,784 * 0.45).

<u>Column C5</u> contains estimates of the taxable base in each category. The taxable base is defined here as the total assessed value. The values in C5 are computed by multiplying the number of parcels (Column C2) by the average assessed value per parcel (Column C4). For example, the tax base for industrial land use is $71,971,538 = 103 * $698,753. (Note that a multiplication by 100 is implied for the presentation of values in this column.)

Column C6 contains an estimate of a revenue requirement. In this case, the requirement is $1,500,000. This number was selected to represent a rough estimate of Harford County's operating budget for stormwater control.

Column C7 contains an estimate of the tax rate per $100 of assessed valuation necessary to meet the revenue requirement. This is calculated by dividing the revenue requirement (bottom of Column C6) by the total taxable base (total summation of Column C5) $1,500,000/$27,996,913 = $0.0536.

Column C8 contains estimates of the annual property taxes for an average-valued parcel in each category that would be required to generate the arbitrary revenue requirement of $1,500,000. The values in C8 were computed by dividing the average assessed values (Column C4) by 100 and multiplying the result by $0.0536. For example, the average annual tax for an industrial parcel would be about $374 = ($698,753 / 100) * $0.0536.

Column C9 contains estimates of the total tax paid by all parcels in each land use category (to generate $1,500,000 in revenue). These values were calculated by multiplying the number of parcels (Column C2) by the average annual property tax (Column C8). For example, in sum, the 57 industrial parcels would pay approximately $38,560 = $374 * 103.

Column C10 contains the percent of total tax paid by each land use category. These values were computed by dividing the amounts paid by all parcels in each land use category (Column C9) by the total revenue ($1,500,000). The portion paid by the Industrial Sector is about 3%.

Table 3

Illustrative Worksheet for Estimating Stormwater Revenues From Property Taxes in Harford County, Maryland

Property Tax ($1.5M Revenue Requirement)
(DRAFT - 1990 Data)

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Land Use Category	Number of Parcels	Average Value/ Parcel	Average Assessed Value	Tax Base (x 100)	Revenue Required	Tax Rate Per $100 Valuation	Yearly Tax Per Average Parcel	Total Paid By Category	Fraction Paid By Parcel
Agriculture	1,330	149,843	67,429	896,810			36.13	48,049	0.03
Commercial	1,692	382,247	172,011	2,910,429			92.16	155,933	0.10
Comm Res	5	270,280	121,626	6,081			65.16	326	0.00
Exempt	727	1,693,199	761,940	0			0.00	0	0.00
Park									
Playground									
School									
Industrial	103	1,552,784	698,753	719,715			374.37	38,560	0.03
Apartments	188	935,982	421,192	791,841			225.66	42,425	0.03
Not Perc	9	31,022	13,960	1,256			7.48	67	0.00
Residential									
< 1 Acre	35,461	93,767	42,195	14,962,742			22.61	801,664	0.53
> 1 Acre	10,073	121,212	54,545	5,494,357			29.22	294,373	0.20
Res Ag	695	114,743	51,634	358,859			27.66	19,227	0.01
Res Comm	29	124,176	55,879	16,205			29.94	868	0.00
Condominium	1,680	62,406	28,083	471,789			15.05	25,277	0.02
Condo Comm	22	136,050	61,223	13,469			32.80	722	0.00
Marshland	0	0	0	0			0.00	0	0.00
Non-standard									
Cooperative	0	0	0	0			0.00	0	0.00
Mobil/Traile	0	0	0	0			0.00	0	0.00
Group Quar	0	0	0	0			0.00	0	0.00
Motel	0	0	0	0			0.00	0	0.00
Forest Cons	0	0	0	0			0.00	0	0.00
Detached S-F									
0 - .5 Ac	0	0	0	0			0.00	0	0.00
> .5 - 1 Ac	0	0	0	0			0.00	0	0.00
> 1 Acre	0	0	0	0			0.00	0	0.00
Garden Apt.	0	0	0	0			0.00	0	0.00
High Rise	0	0	0	0			0.00	0	0.00
Other	0	0	0	0			0.00	0	0.00
Total (Dev.)	52,014			26,643,554				1,427,491	0.95
Unimproved	14,070	21,375	9,619	1,353,358			5.15	72,509	0.05
Grand Total	66,084			$27,996,913	$1,500,000	$0.0536		$1,500,000	1.00

4.2.2 Estimating Revenues from User Charges

Estimating potential revenues from charges in a jurisdiction is a straightforward process of summing up the individual user charges of all of the rate payers in the rate base. In this context the rate base is defined as the land use categories[2] that will be assessed user charges.

For planning purposes, the procedure is simplified by grouping users according to similar land uses and estimating the average charge based on the average-sized parcel within each land use category. The charge for the average parcel in each land use category is multiplied by the number of parcels within the category yielding a revenue subtotal for that category. These subtotals are then summed across all of the land use categories to give an estimated total revenue for the County.

The worksheet used to implement this procedure is described in further detail in the illustration below. In this particular case, residential user charges (for parcels less than one acre) were set at a rate that would generate $1,500,000 given an assumption that the average impervious area of these parcels is 3,000 sq.ft. Table 4 is a worksheet used to facilitate the procedure; the purpose of each column is described below. Because some "incorporated places" may manage separate stormwater programs, a more accurate estimation than performed below would be to subtract out contributions from these "incorporated places".

It is not the intent of this section to explore user charge systems in depth. It is worth noting, however, that user charge algorithms allow considerable flexibility in adjusting the distribution of charges among different land use categories. Six alternative user charge systems are presented in Appendix B. These provide a sense of the available options and illustrate different resulting distributions of charges.

Column C1 is the name of the land use category. In the cases of Exempt and Residential land uses, subcategories are defined to allow finer distinctions in stormwater runoff characteristics.

Column C2 is the number of parcels in each land use category.

Column C3 is the average parcel size for each land use category expressed in acres. For the Residential land use category, weighted average parcel sizes were calculated for parcels greater than, and less than one acre using the data displayed in Appendix A.

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[2] Land use categories are standard descriptive classifications (e.g., industrial, commercial, residential, undeveloped, and others). As an approximation, it is assumed that stormwater runoff characteristics per unit area are the same for all parcels in a given land use category.

Column C4 contains the user charge rate factors, which represent the typical percentage of impervious cover on a property. For example, the rate factor for industrial parcels is 0.70 implying that, on average, about 70% of each industrial parcel is covered by impervious material. These factors reflect standard hydrologic runoff coefficients such as those used in the Rational Method of runoff estimation.

For three land use categories (two Residential, and Residential Agriculture) the rate factor is not applicable (na) because the average impervious area was fixed based on information in the engineering literature. This practice is one means of ensuring that user charges for residential parcels greater than one acre do not differ vastly from charges for parcels less than or equal to one acre. Other approaches described in Appendix B do not rely on fixing the area.

This column can also be used to control whether or not a land use category is included in the rate base. Table 4 illustrates a case in which zero values are inserted for agriculture, exempt, and unimproved land use categories thereby excluding them from the rate base.

Column C5 is the average impervious area per parcel for each land use category. This average impervious area is expressed in square feet. The values are calculated as the (average acres per parcel) x (proportion of impervious area) x (43,560 ft/acre). That is, (C3) x (C4) x (43,560 ft/acre). Note, (C4) is the rate factor. As noted in the description of C4, the impervious area was fixed for three of the land use categories rather than being based on this calculation.

Column C6 is the number of Single Family Equivalent (SFE) units. An SFE is defined as the ratio: (impervious area of an average parcel for a given land use) / (average impervious area of a residential parcel less than 1 acre). In the worksheet it is calculated as C5/C5* where C5* is the particular value of C5 for Residential < 1 Acre[3], which in this case is multiples of 3,000 square feet[4].

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[3] Most of the alternative approaches presented in Appendix B of this report define the SFE with respect to the average parcel size among residential parcels less than one acre. In two approaches, however, the delineation of the residential land use is much finer. In those cases, the SFE is defined with respect to the average parcel size among residential parcels less than 1/4 acre. As a consistent rule, all of the approaches presented in this report define SFEs with respect to the smallest subclassification of residential land use. Furthermore, when referring to the smallest subclass the term "typical residential parcel" is often used.

[4] The amount of square feet in an SFE for a given county could be calculated by multiplying a runoff coefficient times the average parcel size. The decision to select a value of 3,000 sq.ft. here was motivated by the desire to standardize SFE charges across all counties for a state-wide study (George, 1991).

For the purposes of this study, this dimensionless unit equals one for a typical single family living on a residential parcel of less than 1 acre. Since most people are familiar with residential land use, SFEs allow a comparison among land use categories based on a familiar measure. Once defined, SFEs also facilitate the user charge calculations, although they are not necessary to meet these ends.

Column C7 is the number of SFEs per land use category. This is equal to the average number SFEs per parcel multiplied by the number of parcels in the given land use category. That is, (C2) x (C6). The column is summed to a total at the bottom.

Column C8 is the Total County Revenue Generated per year. It is the product of $8.33 (the charge per SFE) times the sum of column C7 (the grand total number of SFEs for the county).

Column C9 is the charge per SFE, which in the present case is $8.33/SFE. It is calculated as the fraction (C8*) / (C7*) where the star indicates the values that are used are from the bottom of the respective column.

Column C10 is the typical annual charge for each land use category. It is the amount that would be paid by the owner of an average sized parcel in the given land use category. It is calculated as the typical number of SFEs times the charge per SFE ($8.33), or (C6) x (C9*) where the star indicates the value is from the bottom of the column.

Column C11 is the total amount of revenue generated by a given land use category. It is the product of the average annual charge and the number of parcels for the given land use category. It is calculated as (C10) x (C2).

Column C12 is the percentage of the total revenue paid by the given land use category. It is the total revenue per category divided by the grand total revenue for the entire county. It is calculated as (C11) / (C8*) where the star indicates the value is from the bottom of the column.

Table 4

Illustrative Worksheet for Estimating Revenues From Stormwater User Charges in Harford County, Maryland

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Land Use Category	Number of Parcels per Land Use	Average Acre/ Parcel	Rate Factor (% Imp.)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs per Parcel	Number of SFEs per Land Use Category	Revenue Requirement ($)	Dollars Per SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,692	2.7	0.82	96,442	32.15	54,393			267.70	452,947	0.30
Comm Res	5	4.0	0.68	118,483	39.49	197			328.88	1,644	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	653.55	67,315			5,442.25	560,551	0.37
Apartments	188	2.7	0.64	75,272	25.09	4,717			208.94	39,280	0.03
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.33	na	3,000	1.00	35,461			8.33	295,293	0.20
> 1 Acre	10,073	3.34	na	4,500	1.50	15,110			12.49	125,821	0.08
Res Ag	695	11.2	na	4,500	1.50	1,043			12.49	8,681	0.01
Res Comm	29	4.1	0.64	114,301	38.10	1,105			317.27	9,201	0.01
Condominium	1,680	0.05	0.64	1,394	0.46	781			3.87	6,500	0.00
Condo Comm	22	0.05	0.68	1,333	0.44	10			3.70	81	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					180,131				$1,500,000	1.00
Unimproved	14,070	4.2	0.00	0	0.00	0			0.00	0	0.00
Grand Total	66,084					180,131	$1,500,000	$8.33		$1,500,000	1.00

4.2.3 Advantages and Disadvantages of Taxes and User Charges

Because property taxes and user charges are based on different measures (i.e., property values and impervious land area, respectively), their respective burdens across land use categories differ. The following illustration explores how much owners of average valued parcels would pay under a property tax system versus how much they would pay for average sized parcels under a user charge system. We applied both approaches under the assumption that it was necessary to generate $ 1.5 Million in revenues.

Two alternate applications of the user charge system are explored. The first case, presented in Table 5, excludes agricultural and unimproved land uses from the rate base. The second case, presented in Table 6, includes these two land uses. The property tax approach remains unchanged in both cases. The distribution of the total revenues among land use categories is presented as a percentage for both the tax and user charge systems.

As indicated in Table 5, the distribution of payments under the two systems is significantly different. Residential property owners generally would pay less under a charge system, while nonresidential users generally would pay less under a tax system. For example, to raise $1,500,000 in taxes, the owner of an average priced residential property valued at $93,767 would have to pay $22.61 annually, and the owner of an averaged priced industrial property valued at $1,552,784 would have to pay about $374 annually.

Under a charge system, the owner of a residential property less than or equal to one acre in size would pay only $8.33 annually, while the owner of an average sized industrial parcel of 64.3 acres would pay about $5,442 annually. In addition, under a charge system the industrial sector would bear the bulk of the cost at 37% with the residential sector bearing the next largest portion at 28%, whereas under a property tax system these proportions would be 3% for the commercial sector and 73% for residential parcels. The largest average annual user charge of $374 would be paid by property owners in the industrial sector, while the largest average annual property tax payment would be $5,442, also paid by owners in the industrial sector. This last comparison also represents the largest difference in payments for the average case between the tax and user charge systems, and is more than a fourteen fold difference.

The exclusion of agricultural and unimproved land use categories from the rate base for the user charge system accounts in part for the large differences in payment between the two systems in Table 5. This is because agricultural and unimproved land use categories are represented in the tax system rate base, but are not present in the user charge system rate base. Consequently, revenues from these two land use categories must be absorbed by the remaining land use categories under the user charge system. This source of differences in the distribution of charges between the two systems is eliminated in the second case presented in Table 6.

Table 5

Typical Annual Charges and Property Taxes Necessary to Generate $1.5 Million (Agricultural and Unimproved Parcels Excluded From Rate Base)

Land Use Category	Average User Charge ($/Year)	Average Property Tax ($/Year)	Percent of Total Charges	Percent of Total Taxes
Agriculture	0	36	0%	3%
Commercial	268	92	30%	10%
Comm. Res.	329	65	<1%	<1%
Industrial	5,442	374	37%	3%
Apartments	209	226	3%	3%
Residential < 1 acre	8	23	20%	53%
Residential > 1 acre	12	29	8%	20%
Res Agriculture	12	27	<1%	<1%
Res. Comm.	317	30	<1%	<1%
Condominium	4	33	<1%	2%
Total Developed			100%	95%
Unimproved	0	5	0%	5%
Grand Total			100%	100%

Notes: User charges are based on the illustration summarized in Table 4. The tax data was drawn from the example summarized above in Table 3.

Table 6 summarizes the distribution of stormwater program revenues under the assumption that agricultural and undeveloped lands are included in the rate base of a user charge system (Note that columns 2 and 4 in Table 6 associated with the property tax system are identical to those in Table 5). Based on the charge structure used to develop Table 6, agricultural property owners would experience a eleven fold increase in payments in going from the tax system to the charge system (i.e., on average, $36 property tax, and $402 user

charge)[5]. This result is a direct reflection of the tax system being property-value based, and the user charge system being directly proportional to land area; agricultural property taxes on large parcels (average, 76.5 acres) of relatively inexpensive land are comparable to the taxes paid on small, high-valued residential parcels (the average residential parcel size for those below one acre is 0.33 acres). However, when the charge is proportionate to parcel size, as it is in the case of user charges, the cost to agricultural property owners naturally increases.

Table 6

Typical Annual Charges and Property Taxes Necessary to Generate $1.5 Million (Agricultural and Unimproved Parcels Included In Rate Base)

Land Use Category	Average User Charge ($/Year)	Average Property Tax ($/Year)	Percent of Total Charges	Percent of Total Taxes
Agriculture	402	36	36%	3%
Commercial	116	92	13%	10%
Comm. Res.	143	65	<1%	<1%
Industrial	2,367	374	16%	3%
Apartments	91	226	1%	3%
Residential < 1 acre	4	23	9%	53%
Residential > 1 acre	5	29	4%	20%
Res Agriculture	5	27	<1%	<1%
Res. Comm.	138	30	<1%	<1%
Condominium	2	33	<1%	2%
Total Developed			79%	95%
Unimproved	22	5	21%	5%
Grand Total			100%	100%

Notes: The user charge data was drawn from Worksheet B-5 in Appendix B. The tax data was drawn from the example summarized above in Table 3.

[5] A rate factor of 0.10 was used for agricultural and unimproved parcels. If it were desirable to decrease the contribution from this land use category, the rate factor could be reduced (e.g., a factor of 0.025 would result in an average annual charge of about $9 for agricultural parcels).

Table 6 shows that with the inclusion of the agricultural and unimproved land use categories, the differences between the user charge system and the tax based system are not as disparate as in the former case in which these land use categories were excluded (Table 5). Nevertheless, it is clear that differences exist between the tax based system and user charge systems that raise a number of issues related to the fairness of the systems. In addition, because the two systems are based on different measures, different administrative costs are implied.

The advantages and disadvantages of property taxes and user charge financing systems can be compared by many measures. Several typical areas for comparison are summarized below:

- Ease and cost of administration;
- Elasticity of the revenue source;
- Deductibility;
- Stability of the revenue source;
- Fairness of the revenue measure; and
- Whether the system provides incentives for environmental controls.

Ease and Cost of Administration

Continued reliance on property taxes to finance stormwater controls would not involve changes from existing practice; therefore, a property tax financing system would be easier and cheaper to administer than a user charge system. In addition, creation of a stormwater user charge system could involve reorganization of various departments within the County and new responsibilities for various departments. Significant expenses could be involved with creation of a new billing system, particularly if the amount of impervious cover on each nonresidential parcels were digitized from aerial photos to determine the appropriate bill. The equivalent of four to six months of the first year's revenues could be required to pay for creation of the user charge system. The County Council would have to pass an ordinance to establish the utility and rate structures.

Elasticity of Revenue Source

The elasticity of a revenue source refers to its ability to generate increased revenues without changes in the rate structure. Property taxes generally are considered elastic because the property owners pay more taxes and revenues to the County -- even without increases in the tax rate -- because of appreciation of property values. If property values stagnate or decline, then tax revenues also could decline.

User charges generally are not considered elastic. Although revenues from charges may increase if additional properties are developed, charges to any specific property owner will not inflate over time. Specific decisions by the County Council would be required to

increase rates. While this may by desirable from the perspective of making the Council accountable, opposition to the rate hikes could delay implementation of rate increases necessary for funding essential activities.

Deductibility

Individuals may deduct the cost of property taxes from their income when computing income taxes. Thus, to some degree, the cost of property taxes is offset. User charges such as water and sewer bills generally are not considered deductible. In some cases (e.g, Baltimore County's proposal) stormwater user charge bills appear as line items on property tax bills. If the charges were included on the property tax bill, it is not clear whether they would be considered deductible.

Stability of Revenue Source

Under a property tax system, stormwater control programs must compete with other necessary government functions for limited revenues. Historically, these programs have not fared well in budget allocation processes because they have been given low priority. As a result, stormwater controls have been poorly funded, particularly with respect to maintenance activities (which can be deferred) and water quality programs (because people did not recognize the need for them). Given that competition for limited revenues from property taxes is expected to increase in the future, creation of a dedicated revenue source through a user charge system is considered to be a more stable method of funding than continued reliance on a property tax system. This is because all user charges would be placed into a restricted account that could be used only for stormwater programs.

Fairness of Revenue Measures

The fairness of a charge or tax can be evaluated from a variety of perspectives. One perspective is that a tax or charge is fair if one pays in relation to the extent one uses or benefits form the facilities or programs provided with the revenues from the tax. For example, user fees are considered an equitable method of financing water utilities since it seems fair to charge people for the amount of water they use. A related notion, commonly called the polluter pays principle, is that people should pay to the extent they create a pollution problem that the government must solve. This principle suggests that those who cause water pollution should pay for water quality programs. A different perspective is that a fair charge is one that is somehow related to one's ability to pay (e.g., a progressive income tax).

It is thought that a user charge approach might be more fair than a property tax from all of these perspectives. If owners of property that generate runoff are thought of as "users" of the public drainage and stormwater management system, the user charge approach is clearly more fair than a property tax approach. This is because the size of the parcel and amount of impervious area of a property, which are the bases of the user charge, are determining

factors in the amount of runoff from a property; property value is not as directly related to the amount of runoff from a parcel of land. From the polluter pays perspective, the user charge approach also would be considered more equitable. That is, if new programs are required to control pollution from runoff, it seems fair that the people who generate the runoff should pay. Finally, from the ability to pay perspective, charges may be more fair than taxes. This is shown in Tables 8 and 9 above. Most residential users would pay less under a charge system than they would under a property tax system, while nonresidential property owners such as industrial and commercial would pay more under a charge system. Although it depends on one's perspective, it can be argued that nonresidential property owners (e.g., industrial) have a greater ability to pay than residential owners. Nonresidential property owners, at least, can pass the costs along and the charge can be viewed as cost of running a business in an environmentally sound manner. Overall, financing stormwater controls with user charges is considered to be more fair than financing with property taxes.

Incentives for Environmental Controls

User charge systems are preferable to property tax systems because they provide incentives for property owners to provide environmental controls. That is, if property owners know that they will be charged according to the amount of impervious cover on their property, they have an incentive to minimize cover, thereby reducing runoff. Property tax systems provide no incentives because they are not based on factors related to runoff. One problem with incentives for controls is that if numerous property owners (or a few large ones) reduce the amount of runoff they generate, total revenues might be reduced. Most existing user charge systems allow nonresidential property owners to earn credits against user charges by controlling runoff on-site. Awarding credits is equivalent to reducing the rate base. If credits were granted for on-site controls, either total revenues would decrease, or the charge per unit would have to be increased proportionately for all other property owners.

The development of a stormwater user charge system coupled with a credit system for on-site controls may provide incentives for implementation of best management practices (construction of runoff control structures). For example, if agricultural parcels were in the rate base credits could be extended to owners of agricultural property who implement Soil Conservation District approved conservation plans. A credit system also would make the rate structure more fair. That is, people in new developments who already are required by State law to pay for on-site controls would not have to pay again. While some level of credit is reasonable, it may be desirable not to completely eliminate payment. On-site controls do not eliminate all stormwater discharges. Since downstream water quality is a public good, one approach is to have all property owners pay something. One consistent approach to determining a policy on the minimum payment-after-credit is to have that payment structure equal the amount paid by owners of undeveloped property.

General conclusions about these relative advantages (+) and disadvantages (-) of property tax and user charge financing systems are presented in Table 8. For this discussion, we assume that the user charge system is implemented through the creation of a utility.

Table 8 - Advantages and Disadvantages of Taxes and User Charge Systems

Evaluation Criterion	User Charge	Property Tax
Ease of Administration	-	+
Cost of Implementation	-	+
Elasticity of Revenues	-	+
Deductibility	?	+
Stability of Revenues	+	-
Fairness		
User (Polluter) Pays	+	-
Ability to Pay	+	-
Incentives for Controls	+	-

5.0 SUMMARY AND ADDITIONAL CONSIDERATIONS

The preceding sections have covered a wide range of issues associated with financing stormwater controls in Harford County. The report reviews the administrative organization and responsibilities, estimates the revenues required to fund most stormwater control programs, summarizes primary options for financing stormwater controls (property taxes and user charges), and discusses the advantages and disadvantages of property taxes and user charges.

Harford County currently spends about $1,158,876 a year on stormwater controls. Current Accurate Expenditures for storm drain development and maintenance are not available, thus the figure cited above is likely to under estimate the County's costs. Trends in development activities and recent environmental legislation suggest that resource needs will increase in the years to come.

For major expense items, (stormwater management facility operations and maintenance, watershed planning, and retrofitting), property taxes and user charges are the most viable options for increasing revenues. Each has advantages and disadvantages. The distribution of fees paid by property owners depends on the type of financing system that is used. Residential property owners typically would pay less under a user charge system than a tax system, while many nonresidential property owners (e.g., industrial and commercial) would pay more under a charge system. The advantages of a property tax includes elasticity of revenues, federal tax deductibility, ease of administration, and lower cost of implementation.

User charges appear to be advantageous for a number or reasons including increased stability of revenues, fairness, and providing incentives for controls that benefit the environment. If a user charge system were implemented, the County Council would have to make a number of significant, complex policy decisions. These would include deciding which land use categories of parcels to include in the rate base[6].

This study is only an initial step in the process of identifying the level of financial resources that will be needed to meet future stormwater control demands. While current financial resource needs are modest enough to be met by fees and State grants, this report considers the viability and desirability of pursuing the use of property taxes or a user charge system in anticipation of growing resource needs.

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[6] As a supplement to this report, MDE has appended several findings of the Baltimore County Stormwater Management Committee, which has recently recommended the formation of a stormwater user charge system (See Appendices C and D). These supplements may help provide insights about issues that are far off on the time horizon from the perspective of Harford County decision makers.

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GEOGRAPHY: HARFORD COUNTY-SUMMARY REDISTRIBUTED

TAPE DATE APR 90

LAND USE	IMPROVED NO. OF PARCELS ACRES SPEC.	IMPROVED ACRES	IMPROVED AVERAGE ACRES	IMPROVED NO. OF PARCELS ACRES NOT SPEC	IMPROVED TOTAL ACRES	UNIMPROVED NO. OF PARCELS ACRES SPEC.	UNIMPROVED ACRES	UNIMPROVED AVERAGE ACRES	UNIMPROVED NO. OF PARCELS ACRES NOT SPEC	UNIMPROVED TOTAL ACRES	TOTAL PARCELS	TOTAL ACRES
AGRICULTURAL	1330	101757	76.5	0	101757	416	22306	53.6	0	22306	1746	124063
COMMERCIAL	1692	4602	2.7	0	4602	623	3165	5.1	0	3165	2315	7767
COMM RES	5	20	4.0	0	20	1	17	17.0	0	17	6	37
EXEMPT	727	88713	122.0	0	88713	571	6718	11.8	0	6718	1298	95431
INDUSTRIAL	103	6618	64.3	0	6618	103	1031	10.0	0	1031	206	7649
APARTMENTS	188	515	2.7	0	515	1	1	1.0	0	1	189	516
NOT PERC	9	7	.8	0	7	550	600	1.1	0	600	559	607
RESIDENTIAL	45534	45770	1.0	0	45770	11287	22076	2.0	0	22076	56821	67846
RES AGR	695	7757	11.2	0	7757	374	3450	9.2	0	3450	1069	11207
RES COMM	29	120	4.1	0	120	0	0	.0	0	0	29	120
CONDOMINIUM	1680	83	.0	0	83	144	8	.1	0	8	1824	91
CONDO COMM	22	1	.0	0	1	0	0	.0	0	0	22	1
MARSHLAND	0	0	.0	0	0	0	0	.0	0	0	0	0
DISTRICT TOTAL	52014	255963		0	255963	14070	59372		0	59372	66084	315335

GEOGRAPHY: HARFORD COUNTY-SUMMARY REDISTRIBUTED
LAND USE CODE: RESIDENTIAL

TAPE DATE APR 90

ACREAGE INTERVALS	IMPROVED PARCELS(ACRES SPECIFIED) NUMBER OF PARCELS	PERCENT OF TOTAL PARCELS	CUMULATIVE NUMBER OF PARCELS	CUMULATIVE % OF TOTAL PARCELS	ACREAGE NUMBER OF ACRES	PERCENT OF TOTAL ACRES	CUMULATIVE NUMBER OF ACRES	CUMULATIVE % OF TOTAL ACRES	AVERAGE ACREAGE	CUMULATIV AVERAGE ACREAGE
0 - .25	17524	38.49	17524	38.49	2260	4.94	2260	4.94	.13	.13
>.25 - .5	9447	20.75	26971	59.23	3491	7.63	5750	12.56	.37	.21
>.5 - 1.0	8490	18.65	35461	77.88	6121	13.37	11871	25.94	.72	.33
>1.0 - 1.5	3099	6.81	38560	84.68	3763	8.22	15635	34.16	1.21	.41
>1.5 - 2.0	1602	3.52	40162	88.20	2861	6.25	18496	40.41	1.79	.46
>2.0 - 3.0	2209	4.85	42371	93.05	5365	11.72	23860	52.13	2.43	.56
>3.0 - 5.0	1741	3.82	44112	96.88	6646	14.52	30507	66.65	3.82	.69
>5.0 - 10.0	946	2.08	45058	98.95	6446	14.08	36953	80.74	6.81	.82
>10.0 - 15.0	305	.67	45363	99.62	3530	7.71	40483	88.45	11.57	.89
>15.0 - 20.0	75	.16	45438	99.79	1284	2.80	41767	91.25	17.12	.92
>20.0 - 30.0	53	.12	45491	99.91	1261	2.75	43028	94.01	23.79	.95
>30.0 - 40.0	20	.04	45511	99.95	676	1.48	43704	95.48	33.79	.96
>40.0 - 50.0	7	.02	45518	99.96	317	.69	44021	96.18	45.29	.97
>50.0 - 75.0	6	.01	45524	99.98	357	.78	44378	96.96	59.47	.97
>75.0 - 100.0	2	.00	45526	99.98	166	.36	44544	97.32	83.15	.98
>100.0 - 150.0	4	.01	45530	99.99	527	1.15	45071	98.47	131.67	.99
>150.0 - 200.0	3	.01	45533	100.00	491	1.07	45561	99.54	163.53	1.00
>200.0 - 300.0	1	.00	45534	100.00	209	.46	45771	100.00	209.20	1.01
>300.0 - 500.0	0	.00	45534	100.00	0	.00	45771	100.00	.00	1.01
>500.0 - 750.0	0	.00	45534	100.00	0	.00	45771	100.00	.00	1.01
>750.0 - 1000.0	0	.00	45534	100.00	0	.00	45771	100.00	.00	1.01
>1000.0 - 10,000	0	.00	45534	100.00	0	.00	45771	100.00	.00	1.01
>10,000	0	.00	45534	100.00	0	.00	45771	100.00	.00	1.01
	UNIMPROVED PARCELS (ACRES SPECIFIED)				ACREAGE					
0 - .25	5056	44.79	5056	44.79	628	2.84	628	2.84	.12	.12
>.25 - .5	2090	18.52	7146	63.31	736	3.33	1364	6.18	.35	.19
>.5 - 1.0	1192	10.56	8338	73.87	858	3.89	2221	10.06	.72	.27
>1.0 - 1.5	502	4.45	8840	78.32	614	2.78	2836	12.85	1.22	.32
>1.5 - 2.0	285	2.53	9125	80.85	508	2.30	3344	15.15	1.78	.37
>2.0 - 3.0	656	5.81	9781	86.66	1600	7.25	4944	22.39	2.44	.51
>3.0 - 5.0	642	5.69	10423	92.35	2521	11.42	7465	33.81	3.93	.72
>5.0 - 10.0	476	4.22	10899	96.56	3278	14.85	10743	48.66	6.89	.99
>10.0 - 15.0	189	1.67	11088	98.24	2247	10.18	12990	58.84	11.89	1.17
>15.0 - 20.0	56	.50	11144	98.73	973	4.41	13963	63.25	17.37	1.25
>20.0 - 30.0	61	.54	11205	99.27	1455	6.59	15418	69.84	23.86	1.38
>30.0 - 40.0	21	.19	11226	99.46	725	3.29	16144	73.13	34.54	1.44
>40.0 - 50.0	19	.17	11245	99.63	846	3.83	16990	76.96	44.54	1.51
>50.0 - 75.0	18	.16	11263	99.79	1074	4.87	18064	81.83	59.67	1.60
>75.0 - 100.0	7	.06	11270	99.85	582	2.64	18646	84.47	83.19	1.65
>100.0 - 150.0	6	.05	11276	99.90	695	3.15	19341	87.61	115.82	1.72
>150.0 - 200.0	6	.05	11282	99.96	1036	4.69	20377	92.31	172.60	1.81
>200.0 - 300.0	2	.02	11284	99.97	546	2.48	20923	94.78	273.20	1.85
>300.0 - 500.0	3	.03	11287	100.00	1152	5.22	22076	100.00	384.10	1.96
>500.0 - 750.0	0	.00	11287	100.00	0	.00	22076	100.00	.00	1.96
>750.0 - 1000.0	0	.00	11287	100.00	0	.00	22076	100.00	.00	1.96
>1000.0 - 10,000	0	.00	11287	100.00	0	.00	22076	100.00	.00	1.96
>10,000	0	.00	11287	100.00	0	.00	22076	100.00	.00	1.96

NO. OF IMP. PARCELS, ACREAGE SPECIFIED 45534 (100.0)
NO. OF IMP. PARCELS, ACREAGE NOT SPEC. 0 (.0)
TOTAL 45534

NO. OF UNIMPROVED PARCELS, ACREAGE SPECIFIED 11287 (100.0)
NO. OF UNIMPROVED PARCELS, ACREAGE NOT SPEC. 0 (.0)
TOTAL 11287

Appendix B

Six Alternative Algorithms for Deducing Stormwater User Charges

Six alternative approaches for estimating revenues generated by a user charge approach are briefly described below. These charge structure algorithms are primarily intended to demonstrate the flexibility of the user charge approach and are not intended to be exhaustive. It should also be noted that these algorithms, while similar to algorithms used to implement an actual user charge system, are solely intended for use in estimating potential revenues.

Summary Descriptions of Six Alternative User Charge Approaches

The six different approaches are identified by simple names and numbers. The six approaches summarized below are: Fixed SFE (3,000), Fixed SFE (4,000), Quantile, Detailed, Simplified, Grouped RF (Rate Factors).

Note that for each approach the rate base can be changed (i.e., assessing or not assessing charges for a particular land use category). This represents another layer of options that could be explored. For our purposes, all six of the approaches were investigated both including and excluding the agricultural and unimproved land use categories.

Approach 1 "Fixed SFE (3,000)": The name of this approach is drawn from the fact that the residential SFEs were fixed by professional judgment to 3,000 square feet for residential parcels less than one acre in area[1].

The residential category is divided into two groups: parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

3,000 sq. ft. impervious for parcels < 1 acre (This defines the unit SFE)
4,500 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

Approximately six different rate factors are used for the different land use categories. This represents a degree of specificity of the rate factors that is mid-ranged with respect to the other approaches.

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[1] This value is based on typical values found in the technical literature. In Approach 2 this value is fixed at 4,000 sq. ft..

Approach 2 "Fixed SFE (4,000)": Like Approach 1, the residential category is divided into two groups: parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

4,000 sq. ft. impervious for parcels < 1 acre (This defines the unit SFE)
6,000 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

Approximately six different rate factors are being used for different land use categories. This represents a degree of specificity of the rate factors is mid-ranged with respect to the other approaches.

From the standpoint of not over estimating the potential revenues, this approach is more conservative than Approach 1. At first glance, it may seem counter intuitive that using a higher impervious area for residential parcels would produce a lower revenue estimate. To see how this works, consider the following example in which a comparison is made between SFEs defined to be 4,000 sq.ft./SFE versus 3,000 sq.ft./SFE.

A commercial parcel of 12,000 sq.ft. of impervious area under the Fixed SFE (4,000) approach pays $20/SFE or (12,000/4,000) x $20/ sq.ft. = $60. Under the Fixed SFE (3,000) approach, the same commercial parcel is assessed (12,000/3,000) x $20/ sq.ft. = $80. In both approaches, the same amount of revenue is generated by the residential parcels because their rates are fixed by definition at $20 and $30 per parcel for the two residential subcategories. Consequently, the residential land use category does not contribute to differences in the projected revenue.

Approach 3 "Quantile": Again, the residential category is divided into two groups: Res. < 1 acre, and Res. > 1 acre. Rate factors are used to determine SFEs for the residential land use category rather than fixing the charge as in Approaches 1 and 2.

This approach corrects for sharp differences in user charges between smaller and larger parcels that arise when the residential land use category is broken into two categories and mean acreage values are used to represent typical parcel size. An alternative to the use of mean acreage values, which are often skewed by infrequent extreme values, is to use the median (50th percentile) parcel size for parcels less than one acre and the 90th percentile size as the typical value for parcels greater than one acre[2].

The level of specificity of rate factors is slightly increased above that of Approaches 1 and 2 with approximately eight different rate factors being used for different land use categories.

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[2] It is the parcel size below which 90 percent of the parcels are smaller, or stated the another way, is the parcel size for which only 10 percent of the parcels are larger.

Approach 4 "Detailed": For this approach, the residential category is divided into about 20 acreage intervals according to the data available (See Appendix A above). In addition to the high level of specificity of the residential category, the rate factors are highly detailed since a different rate factor is assigned to each of the 20 residential acreage categories. The SFEs for residential parcels are all computed using rate factors as opposed to being fixed.

This approach represents the most detailed revenue estimation approach of the study, although it is quite simplified in comparison to actual implementation methods.

Approach 5 "Simplified": This approach was motivated by a key aspect of the approach used in Austin, Texas, which classifies each land use category into one of three rate factor groups 0.10, 0.40, or 0.80.

This approach uses rate factors to determine the SFE for the residential parcels < 1 acre, but fixes the SFE for parcels > 1 acre at 1.5 SFEs. Consequently, the value of the unit SFE can rise and fall for different estimates between counties, while the SFE for parcels > 1 acre follows that rise and fall. This combined use of rate factors to compute the unit SFE and fixed SFEs for the parcels > 1 acre is referred to a hybrid treatment of residential SFEs.

This approach derives its name from the fact that it is characterized by having two simplified features: the collapsed rate factors and only two residential categories.

Approach 6 "Grouped RF": This approach is based loosely on the Ft. Collins, Texas approach, which attempts to minimize administrative burdens and contested charges by aggregating users into relatively broad rate factor categories.

Like the Detailed Approach, the level of specificity of the residential category is highly detailed, and the SFEs for residential parcels are all computed using rate factors. Unlike the Detailed Approach, however, the level of specificity of the rate factors is simplified by grouping (hence the name Grouped RF).

The SFE was calculated as (0.60) x (mean acreage) using the smallest residential acreage interval (0 - 0.25 acres), where 0.60 is the rate factor.

Summary Results of Revenue Estimates Based on the Six Approaches

Table B-1 and Table B-2 present the results of the six revenue estimation approaches under two scenarios. Table B-1 excludes agricultural and unimproved land uses and Table B-2 includes these two land uses. Note that the second case (Table B-2) is directly comparable to the property tax approach, which also levies costs on the agricultural and unimproved lands.

The six revenue estimates were all developed under the assumption that residential parcels less than or equal to 1 acre in size would be charged $20 a year. This assumption contrasts with an approach where by a single revenue target (e.g., $1.5 Million) is specified for all six approaches, and annual residential fees are allowed to vary to meet the target. Recall that for the Detailed Approach the Grouped RF Approach residential parcels are divided into numerous subcategories. For residential parcels less than one acre are grouped into one of three categories: those below 0.25 acre, those greater than 0.25 acre and less than 0.5 acre, and those greater than 0.5 acre and less than 1.0 acre. Consequently, the dollar amount in the column for "Residential, < 1 acre" (Tables B-1 and B-2) is the weighted averages of the charges associated with these three categories (weighted by number of parcels).

Table B-1

Revenues and Payment Distributions for Six Alternative Stormwater User Charge Structures (Agricultural and Unimproved Land Uses Excluded)

Percentage Paid by Category
(Cost per Average Parcel Size)

	Revenues	Residential < 1 acre	Residential > 1 acre	Commercial	Industrial	All Others
Fixed SFE 3,000	$1,968,080	22% ($20)	17% ($30)	46% ($667)	12% ($2,114)	3%
Fixed SFE 4,000	$1,676,600	26% ($20)	20% ($30)	40% ($500)	10% ($1,586)	4%
Quantile	$1,792,120	25% ($20)	38% ($60)	23% ($310)	6% ($983)	8%
Detailed	$2,132,460	24% ($24)	28% ($51)	30% ($471)	8% ($1,493)	10%
Simplified	$1,316,240	33% ($20)	26% ($30)	24% ($237)	7% ($882)	10%
Grouped RF	$2,448,080	18% ($20)	25% ($53)	28% ($489)	6% ($1,387)	23%

Table B-2

Revenues and Payment Distributions for Six Alternative Stormwater User Charge Structures (Agricultural and Unimproved Land Uses Included[3])

Percentage Paid by Category
(Cost per Average Parcel Size)

	Revenues	Residential <1 acre	Residential >1 acre	Commerc.	Indust.	Agri.	Unimp.	Others
Fixed SFE 3,000	$8,281,560	9% ($20)	4% ($30)	13% ($643)	16% ($13,071)	36% ($2,222)	21% ($123)	1%
Fixed SFE 4,000	$6,469,240	11% ($20)	5% ($30)	13% ($482)	16% ($9,803)	34% ($1,666)	20% ($92)	1%
Quantile	$8,466,800	8% ($20)	9% ($79)	12% ($598)	15% ($12,165)	32% ($2,068)	19% ($114)	5%
Detailed	$7,544,660	12% ($24)	9% ($53)	12% ($524)	15% ($10,653)	32% ($1,811)	19% ($100)	1%
Simplified	$4,958,340	14% ($20)	6% ($30)	11% ($323)	16% ($7,682)	31% ($1,142)	18% ($63)	4%
Grouped RF	$8,094,480	9% ($21)	8% ($53)	12% ($554)	13% ($9,892)	32% ($1,962)	19% ($108)	7%

Table B-1 and Table B-2 were developed using two sets of worksheets provided at the end of this appendix (Worksheet Set B-1 excludes agricultural and unimproved land uses from the rate base, and Worksheet Set B-2 includes these two land uses in the rate base).

In addition, worksheets for the Fixed SFE (3,000) Approach are provided for three cases in which $1.5M is set as the revenue target. The first case, Worksheet B-3, excludes agricultural and unimproved parcels from the rate base. The second case, Worksheet B-4 brings agriculture into the rate base, but excludes unimproved parcels. The third case, Worksheet B-5, includes both agriculture and unimproved parcels in the rate base.

Finally, two work sheets using the property tax approach are provided. The first case, Worksheet B-6, is designed to meet a $1.5M revenue target, and is directly comparable to the user charge approach presented in Worksheet B-5 noted above. The second property tax case, Worksheet B-7, was developed by fixing the residential rate at $20 per year. This allows comparison with the user charge work sheets that fix residential charges at 20$ per year. It should be remembered when making comparisons that the property tax approaches include both agricultural and unimproved parcels in the rate base, where as some of the cases based on user charge approaches do not include both of these land use categories.

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[3] A relatively small rate factor of 0.10 was used for agricultural and unimproved land uses as compared with 0.80 - 0.82 for commercial, and 0.60 - 0.70 for industrial.

An Illustrative Sensitivity Analysis: Removal of Elkton Parcels From Rate Base

The City of Elkton (Cecil County) has an independent stormwater control system, and thus Elkton is not likely to participate in a county-wide utility. The impact of removing Elkton from the rate base was assessed by reevaluating four of the six utility charge approaches. This entailed subtracting the appropriate number of parcels for each land use category based on information in property tax assessment tables, and adjusting the average parcel size. In general, the average parcel size of the remaining parcels increased slightly. This seems consistent with the general tendency for lot sizes to be smaller within city limits.

The analysis was based on the assumption that residential parcels less than one acre in size would be assessed a fixed annual charge of $20. This results in each of the alternative approaches generating different revenue totals rather than being fixed to meet a $1.5 Million revenue target. Depending on the charge approach, the percentage decrease in revenues resulting from the removal of Elkton from the rate base ranged from 3.9% to 5.4%. Since the different charge structures generated varying total revenues prior to the removal of Elkton parcels, the decrease in the dollar amounts are not directly comparable. Table B-3 presents the analysis results.

Table B-3

Sensitivity Analysis: Removal of Elkton Parcels From User Charge Rate Base

Charge Approach	Revenues Generated (Elkton Included)	Revenues Generated (Elkton Excluded)	Revenue Decrease	Percent Decrease
Fixed SFE 3000	$2,268,600	$2,180,600	$88,000	3.9%
Fixed SFE 4000	$1,823,560	$1,745,340	$78,220	4.3%
Quantile	$4,009,720	$3,821,040	$188,680	4.7%
Simplified	$1,333,940	$1,262,520	$71,420	5.4%

FIXED SFE (3,000)
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,692	2.7	0.82	96,442	32.15	54,393			642.95	1,087,863	0.30
Comm Res	5	4.0	0.68	118,483	39.49	197			789.89	3,949	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	653.55	67,315			13,070.89	1,346,302	0.37
Apartments	188	2.7	0.64	75,272	25.09	4,717			501.81	94,340	0.03
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.33	na	3,000	1.00	35,461			20.00	709,219	0.20
> 1 Acre	10,073	3.34	na	4,500	1.50	15,110			30.00	302,190	0.08
Res Ag	695	11.2	na	4,500	1.50	1,043			30.00	20,850	0.01
Res Comm	29	4.1	0.64	114,301	38.10	1,105			762.01	22,098	0.01
Condominium	1,680	0.05	0.64	1,394	0.46	781			9.29	15,612	0.00
Condo Comm	22	0.05	0.68	1,333	0.44	10			8.89	195	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					180,131				$3,602,620	1.00
Unimproved	14,070	4.2	0.00	0	0.00	0			0.00	0	0.00
Grand Total	66,084					180,131	$3,602,620	$20.00		$3,602,620	1.00

FIXED SFE (4,000)
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,692	2.7	0.82	96,442	24.11	40,795			482.21	815,900	0.28
Comm Res	5	4.0	0.68	118,483	29.62	148			592.42	2,962	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	490.16	50,486			9,803.20	1,009,730	0.34
Apartments	188	2.7	0.64	75,272	18.82	3,538			376.36	70,756	0.02
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.33	na	4,000	1.00	35,461			20.00	709,222	0.24
> 1 Acre	10,073	3.34	na	6,000	1.50	15,110			30.00	302,191	0.10
Res Ag	695	11.2	na	6,000	1.50	1,043			30.00	20,850	0.01
Res Comm	29	4.1	0.64	114,301	28.58	829			571.51	16,574	0.01
Condominium	1,680	0.05	0.64	1,394	0.35	585			6.97	11,709	0.00
Condo Comm	22	0.05	0.68	1,333	0.33	7			6.66	147	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014			—		148,002				$2,960,040	1.00
Unimproved	14,070	4.2	0.00	0	0.00	0			0.00	0	0.00
Grand Total	66,084					148,002	$2,960,040	$20.00		$2,960,040	1.00

DETAILED
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,692	2.7	0.82	96,442	26.20	44,332			524.02	886,646	0.24
Comm Res	5	4.0	0.68	118,483	32.19	161			643.79	3,219	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	532.66	54,864			10,653.23	1,097,283	0.29
Apartments	188	2.7	0.64	75,272	20.45	3,845			408.99	76,891	0.02
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	17,524	0.13	0.650	3,681	1.00	17,524			20.00	350,479	0.09
>.25 - .5	9,447	0.37	0.250	4,029	1.09	10,341			21.89	206,827	0.06
>.5 - 1	8,490	0.72	0.200	6,273	1.70	14,468			34.08	289,363	0.08
> 1 - 1.5	3,099	1.21	0.160	8,433	2.29	7,100			45.82	142,004	0.04
> 1.5 - 2	1,602	1.79	0.130	10,136	2.75	4,412			55.08	88,233	0.02
> 2 - 3	2,209	2.43	0.100	10,585	2.88	6,353			57.51	127,050	0.03
> 3 - 5	1,741	3.82	0.080	13,312	3.62	6,296			72.33	125,929	0.03
> 5 - 10	946	6.81	0.055	16,315	4.43	4,193			88.65	83,864	0.02
> 10 - 15	305	11.57	0.030	15,120	4.11	1,253			82.15	25,057	0.01
> 15 - 20	75	17.12	0.020	14,915	4.05	304			81.04	6,078	0.00
> 20 - 30	53	23.79	0.013	13,472	3.66	194			73.20	3,880	0.00
> 30 - 40	20	33.79	0.010	14,719	4.00	80			79.98	1,600	0.00
> 40 - 50	7	45.29	0.006	11,837	3.22	23			64.32	450	0.00
> 50 - 75	6	59.47	0.005	12,953	3.52	21			70.38	422	0.00
> 75 - 100	2	83.15	0.004	14,488	3.94	8			78.72	157	0.00
> 100 - 150	4	131.67	0.003	17,207	4.67	19			93.49	374	0.00
> 150 - 200	3	163.53	0.002	11,471	3.12	9			62.33	187	0.00
> 200 - 300	1	209.20	0.001	7,123	1.94	2			38.71	39	0.00
Res Ag	695	11.2	0.10	48,787	13.25	9,212			265.09	184,236	0.05
Res Comm	29	4.1	0.64	114,301	31.05	901			621.06	18,011	0.00
Condominium	1,680	0.05	0.64	1,394	0.38	636			7.57	12,724	0.00
Condo Comm	22	0.05	0.68	1,333	0.36	8			7.24	159	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					186,558				$3,731,160	1.00
Unimproved	14,070	4.2	0.00	0	0.00	0			0.00	0	0.00
Grand Total	66,084					186,558	$3,731,160	$20.00		$3,731,160	1.00

SIMPLIFIED
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,692	2.7	0.80	94,090	16.13	27,290			322.58	545,805	0.21
Comm Res	5	4.0	0.80	139,392	23.89	119			477.90	2,389	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.80	2,240,726	384.11	39,563			7,682.18	791,265	0.31
Apartments	188	2.7	0.80	94,090	16.13	3,032			322.58	60,645	0.02
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.33	0.40	5,834	1.00	35,461			20.00	709,218	0.28
> 1 Acre	10,073	3.34	na	8,750	1.50	15,110			30.00	302,189	0.12
Res Ag	695	11.2	0.10	48,787	8.36	5,812			167.26	116,248	0.05
Res Comm	29	4.1	0.80	142,877	24.49	710			489.84	14,205	0.01
Condominium	1,680	0.05	0.80	1,742	0.30	502			5.97	10,036	0.00
Condo Comm	22	0.05	0.80	1,568	0.27	6			5.38	118	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.80	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014			—		127,606				$2,552,120	1.00
Unimproved	14,070	4.2	0.00	0	0.00	0			0.00	0	0.00
Grand Total	66,084					127,606	$2,552,120	$20.00		$2,552,120	1.00

QUANTILE
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,692	2.7	0.82	96,442	29.92	50,623			598.38	1,012,455	0.25
Comm Res	5	4.0	0.68	118,483	36.76	184			735.13	3,676	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	608.24	62,649			12,164.85	1,252,979	0.30
Apartments	188	2.7	0.64	75,272	23.35	4,390			467.03	87,801	0.02
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.37	0.20	3,223	1.00	35,461			20.00	709,219	0.17
> 1 Acre	10,073	2.45	0.12	12,807	3.97	40,020			79.46	800,394	0.19
Res Ag	695	11.2	0.10	48,787	15.14	10,519			302.70	210,378	0.05
Res Comm	29	4.1	0.64	114,301	35.46	1,028			709.19	20,566	0.01
Condominium	1,680	0.05	0.64	1,394	0.43	726			8.65	14,530	0.00
Condo Comm	22	0.05	0.68	1,333	0.41	9			8.27	182	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					205,609				$4,112,180	1.00
Unimproved	14,070	4.2	0.00	0	0.00	0			0.00	0	0.00
Grand Total	66,084					205,609	$4,112,180	$20.00		$4,112,180	1.00

GROUPED RF
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,692	2.7	0.80	94,090	27.69	46,855			553.85	937,109	0.24
Comm Res	5	4.0	0.60	104,544	30.77	154			615.39	3,077	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.60	1,680,545	494.62	50,945			9,892.32	1,018,909	0.26
Apartments	188	2.7	0.60	70,567	20.77	3,905			415.39	78,092	0.02
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	17,524	0.13	0.600	3,398	1.00	17,524			20.00	350,480	0.09
>.25 - .5	9,447	0.37	0.250	3,247	0.96	9,028			19.11	180,563	0.05
>.5 - 1	8,490	0.72	0.250	4,162	1.22	10,399			24.50	207,987	0.05
> 1 - 1.5	3,099	1.21	0.250	5,442	1.60	4,964			32.04	99,281	0.03
> 1.5 - 2	1,602	1.79	0.250	6,958	2.05	3,281			40.96	65,617	0.02
> 2 - 3	2,209	2.43	0.250	8,631	2.54	5,611			50.81	112,230	0.03
> 3 - 5	1,741	3.82	0.250	12,264	3.61	6,284			72.19	125,683	0.03
> 5 - 10	946	6.81	0.250	20,079	5.91	5,590			118.19	111,808	0.03
> 10 - 15	305	11.57	0.250	32,519	9.57	2,919			191.42	58,383	0.01
> 15 - 20	75	17.12	0.250	47,025	13.84	1,038			276.81	20,760	0.01
> 20 - 30	53	23.79	0.250	64,458	18.97	1,005			379.42	20,109	0.01
> 30 - 40	20	33.79	0.250	90,594	26.66	533			533.27	10,665	0.00
> 40 - 50	7	45.29	0.250	120,650	35.51	249			710.19	4,971	0.00
> 50 - 75	6	59.47	0.250	157,711	46.42	279			928.35	5,570	0.00
> 75 - 100	2	83.15	0.250	219,601	64.63	129			1,292.65	2,585	0.00
> 100 - 150	4	131.67	0.250	346,413	101.96	408			2,039.12	8,156	0.00
> 150 - 200	3	163.53	0.250	429,682	126.46	379			2,529.27	7,588	0.00
> 200 - 300	1	209.20	0.250	549,045	161.59	162			3,231.89	3,232	0.00
Res Ag	695	11.2	0.25	121,968	35.90	24,949			717.95	498,975	0.13
Res Comm	29	4.1	0.60	107,158	31.54	915			630.77	18,292	0.00
Condominium	1,680	0.05	0.60	1,307	0.38	646			7.69	12,923	0.00
Condo Comm	22	0.05	0.60	1,176	0.35	8			6.92	152	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					198,160				$3,963,200	1.00
Unimproved	14,070	4.2	0.00	0	0.00	0			0.00	0	0.00
Grand Total	66,084					198,160	$3,963,200	$20.00		$3,963,200	1.00

FIXED SFE (3,000)
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.10	333,234	111.08	147,734			2,221.56	2,954,675	0.36
Commercial	1,692	2.7	0.82	96,442	32.15	54,393			642.95	1,087,864	0.13
Comm Res	5	4.0	0.68	118,483	39.49	197			789.89	3,949	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	653.55	67,315			13,070.91	1,346,303	0.16
Apartments	188	2.7	0.64	75,272	25.09	4,717			501.81	94,341	0.01
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.33	na	3,000	1.00	35,461			20.00	709,220	0.09
> 1 Acre	10,073	3.34	na	4,500	1.50	15,110			30.00	302,190	0.04
Res Ag	695	11.2	na	4,500	1.50	1,043			30.00	20,850	0.00
Res Comm	29	4.1	0.64	114,301	38.10	1,105			762.01	22,098	0.00
Condominium	1,680	0.05	0.64	1,394	0.46	781			9.29	15,612	0.00
Condo Comm	22	0.05	0.68	1,333	0.44	10			8.89	195	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					327,865				$6,557,298	0.79
Unimproved	14,070	4.2	0.10	18,382	6.13	86,213			122.55	1,724,262	0.21
Grand Total	66,084					414,078	$8,281,560	$20.00		$8,281,560	1.00

FIXED SFE (4,000)
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.10	333,234	83.31	110,800			1,666.17	2,216,008	0.34
Commercial	1,692	2.7	0.82	96,442	24.11	40,795			482.21	815,899	0.13
Comm Res	5	4.0	0.68	118,483	29.62	148			592.42	2,962	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	490.16	50,486			9,803.19	1,009,728	0.16
Apartments	188	2.7	0.64	75,272	18.82	3,538			376.36	70,755	0.01
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.33	na	4,000	1.00	35,461			20.00	709,221	0.11
> 1 Acre	10,073	3.34	na	6,000	1.50	15,110			30.00	302,190	0.05
Res Ag	695	11.2	na	6,000	1.50	1,043			30.00	20,850	0.00
Res Comm	29	4.1	0.64	114,301	28.58	829			571.51	16,574	0.00
Condominium	1,680	0.05	0.64	1,394	0.35	585			6.97	11,709	0.00
Condo Comm	22	0.05	0.68	1,333	0.33	7			6.66	147	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					258,802				$5,176,043	0.80
Unimproved	14,070	4.2	0.10	18,382	4.60	64,660			91.91	1,293,197	0.20
Grand Total	66,084					323,462	$6,469,240	$20.00		$6,469,240	1.00

QUANTILE
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.10	333,234	103.38	137,493			2,067.57	2,749,868	0.32
Commercial	1,692	2.7	0.82	96,442	29.92	50,623			598.38	1,012,457	0.12
Comm Res	5	4.0	0.68	118,483	36.76	184			735.14	3,676	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	608.24	62,649			12,164.88	1,252,982	0.15
Apartments	188	2.7	0.64	75,272	23.35	4,390			467.03	87,801	0.01
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.37	0.20	3,223	1.00	35,461			20.00	709,221	0.08
> 1 Acre	10,073	2.45	0.12	12,807	3.97	40,020			79.46	800,396	0.09
Res Ag	695	11.2	0.10	48,787	15.14	10,519			302.70	210,379	0.02
Res Comm	29	4.1	0.64	114,301	35.46	1,028			709.19	20,567	0.00
Condominium	1,680	0.05	0.64	1,394	0.43	726			8.65	14,530	0.00
Condo Comm	22	0.05	0.68	1,333	0.41	9			8.27	182	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					343,103				$6,862,058	0.81
Unimproved	14,070	4.2	0.10	18,382	5.70	80,237			114.05	1,604,742	0.19
Grand Total	66,084					423,340	$8,466,800	$20.00		$8,466,800	1.00

DETAILED
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.10	333,234	90.53	120,408			1,810.65	2,408,163	0.32
Commercial	1,692	2.7	0.82	96,442	26.20	44,332			524.02	886,647	0.12
Comm Res	5	4.0	0.68	118,483	32.19	161			643.79	3,219	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	532.66	54,864			10,653.24	1,097,284	0.15
Apartments	188	2.7	0.64	75,272	20.45	3,845			408.99	76,891	0.01
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	17,524	0.13	0.650	3,681	1.00	17,524			20.00	350,480	0.05
>.25 - .5	9,447	0.37	0.250	4,029	1.09	10,341			21.89	206,828	0.03
>.5 - 1	8,490	0.72	0.200	6,273	1.70	14,468			34.08	289,363	0.04
> 1 - 1.5	3,099	1.21	0.160	8,433	2.29	7,100			45.82	142,004	0.02
> 1.5 - 2	1,602	1.79	0.130	10,136	2.75	4,412			55.08	88,233	0.01
> 2 - 3	2,209	2.43	0.100	10,585	2.88	6,353			57.51	127,050	0.02
> 3 - 5	1,741	3.82	0.080	13,312	3.62	6,296			72.33	125,929	0.02
> 5 - 10	946	6.81	0.055	16,315	4.43	4,193			88.65	83,864	0.01
> 10 - 15	305	11.57	0.030	15,120	4.11	1,253			82.15	25,057	0.00
> 15 - 20	75	17.12	0.020	14,915	4.05	304			81.04	6,078	0.00
> 20 - 30	53	23.79	0.013	13,472	3.66	194			73.20	3,880	0.00
> 30 - 40	20	33.79	0.010	14,719	4.00	80			79.98	1,600	0.00
> 40 - 50	7	45.29	0.006	11,237	3.22	23			64.32	450	0.00
> 50 - 75	6	59.47	0.005	12,[illegible]53	3.52	21			70.38	422	0.00
> 75 - 100	2	83.15	0.004	14,488	3.94	8			78.72	157	0.00
> 100 - 150	4	131.67	0.003	17,207	4.67	19			93.49	374	0.00
> 150 - 200	3	163.53	0.002	11,471	3.12	9			62.33	187	0.00
> 200 - 300	1	209.20	0.001	7,123	1.94	2			38.71	39	0.00
Res Ag	695	11.2	0.10	48,787	13.25	9,212			265.09	184,236	0.02
Res Comm	29	4.1	0.64	114,301	31.05	901			621.06	18,011	0.00
Condominium	1,680	0.05	0.64	1,394	0.38	636			7.57	12,724	0.00
Condo Comm	22	0.05	0.68	1,333	0.36	8			7.24	159	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					306,967				$6,139,327	0.81
Unimproved	14,070	4.2	0.10	18,382	4.99	70,267			99.88	1,405,333	0.19
Grand Total	66,084					377,233	$7,544,660	$20.00		$7,544,660	1.00

SIMPLIFIED
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.10	333,234	57.12	75,974			1,142.47	1,519,488	0.31
Commercial	1,692	2.7	0.80	94,090	16.13	27,290			322.58	545,806	0.11
Comm Res	5	4.0	0.80	139,392	23.89	119			477.90	2,389	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.80	2,240,726	384.11	39,563			7,682.19	791,266	0.16
Apartments	188	2.7	0.80	94,090	16.13	3,032			322.58	60,645	0.01
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.33	0.40	5,834	1.00	35,461			20.00	709,219	0.14
> 1 Acre	10,073	3.34	na	8,750	1.50	15,110			30.00	302,190	0.06
Res Ag	695	11.2	0.10	48,787	8.36	5,812			167.26	116,248	0.02
Res Comm	29	4.1	0.80	142,877	24.49	710			489.84	14,205	0.00
Condominium	1,680	0.05	0.80	1,742	0.30	502			5.97	10,036	0.00
Condo Comm	22	0.05	0.80	1,568	0.27	6			5.38	118	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.80	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					203,581				$4,071,611	0.82
Unimproved	14,070	4.2	0.10	18,382	3.15	44,336			63.02	886,729	0.18
Grand Total	66,084					247,917	$4,958,340	$20.00		$4,958,340	1.00

GROUPED RF
(DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.10	333,234	98.08	130,442			1,961.54	2,608,844	0.32
Commercial	1,692	2.7	0.80	94,090	27.69	46,855			553.85	937,107	0.12
Comm Res	5	4.0	0.60	104,544	30.77	154			615.38	3,077	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.60	1,680,545	494.62	50,945			9,892.30	1,018,907	0.13
Apartments	188	2.7	0.60	70,567	20.77	3,905			415.38	78,092	0.01
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	17,524	0.13	0.600	3,398	1.00	17,524			20.00	350,480	0.04
>.25 - .5	9,447	0.37	0.250	3,247	0.96	9,028			19.11	180,563	0.02
>.5 - 1	8,490	0.72	0.250	4,162	1.22	10,399			24.50	207,987	0.03
> 1 - 1.5	3,099	1.21	0.250	5,442	1.60	4,964			32.04	99,280	0.01
> 1.5 - 2	1,602	1.79	0.250	6,958	2.05	3,281			40.96	65,617	0.01
> 2 - 3	2,209	2.43	0.250	8,631	2.54	5,611			50.81	112,229	0.01
> 3 - 5	1,741	3.82	0.250	12,264	3.61	6,284			72.19	125,683	0.02
> 5 - 10	946	6.81	0.250	20,079	5.91	5,590			118.19	111,808	0.01
> 10 - 15	305	11.57	0.250	32,519	9.57	2,919			191.42	58,383	0.01
> 15 - 20	75	17.12	0.250	47,025	13.84	1,038			276.81	20,760	0.00
> 20 - 30	53	23.79	0.250	64,458	18.97	1,005			379.42	20,109	0.00
> 30 - 40	20	33.79	0.250	90,594	26.66	533			533.27	10,665	0.00
> 40 - 50	7	45.29	0.250	120,650	35.51	249			710.19	4,971	0.00
> 50 - 75	6	59.47	0.250	157,711	46.42	279			928.34	5,570	0.00
> 75 - 100	2	83.15	0.250	219,601	64.63	129			1,292.65	2,585	0.00
> 100 - 150	4	131.67	0.250	346,413	101.96	408			2,039.11	8,156	0.00
> 150 - 200	3	163.53	0.250	429,682	126.46	379			2,529.26	7,588	0.00
> 200 - 300	1	209.20	0.250	549,045	161.59	162			3,231.88	3,232	0.00
Res Ag	695	11.2	0.25	121,968	35.90	24,949			717.95	498,974	0.06
Res Comm	29	4.1	0.60	107,158	31.54	915			630.77	18,292	0.00
Condominium	1,680	0.05	0.60	1,307	0.38	646			7.69	12,923	0.00
Condo Comm	22	0.05	0.60	1,176	0.35	8			6.92	152	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					328,602				$6,572,035	0.81
Unimproved	14,070	4.2	0.10	18,382	5.41	76,122			108.21	1,522,445	0.19
Grand Total	66,084					404,724	$8,094,480	$2 .00		$8,094,480	1.00

FIXED SFE (3,000)
($1.5M DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,692	2.7	0.82	96,442	32.15	54,393			267.70	452,947	0.30
Comm Res	5	4.0	0.68	118,483	39.49	197			328.88	1,644	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	653.55	67,315			5,442.25	560,551	0.37
Apartments	188	2.7	0.64	75,272	25.09	4,717			208.94	39,280	0.03
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.33	na	3,000	1.00	35,461			8.33	295,293	0.20
> 1 Acre	10,073	3.34	na	4,500	1.50	15,110			12.49	125,821	0.08
Res Ag	695	11.2	na	4,500	1.50	1,043			12.49	8,681	0.01
Res Comm	29	4.1	0.64	114,301	38.10	1,105			317.27	9,201	0.01
Condominium	1,680	0.05	0.64	1,394	0.46	781			3.87	6,500	0.00
Condo Comm	22	0.05	0.68	1,333	0.44	10			3.70	81	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					180,131				$1,500,000	1.00
Unimproved	14,070	4.2	0.00	0	0.00	0			0.00	0	0.00
Grand Total	66,084					180,131	$1,500,000	$8.33		$1,500,000	1.00

FIXED SFE (3,000)
($1.5M DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.10	333,234	111.08	147,734			508.19	675,890	0.45
Commercial	1,692	2.7	0.82	96,442	32.15	54,393			147.08	248,852	0.17
Comm Res	5	4.0	0.68	118,483	39.49	197			180.69	903	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	653.55	67,315			2,990.01	307,971	0.21
Apartments	188	2.7	0.64	75,272	25.09	4,717			114.79	21,581	0.01
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.33	na	3,000	1.00	35,461			4.58	162,236	0.11
> 1 Acre	10,073	3.34	na	4,500	1.50	15,110			6.86	69,127	0.05
Res Ag	695	11.2	na	4,500	1.50	1,043			6.86	4,769	0.00
Res Comm	29	4.1	0.64	114,301	38.10	1,105			174.31	5,055	0.00
Condominium	1,680	0.05	0.64	1,394	0.46	781			2.13	3,571	0.00
Condo Comm	22	0.05	0.68	1,333	0.44	10			2.03	45	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014			—		327,865				$1,500,000	1.00
Unimproved	14,070	4.2	0.00	0	0.00	0			0.00	0	0.00
Grand Total	66,084					327,865	$1,500,000	$4.58		$1,500,000	1.00

FIXED SFE (3,000)
($1.5M DRAFT - 1990)

Stormwater Utility Charge System for Harford County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,330	76.5	0.10	333,234	111.08	147,734			402.38	535,166	0.36
Commercial	1,692	2.7	0.82	96,442	32.15	54,393			116.45	197,040	0.13
Comm Res	5	4.0	0.68	118,483	39.49	197			143.07	715	0.00
Exempt	727	122.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	103	64.3	0.70	1,960,636	653.55	67,315			2,367.47	243,850	0.16
Apartments	188	2.7	0.64	75,272	25.09	4,717			90.89	17,087	0.01
Not Perc	9	0.8	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	35,461	0.33	na	3,000	1.00	35,461			3.62	128,458	0.09
> 1 Acre	10,073	3.34	na	4,500	1.50	15,110			5.43	54,734	0.04
Res Ag	695	11.2	na	4,500	1.50	1,043			5.43	3,776	0.00
Res Comm	29	4.1	0.64	114,301	38.10	1,105			138.02	4,003	0.00
Condominium	1,680	0.05	0.64	1,394	0.46	781			1.68	2,828	0.00
Condo Comm	22	0.05	0.68	1,333	0.44	10			1.61	35	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	52,014					327,865				$1,187,693	0.79
Unimproved	14,070	4.2	0.10	18,382	6.13	86,213			22.20	312,307	0.21
Grand Total	66,084					414,078	$1,500,000	$3.62		$1,500,000	1.00

Stormwater Revenue Estimation for Harford County, Maryland

(DRAFT - 1990)

Property Tax ($1.5M Rev. Requirment)

Land Use	Number of Parcels	Average Value/ Parcel	Average Assessed Value	Tax Base (x 100)	Revenue Required	Tax Rate Per $100 Valuation	Yearly Tax Per Average Parcel	Total Paid By Parcel	Percent Paid By Parcel
Agriculture	1,330	149,843	67,429	896,810			36.13	48,049	0.03
Commercial	1,692	382,247	172,011	2,910,429			92.16	155,933	0.10
Comm Res	5	270,280	121,626	6,081			65.16	326	0.00
Exempt	727	1,693,199	761,940	0			0.00	0	0.00
Park									
Playground									
School									
Industrial	103	1,552,784	698,753	719,715			374.37	38,560	0.03
Apartments	188	935,982	421,192	791,841			225.66	42,425	0.03
Not Perc	9	31,022	13,960	1,256			7.48	67	0.00
Residential									
< 1 Acre	35,461	93,767	42,195	14,962,742			22.61	801,664	0.53
> 1 Acre	10,073	121,212	54,545	5,494,357			29.22	294,373	0.20
Res Ag	695	114,743	51,634	358,859			27.66	19,227	0.01
Res Comm	29	124,176	55,879	16,205			29.94	868	0.00
Condominium	1,680	62,406	28,083	471,789			15.05	25,277	0.02
Condo Comm	22	136,050	61,223	13,469			32.80	722	0.00
Marshland	0	0	0	0			0.00	0	0.00
Non-standard									
Cooperative	0	0	0	0			0.00	0	0.00
Mobil/Traile	0	0	0	0			0.00	0	0.00
Group Quar	0	0	0	0			0.00	0	0.00
Motel	0	0	0	0			0.00	0	0.00
Forest Cons	0	0	0	0			0.00	0	0.00
Detached S-F									
0 - .5 Ac	0	0	0	0			0.00	0	0.00
> .5 - 1 Ac	0	0	0	0			0.00	0	0.00
> 1 Acre	0	0	0	0			0.00	0	0.00
Garden Apt.	0	0	0	0			0.00	0	0.00
High Rise	0	0	0	0			0.00	0	0.00
Other	0	0	0	0			0.00	0	0.00
Total (Dev.)	52,014			26,643,554				1,427,491	0.95
Unimproved	14,070	21,375	9,619	1,353,358			5.15	72,509	0.05
Grand Total	66,084			$27,996,913	$1,500,000	$0.0536		$1,500,000	1.00

Stormwater Revenue Estimation for Harford County, Maryland

(DRAFT - 1990)

Property Tax ($20 / Res. parcel < 20 Acres)

Land Use	Number of Parcels	Average Value/ Parcel	Average Assessed Value	Tax Base (x 100)	Revenue Required	Tax Rate Per $100 Valuation	Yearly Tax Per Average Parcel	Total Paid By Parcel	Percent Paid By Parcel
Agriculture	1,330	149,843	67,429	896,810			32	42,509	0.03
Commercial	1,692	382,247	172,011	2,910,429			82	137,954	0.10
Comm Res	5	270,280	121,626	6,081			58	288	0.00
Exempt	727	1,693,199	761,940	0			0	0	0.00
Park									
Playground									
School									
Industrial	103	1,552,784	698,753	719,715			331	34,115	0.03
Apartments	188	935,982	421,192	791,841			200	37,533	0.03
Not Perc	9	31,022	13,960	1,256			7	60	0.00
Residential									
< 1 Acre	35,461	93,767	42,195	14,962,742			20	709,234	0.53
> 1 Acre	10,073	121,212	54,545	5,494,357			26	260,433	0.20
Res Ag	695	114,743	51,634	358,859			24	17,010	0.01
Res Comm	29	124,176	55,879	16,205			26	768	0.00
Condominium	1,680	62,406	28,083	471,789			13	22,363	0.02
Condo Comm	22	136,050	61,223	13,469			29	638	0.00
Marshland	0	0	0	0			0	0	0.00
Non-standard									
Cooperative	0	0	0	0			0	0	0.00
Mobil/Traile	0	0	0	0			0	0	0.00
Group Quar	0	0	0	0			0	0	0.00
Motel	0	0	0	0			0	0	0.00
Forest Cons	0	0	0	0			0	0	0.00
Detached S-F									
0 - .5 Ac	0	0	0	0			0	0	0.00
> .5 - 1 Ac	0	0	0	0			0	0	0.00
> 1 Acre	0	0	0	0			0	0	0.00
Garden Apt.	0	0	0	0			0	0	0.00
High Rise	0	0	0	0			0	0	0.00
Other	0	0	0	0			0	0	0.00
Total (Dev.)	52,014			26,643,554				1,262,904	0.95
Unimproved	14,070	21,375	9,619	1,353,358			5	64,149	0.05
Grand Total	66,084			27,996,913	$1,327,054	0.0474		$1,327,054	1.00

Appendix C

Additional Considerations In Implementing A Stormwater Utility System

Overview

Maryland Department of Environment, Sediment and Stormwater Administration has published a sample stormwater utility that could serve as a guide for the development of an ordinance for Harford County. The MDE sample ordinance is based on a review of 20 ordinances adopted by other municipalities and counties. The sample ordinance includes 12 basic sections which are typical of the points that must be addressed when a user charge system is formed:

1. A statement of findings, intent, and authority.
2. Definitions.
3. Provisions for the creation and administration of a user charge system.
4. References to master stormwater or watershed plans.
5. Provisions for the imposition and calculation of stormwater charges.
6. Creation of a restricted fund for collection and disbursement of stormwater charges and fees.
7. Provisions for credits, exemptions, or surcharges.
8. Provisions for billing procedures.
9. Provisions for enforcement and penalties.
10. Provisions for appeals of charges.
11. A severability clause.
12. Limitations of liability in the event of floods.

The following paragraphs outline the types of charges that the County Council would have to make to the County Code.

Findings, Intent, and Authority

Findings sections of utility ordinances typically state that all people (property owners) in a community generate runoff, that stormwater management is necessary to protect the public health, safety, and welfare, that all benefit from control of stormwater, and that all should pay for control of stormwater in relation to the reasons for creating a utility. For example, one reason for a utility may be to consolidate responsibilities for different aspects of stormwater control.

While sections concerning findings and intent are general in nature, they are important in establishing the basis for a utility, and courts may look to them in the event of litigation over creation of the utility. The necessary section(s) of the County Code would have to be modified to include language specific to the rationale for creating a utility.

The County also would have to reference provisions in State law which grant authority for imposition of stormwater charges. The Stormwater Management Act (Title 4, Subtitle 2, Annotated Code of Maryland 1987) states:

> Each county or municipality may adopt a fee system to cover the cost of reviewing stormwater management plans and implementing stormwater management programs. The fee shall take effect upon enactment by the local governing body.

The County Code would have to be amended to include a reference to this provision.

Definitions

The MDE sample ordinance includes definitions for 12 terms that currently are not defined in the County Code. These and other terms would have to be added to the existing County Code if a utility were established.

Creation and Administration of the Utility

Utility ordinances usually describe how the utility will be managed. The position of the utility with the local administration is specified (e.g., within DNRP). The responsibilities of specific staff (e.g., County Executive, the Director of DNRP, The Director of Finance), including their relation to the County Council, may be described.

Specific clauses of ordinances may:

- create Stormwater Boards comprised of appointed citizens, establish terms of office, and

assign authority, duties, and responsibilities (e.g., require benefit-cost analyses for all projects);

- State responsibilities of local staff

  - authorize Department of Finance to collect charges;
  - authorize the appropriate Department to hear appeals and petitions;
  - clarify the relations of the county executive with the utility staff;

- Clarify the relation between public and private facilities;

- Specify the type of facilities that the utility will construct and maintain and the types of private facilities that the utility will accept;

- Specify the types of maintenance for which the utility will be responsible;

- Establish the procedures by which various departments will implement the utility.

Master Stormwater or Watershed Plans

Stormwater ordinances typically require that utilities operate in the context of a master stormwater plan; they may specify the minimum contents of plans. For example, ordinances may require that all capital improvements be mapped by basin and that they be budgeted according to priorities established in individual basin plans. The existence of a master plan reinforces the idea that stormwater management is a service to be financed by users like water supply and wastewater treatment. Operating within the context of a master plan or a set of watershed plans also strengthens the position of a utility in the even of a suit challenging its legitimacy.

Imposition and Calculation of Stormwater Charges

Utility ordinances typically include several sections related to the establishment and calculation of utility fees. These are coordinated with other sections of ordinances concerning fees, such as those that establish plan review or permit fees. Usually, separate section establish the fees, explain how they will be calculated, and set the levels of the charges. The rationale for all fees and the purposes of the fees are explained carefully. Items usually specified include:

- References to authorization for imposing fees;

- Amount to be generated by fees (e.g., charges shall cover all stormwater management costs);

- Uses of fees (e.g., planning, design, acquisition of right-of-way, construction, routine and remedial maintenance, and reconstruction); and

- Basis for charges (land use classification, runoff coefficients, billing algorithm, rate schedules and provisions for increasing fees).

- The rationale for standardized residential charges.

Stormwater Fund

Utility ordinances require that a separate fund be established for all revenues collected by the utility (generally referred to as an enterprise fund). The ordinances usually specify permissible disbursements from the fund (e.g., some utilities allow payments to developers to reimburse costs of constructing facilities designed to serve areas larger than the immediate development). Ordinances also clarify the relationship between the stormwater fund and the general fund (e.g., funds may be used to pay for a proportionate share of municipal accounting expenses but funds may not be commingled).

Credits, Exemptions, or Surcharges

Some utilities provide credits, reductions, or exemptions for charges if stormwater is retained on-site or if other criteria are met. These special features usually are specified in separate sections of the ordinance. The particular section could be amended to include exemptions form utility charges and procedures for credits from charges, if any. For example, residential developments consisting of single family houses each on a lot of two acres or greater presently are exempt from permits; consideration must be given as to whether these homes would be charged by the utility.

Billing

Utility ordinances specify how frequently bills will be issued and who will be responsible for collecting them.

The model ordinance includes no references to mechanisms for charging users of systems. Sections about billing would need to be added; options in billing are discussed below.

Enforcement and Penalties

Most utility ordinances specify actions that can be taken to collect delinquent bills. Officials responsible for collection (e.g., Director of Finance) may be specified. Ordinances may provide for liens against property in the event of failure to pay. References to other sections of the local code that specify procedures for the collection of bills may be made. Penalties for failure to comply with the ordinance may be included.

Provisions for Appeals of Charges

Ordinances typically include a separate section that establishes the procedures that people can use to appeal stormwater charges. For example, hearings could be requested with the appropriate County Department, and the Department decisions appealed to a stormwater board or to the local council.

Severability

Severability clauses specify that the entire ordinance does not become invalid if a single section is found to be invalid.

Limitations of Liability

Utility ordinances typically specify that the existence of a stormwater utility does not ensure that floods will not occur and that the local jurisdiction assumes no liability for any damages caused by flooding.

Summary

The sample ordinance available from MDE provides an overview of the basic legal requirements for establishing a utility. MDE also can make available to the County copies of ordinances adopted by approximately 20 jurisdictions. The language of an ordinance is extremely important in the event of a suit challenging the legitimacy of the utility. Support from the County's Office of Law would be required during development.

Billing Considerations

Development of a billing system can begin after local officials have selected a rate structure and specified the types of data to be used in the calculation of charges. Practical considerations in the development of a billing system are reviewed in this section. Specific factors include:

- o Methods and frequency of billing;
- o Data requirements for billing; and
- o Costs of billing.

Methods and Frequency of Billing

Options for billing in Harford County would include:

1. Adding stormwater charges to existing bills for water and sewer service;

2. Adding stormwater charges to annual property tax bills as a line item; and

2. Creating a new, separate billing system.

Most utilities add stormwater charges to existing water and sewer bills that are mailed monthly or quarterly rather than to property tax bills that are mailed annually or semiannually. This method reportedly is favored because it reinforces the notion that the fees are user charges and not taxes. The benefit of adding the stormwater charges to existing bills is that the cost of developing and maintaining a new billing system can be significant. The most likely billing option in the County would be to add the stormwater charges to an existing billing system. This could be done very cheaply if the information in the tax assessor's files is sufficient for calculating the charges.

Data Requirements for Billing

The types of information that must be coded in a billing system are presented in table 19. Much of this information already is in the Harford County tax files.

Table C-1

Data Needs For a Stormwater Utility Billing System

Data Needed	Data Needed
Account Number	Equivalent Runoff Units
Service Address (site)	Drainage Basin Code
Map and Parcel Number (from working maps)	Floodplain Location Code
Billing Address	Billing Cycle Code
Tax Assessor's Number	Billing History Summary
Parcel Area (estimate or measured)	Delinquency Action Code
Land Use Code	Special Charge Code
Intensity of Development Factor (rate factor)	Special Charges
	Impervious Area (if measured)
	Credits

This information must be readily accessible so that utility staff can respond to inquiries about accounts from customers.

Costs of Billing

The development of the billing system can be one of the most time consuming and costly tasks in establishing a utility, particularly if all nonresidential parcels are digitized to determine the amount of impervious area. Cyre (1986, 1987) estimates that between six and 10 months may be required to develop and implement a billing system and that the costs to develop and implement a system can range from $50,000 to $150,000 for professional services plus $3 to $10 per account. Utilities surveyed by MDE reported annual billing costs per account ranging from $1 to $8.64; for these utilities, billing costs accounted for between 1.4% to 16.3% of total revenues. If an existing billing system is used, the most significant cost the County would incur would be modification of existing databases to include information for calculating charges (e.g., runoff coefficients, percent of impervious area per parcel).

Public Relations

Opposition to proposals for stormwater management utilities (i.e., to new fees or to the magnitude of new fees) almost always emerges. Some utilities have been stalled or defeated because of opposition. Hence, most local officials with experience in the formation of utilities stress the need for carefully planned, vigorous public information programs.

Elements of public information programs include:

- news release;
- letters to business associations and community groups;
- public service announcements;
- mailing of brochures to all accounts;
- public meetings; and
- meetings with influential community leaders.

An example of a brochure used in Denver, Colorado to explain the utility concept to residents is included as Figure 1. An approach to gain public support, used successfully in Cincinnati, was to relate proposed capital improvements to complaints. Public works staff logged over 10,000 complaints about stormwater. The locations of the problems were noted on maps of 48 recognized communities or neighborhoods in Cincinnati, Ohio. Meetings then were held with the executive boards of each of the community councils to explain the need for the utility. Stitt (1986) reports that constituency development through the meetings was important to the success of the proposed utility.

Figure 1. Utility Informational Brochure, Denver, Colorado (Denver Wastewater Division, no date).

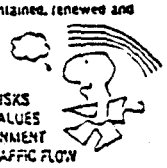
when it rains

THE NEED FOR STORM DRAINAGE

Before people settled in the front range area of Denver, the natural state of the land was rolling prairie covered by grass. When it rained, the water soaked into the land or naturally flowed to the streams and rivers.

When people did come to Denver and settle in the area, they built homes, stores, offices, churches and apartment houses. They paved the land with streets, parking lots, sidewalks and driveways. Now, when it storms, the ground cannot absorb the water as easily and many flow patterns have been changed.

As development of the land continued, it became increasingly important to control the storm water. Storm drainage facilities had to be built, operated, maintained, renewed and replaced in order to:

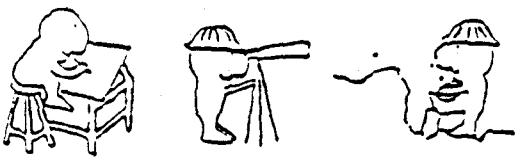


PROTECT PEOPLE
PROTECT PROPERTY
REDUCE INSURANCE RISKS
IMPROVE PROPERTY VALUES
ENHANCE THE ENVIRONMENT
PROVIDE FOR SAFE TRAFFIC FLOW

To control storm waters and receive the benefits of that control, there is a cost. Since everyone in the City benefits, the Denver City Council passed an ordinance which authorizes a Storm Drainage Service Charge to be collected from all improved parcels of land in the City.

The Wastewater Management Division of the Department of Public Works has been given the responsibility to manage this important function for the Citizens of Denver.

HOW WILL THE MONEY BE USED?



(1) Denver is a vital and growing City, and planning for future as well as present storm sewer needs is extremely important. A Storm Drainage Master Plan has been developed and is continuously upgraded so that information is always available to determine:

- Where and when repairs, changes and enlargement of the existing storm drainage system are needed to solve the present problems.
- Where and when future storm sewers will be needed so that new problems do not develop as Denver grows.
- What the costs will be to construct, operate and maintain the needed storm drainage system, including the best and least expensive method of paying these costs.

(2) In addition to the money needed to operate and maintain the present storm drainage system, a large portion of the storm drainage service charge will be used to:

- Renew the existing storm facilities so they operate properly for a longer period of time.
- Replace existing storm facilities that have become unusable over the years due to the natural deterioration process.

(3) Management of new land development in the City is required to provide for a proper and adequate storm drainage system. Some of the money will be used for this important function in the review of plans for new subdivisions, buildings, parking lots, driveways, etc. to insure that these requirements are met by new construction.

THE EXISTING STORM SYSTEM

The Storm Drainage System is complex. There are many parts which make up this system from underground pipelines, which gather the water as it first enters the system, to the gutches and natural waterways which control and carry the storm water away. The existing storm drainage system, presently valued at approximately $73 million consists of:

12,200 Catch Basins
950 Siphons
375 miles of underground lines and structures
40 miles of Gutches
20 miles of gutches & natural waterways

This System must be maintained on a year around basis so that when needed, it will operate to safely control and dispose of the storm waters.

QUESTIONS??? AND ANSWERS!!!

WHO WILL PAY FOR THE SYSTEM?
The owners of every improved parcel of land within the City of Denver will help share the cost of Denver's Storm Drainage System in an equitable manner.

HOW WILL THE CHARGE BE FIGURED?
The annual charge to a land owner will be determined by the overall need of the land parcel to use the Storm Sewer System. For instance, a parking lot will have more storm runoff than a grassy area of the same size. The annual charge will be based on the total amount of impervious surface on a parcel in relation to its total area.

WHAT IS IMPERVIOUS SURFACE?
Impervious surface is a manmade area that will not readily absorb rain water as it falls. Examples would be roof tops and paved areas.

CITY AND COUNTY OF DENVER

DEPARTMENT OF PUBLIC WORKS
WASTEWATER MANAGEMENT DIV

WASTEWATER MANAGEMENT DIVISION
P.O. Box 17827 Terminal Annex
Denver, Colorado 80217

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Denver, CO

STORM DRAINAGE
SERVICE CHARGE
ADVANCE NOTIFICATION

OWNER/OCCUPANT

WHAT IS MY SHARE OF THE COST?

The probability of storm water runoff from a specific parcel of land using the storm drainage system of the City is directly related to the amount of impervious surface area on that parcel. The Storm Drainage Service Charge is based on the percentage of impervious surface area to the total parcel area. For instance, to determine the rate and annual charge for a specific parcel of land: (1) divide the impervious area by the parcel area, the answer is the ratio of impervious area to parcel area; (2) go the rate table and find the proper ratio group and rate which applies to that parcel; (3) then, multiply the rate times the impervious area and divide by 100; the answer to the above will be the annual Storm Drainage Service Charge for that parcel of land.

The information shown below is for the listed service address and will be used to determine the storm drainage service charge for the parcel. Space has been provided for you to check the accuracy of our information. In the event your figures differ from those of record, please fill in the boxes and return the section below the dotted line to this office for further checking, and if necessary, a field survey.

The date you may expect to receive a bill for the Storm Drainage Service Charge is shown on the last line of the page. Please do not send money at this time.

RATE TABLE

Ratio Group	Rate
0 to .10	$0.37
.11 to .20	0.47
.21 to .30	0.57
.31 to .40	0.67
.41 to .50	0.77
.51 to .60	0.77
.61 to .70	0.87
.71 to .80	0.97
.81 to .90	1.07
.91 to 1.00	1.17
Minimum $3.30/parcel	

IF YOU NEED MORE INFORMATION!!

Should you have any questions or want more information about the storm drainage service charge, please call the Wastewater Management Division, Customer Services at 629-1451, extension 235.

THIS IS NOT A BILL

MAILING ADDRESS: ACCOUNT NUMBER: SERVICE ADDRESS:

	PARCEL AREA	IMPERVIOUS AREA	RATIO
RECORDS INDICATE	SQ. FT.	SQ. FT.	
ENTER FROM YOUR RECORDS			

YOU WILL RECEIVE A BILL FOR THE ABOVE PARCEL ON OR ABOUT:

There is some evidence, however, that public relations programs have only a limited effect on the success of a proposal and that the most important factor is the size of the proposed charge. Proposals for utilities with fees in the range of $1 to $2 per month for single family residences seem to be accepted, while proposals for higher fees seem to have been rejected. In Tampa, Florida, for example, a proposal for a utility with monthly residential fees in excess of $4 was stopped by public opposition despite (Wallace 1986):

- 77 letters to business, civic, and professional groups
- 6 news articles;
- 9 public announcements in three newspapers;
- public meetings in each of seven districts;
- 70,000 utility bill messages; and
- responses to 75 telephone inquiries.

Cyre (1986) suggests that users seem to be willing to pay from one-third to one-half as much as they pay for water or sewer bills, whichever is lower, and that there "seems to be a psychological ceiling on stormwater charges of $3 per month for residences." The City of Bellevue, however, charges more than $4 per month to single family residences. Fees in Bellevue, however, have been increased gradually over time.

There also is evidence that the timing of a proposal may affect its success. Utilities in Austin, Texas and Tulsa, Oklahoma were established after severe floods resulted in the drowning of several people. Stitt (1986) declares flatly:

> You need a storm. Nothing was more helpful for stimulating public interest in the stormwater problem than the two 100 year storms that Cincinnati experienced in 1982.

Regardless of the effectiveness of a public information program in explaining the utility, the first bill is certain to generate inquiries that the county should be prepared for. Some communities have installed extra telephone lines and hired additional temporary help to respond to calls. Stitt (1986) reports that the Cincinnati Stormwater Division received 1,000 calls the day the bills were first issued, but that the number of calls declined to "only about 100" per day after a week.

Appendix D

While the report to which this supplement is appended includes an overview of issues that would arise in the implementation of a user charge system (e.g., the need for a public relations program), several pragmatic political issues have not been addressed with the attention that would be required in the event a decision were made to pursue a utility. These include a host of issues that may be thought of as strategic: how the County Executive ought "package" a utility proposal, how issues of equity ought be characterized publicly, the timing of implementation, or ways to adjust runoff coefficients (which are controls) to achieve other equity objective or to make administration of the system cheaper and easier. These issues are far off on the time horizon, and do not require direct attention unless a decision is made in favor of pursing a utility. Never the less, it may be important to keep these long-term matters in mind when considering the issue of utilities in general.

It may be insightful to consider the findings of the Baltimore County Stormwater Management Committee, convened by the Director of Environmental Protection and Resource Management. They have recently recommended the formation of a stormwater utility to finance stormwater controls. In doing so, they suggested that guidance from the Administration would be essential in addressing the following issues, which in view of geographic proximity may be relevant to Harford County.

1. Justification for a Utility People will question the need for a utility. A utility is needed for two reasons: current funding for maintenance is inadequate and new programs are needed to help achieve water quality goals related to cleaning up the Chesapeake Bay and its tributaries. While documentation to support these two reasons is adequate, each has political implications. For example, the statement that current funding for maintenance is inadequate could be construed as a criticism of budgetary or allocation decisions made by elected officials. The proposition that the only way for maintenance to be funded is to establish a separate fee that is placed into a restricted account is a more direct criticism. On the other hand, this alternative approach to financing is consistent with the Administration's stated goals of looking into sources of revenue other than property tax.

2. Equity of the Rate Structure The example in Chapters 4 and 5 is illustrative of the way in which utility financing works. Although most residential users would be better off paying user chances, most nonresidential property owners, particularly owners of industrial, agricultural, and tax exempt property would be better off under a property tax system. It is likely that classes of users will contest elements of the rate base. Based on expected responses to a utility proposal, official could modify the rate structure in ways to mute objections while leaving basic principles intact. For example, rather than using engineering based runoff coefficients themselves as charge rate factors, the coefficients could be grouped so that there would only be a few rate classifications (the Grouped RF (Rate Factor) Approach is an example of this concept). This would minimize the number of different rates and could reduce the disparity between types of property owners.

   Another issue pertains to credits. Most utilities offer waivers or credits, at least partial ones, to owners of nonresidential properties who control stormwater on-site. The Committee believes that it is unfair to impose charges on the owner of property who already has paid for the construction of stormwater management facilities and is responsible for maintaining them. In addition, the development and implementation of a credit system is considered essential for the success of proposals to include agricultural properties in the rate base. Agricultural land is the largest single source of non-point source pollution. Although aid is available to assist farmers in the implementation of conservation plans, the cost of implementation still is high. Although utility charges to owners of agricultural land could be significant, formation of a utility that included credits for implementation of best management practices would provide an additional incentive for farmers. Although the Committee believes that credits should be available, the Committee does not believe that charges for runoff should be waived completely for any property owner. Stormwater discharges occur even from properties that control water on-site. In general, the Committee believes that property owners who receive credits should continue to pay at the rate at which owners of undeveloped property are charged.

   While a credit system provides incentives for on-site controls and is important front eh perspective of equity, credits reduce total revenues. The impact of a credit system on potential utility revenues and on charges paid by people not eligible for credits needs to be investigated. Design of a credit system will be a major task in implementation of a utility.

3. Scope of Utility System While the costs of current stormwater programs represent a relatively small portion of the County's total budget (about 2%), the costs are significant (about $20,000,000). The costs of proposed new programs ($1.9 million) would represent an increase of almost 10% in current expenditures. If the new programs (watershed planning and maintenance) were assigned to DEPRM, DEPRM's operating budget would increase by 135%. An increase of this magnitude could be difficult to manage in the short term.

   A utility could be established to fund all or only a few of the existing and proposed activities. If

all stormwater activities were to be financed with at utility, current tax revenues would be freed for other activities or, theoretically, property taxes could be cut. While this may seem an unlikely scenario, several municipalities have done this when implementing utilities. Locally, the City of Baltimore recently dropped the tax rate by five cents, recognizing that the action was largely symbolic. Determining the scope of programs to be funded by a utility involves numerous political as well as technical considerations.

4. Implementation Creation of a utility typically requires a substantial period of time. Utility managers responding to a survey by MDE reported planning periods prior to Council authorization ranging from seven months to 2.5 years. The planning period reported most frequently was 1.5 to 2 years. Most (75%) of the utilities reported that utilities were implemented within six months following council authorization to proceed. In Baltimore County, the Committee has been studying the utility concept for nearly a year; pre-implementation studies have been completed. Overall, the Committee believes that the data available to them is sufficient for the Council to determine whether a utility ought be implemented in Baltimore County. Depending on when a proposal could be presented to the Council, a utility could be implemented as early as 1991.

This brief list of issues illustrates the types of problems that will be encountered in the implementation of a utility. Systematic considerations should be given to these and other issues prior to and during implementation. Consultants may need to be hired during the implementation phase.

FINANCING STORMWATER CONTROLS IN CECIL COUNTY: A PRELIMINARY INVESTIGATION

(Final Report)

July 26, 1991

Prepared By:

Jim George
Greg Lindsey

Sediment and Stormwater Administration
Maryland Department of the Environment
2500 Broening Highway
Baltimore, Maryland 21224

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1.0 INTRODUCTION

The State of Maryland passed the Stormwater Management Act in 1982. Regulations promulgated in 1983 required all incorporated counties and municipalities to adopt stormwater management ordinances by 1984. The local programs are to provide controls that will "maintain after development, as nearly as possible, the predevelopment runoff characteristics." In addition, local governments must manage programs to implement provisions of the State's Sediment Control Law, and Maryland's Critical Areas Laws where applicable.

In 1987 Congress passed the Water Quality Act, a comprehensive overhaul of the Clean Water Act. Section 319 of the Act requires all states to develop assessment and management reports that outline strategies to control nonpoint source pollution. In response, Maryland's primary goal has been to implement the Nutrient Reduction Plan for which quantitative goals already were in place (i.e., a 40% reduction in nutrient loadings to the Chesapeake Bay by the year 2000).

These statues, regulations, and policies reflect concerns about the negative impacts of stormwater runoff on the quality of streams and rivers in Cecil County that are tributaries of the Chesapeake Bay. A number of stormwater policies, programs, and projects have been identified to control the quantity and improve the quality of runoff. This report focuses on options available for financing these activities.

Contents of Report

This report begins with a description of administrative and managerial considerations for collection and management of stormwater. County departments responsible for various aspects of stormwater management are identified. This description is followed by a discussion of revenue requirements for stormwater controls. Costs are estimated for existing and proposed activities, including expanded maintenance programs. To the extent possible, costs are presented by administrative department and function.

Next, current and potential sources of revenue are described. Two major potential sources, property taxes and user charges, are evaluated against several criteria including ease and cost of administration and fairness. Legal requirements, options for billing, and other issues related to the formation and implementation of a user charge system are reviewed in the appendices.

Definitions

The stormwater control system includes structures and natural waterways used for the collection, conveyance, storage, treatment, and disposal of stormwater runoff in a manner that prevents accelerated channel erosion, increased flood damage, and/or degradation of water quality. The stormwater control system conventionally has comprised two

distinct elements: (1) storm drain systems and (2) stormwater management structures.

The storm drain system, which includes facilities used primarily to collect and convey runoff, includes two basic elements:

(a) open systems consisting of natural watercourses, and

(b) closed systems consisting of pipes and other structures constructed specifically for the purpose of transporting runoff.

The Cecil County Stormwater Management Ordinance provides a specific definition of stormwater management, which distinguishes it from stormwater drainage or conveyance. This definition of stormwater management also includes two basic elements:

(a) for Quantitative control, a system of vegetative and structural measures may be used to counter the increased volume and rate of surface runoff caused by man-made changes to the land.

(b) for Qualitative control, a system of vegetative and structural measures may be used to reduce or eliminate pollutants that might otherwise be carried by surface runoff.

In this report, the terms stormwater control systems, stormwater controls, and stormwater system are used to refer to both stormwater management and storm drainage. Consistent use of these definitions will help avoid confusion. The term flood control occasionally is used interchangeably with quantity control and refers mainly to control of the peak and duration of runoff flows. In general, the discussion of financing options that follows applies to both storm drain systems and stormwater management.

2.0 ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITIES

The Cecil County Department of Public Works (DPW) bears primary responsibility for both storm drain systems and stormwater management. To this end, DPW maintains a seat on the Technical Advisory Committee and Planning Commission.

All new subdivision plans must be reviewed by these bodies, and new commercial projects must obtain site plan approval from the Planning Commission prior to the issuance of a building permit. Final approval from the Planning Commission can be granted for these types of projects only after the approval of stormwater management plans is obtained from the DPW. Construction inspections are conducted by the DPW as are maintenance inspections.

All County capital projects are designed by consultants. The projects are subject to the same approval process as private projects. The construction and maintenance inspections are performed by a stormwater management inspector from DPW. Additionally, private testing and engineering firms are hired to conduct necessary tests and to perform any as-built certifications necessary.

As mentioned above, stormwater management plan reviews are conducted by DPW. In the special case of basin and pond plans, designs are also submitted to the Soil Conservation District for their review. Once plans are acceptable, approval may be granted by the Director of Public Works.

3.0 REVENUE REQUIREMENTS

Revenue requirements are the costs of all stormwater control programs and functions. There are two basic components of revenue requirements: (1) the cost of existing programs and functions and (2) the cost of new programs considered necessary for achieving stormwater control objectives. Both can include operating and capital costs. A good estimate of the total costs is necessary to establish priorities for financing and to determine the amount of revenues from different sources necessary to pay for the programs.

A difficulty in determining the cost of existing programs is that costs generally are reported by administrative unit (department), not by program or function. Although the Department of Public Works (DPW) is the sole agency with responsibility for stormwater management, it is difficult to determine the fraction of DPW expenditures that are related to stormwater controls. A rough cost estimate for maintenance of structures can be performed based on recent site-survey information compiled by MDE and general engineering formulas.

The challenge in estimating costs of potential functions not currently performed by the County is that few data are available on which to base such cost estimates. The cost estimates for new functions were developed from a variety of data sources and are considered accurate only within an order of magnitude.

3.1 Current Operating Costs

Direct Operating Costs

Direct operating costs are those incurred by operating agencies that provide direct services to County residents (DPW in this case). The costs include salaries, consultant costs, and other budgeted expenses not funded by capital funding mechanisms (e.g., bonds). Fiscal Year 1990 operating expenses for stormwater management were estimated to be $92,000[1].

The FY 1990 operating expenses for storm drainage system development and maintenance are not available. The expenses are some fraction of the FY 89-90 budget for DPW that is presented in Table 1.

---

[1] Cecil County "Data Form for Local Stormwater Management Program Reviews", April, 1990 (MDE, SSA).

Table 1

Cecil County DPW Budget by Function (FY 89-90)

Function	Regular Operations	Enterprise Operations
Highway	$3.79 Million	--
Sanit./Waste Control	$525,000	$1.56 Million
Other	$456,300	$748,500

Source: Maryland Association of Counties

A significant fraction of the budget allocated to Highway and Other functions may be attributable to maintenance of storm drains and ditches. A specific estimation of this cost, however, would require DPW staff to review records of past expenditures.

Indirect Operating Costs

Indirect operating costs are those incurred by County agencies that provide support services to operating agencies (Legal, Financial, etc.). As a rule-of-thumb, indirect operating costs may be estimated as 20 percent of total payroll costs of the operating agencies (DPW in this case). In turn, payroll costs account for roughly anywhere from 75% to 95% of total direct operating costs related to controlling stormwater.

An estimate of the total payroll costs for current and proposed programs (discussed below) is $78,000 or 85% of the total costs. Using the rule-of-thumb estimate of 20 percent of total payroll costs leads to an estimated indirect operating cost of $15,640.

3.2 Costs of Proposed and Potential Programs

As discussed in Section 3.4, the general trend in Cecil County is toward increased stormwater management activities. Activities that may be warranted in the future include watershed planning, improved maintenance of facilities, and retrofit projects.

Watershed Planning

Watershed planning is necessary to establish water quality goals and to identify actions that can be taken to achieve the goals. A major component of a watershed plan is the identification of retrofit projects that can reduce pollution from areas of existing development. Due to physiographic differences, objectives and projects necessarily will

vary by watershed. The cost of watershed planning can vary significantly depending on the problems that exist within a given watershed and the level of detail needed in the plans.

No watershed specific estimates of the costs to prepare plans are available for this report; however, the following rough estimate may be used as a guideline. Prince George's County estimates that a watershed plan for an area approximately 100 square miles in size costs approximately $500,000. There are 352 square miles in Cecil County. Based on Prince George's County rule-of-thumb, the cost of completing watershed plans for all of Cecil County could be about $1,760,000. Because Cecil County is rural and Prince George's County is more urban, this rule-of-thumb may over estimate the cost of watershed planning.

Given current expenditures on stormwater programs these costs, if accurate, seem extremely high. The State has not mandated the preparation of watershed plans, and, given the high costs of such planning activities, it is unlikely that they would be undertaken by the Counties voluntarily. Nevertheless, this estimate provides a reasonable indication of the magnitude of costs that could be incurred if watershed planning was required. Given the potential magnitude of such costs, it is clear that costs would have to be phased in over time.

Improved Maintenance

The County has two basic responsibilities with respect to maintenance:

(1) the County must inspect private facilities and use its regulatory authority to enforce necessary maintenance; and

(2) the County must inspect and maintain facilities that the County constructs or has assumed ownership of.

State regulations require that all existing facilities be inspected for maintenance at least once every three years[2]. Because the number of facilities in Cecil County is relatively small, current staff are able to incorporate maintenance inspection into their regular workload. Thus costs for inspection are included in current programmatic cost estimates. The County's inventory and records appeared to be well organized and complete. As one result of the MDE survey, DPW and MDE staff entered the information in a computer inventory that is now easily accessible. The overall need for maintenance is considerably less in Cecil County than in other counties inspected in the summer of 1990.

---

[2] COMAR 26.09.02.10

During the summer of 1990, MDE inspected all 33 of the inventoried sites to ascertain their condition. Inspectors found that 69% of the sites were functioning hydrologically, and that 81% were providing water quality benefits. Routine maintenance was needed at 45% of the facilities and 16% warranted immediate enforcement action (i.e., there were major repairable problems that prevent proper function, lesser repairable problems that influence function, or problems that are hazards to human safety or property).

An accurate estimation of the costs of maintaining stormwater facilities in Cecil County would require historical information on the costs of different maintenance activities. Rough estimates of maintenance costs can be developed either from inventory data, from the MDE inspection data, or from generalized estimates of maintenance costs in the engineering literature. For example, Schuler (1986) has suggested that three to five percent of construction costs for stormwater management facilities be allocated annually for routine and nonroutine maintenance. This latter approach is appropriate for rough planning purposes, and is most appropriate for this report.

Using Schuler's method and 1989 dollars, annual maintenance costs were estimated to be about $174 per acre of drainage area for dry and wet basins. The estimated annual maintenance costs for the fourteen dry and wet basins and one underground basin amounts to about $25,000. Maintenance costs for vegetated swales, dry wells, and infiltration trenches were not estimated and are excluded from this maintenance cost estimate.

In Cecil County private entities presently are responsible for maintenance of most of these structures. Given the results of inspections, this seems to be working reasonably well. In some counties, however, local officials have found that private home owner's associations frequently are unable to maintain facilities adequately. Hence, some jurisdictions are considering assuming responsibility for maintaining privately-owned structures. SSA is uncertain as to whether this is an issue in Cecil County. If so, and if County staff and officials believe that acceptance of maintenance responsibilities by the County would improve conditions, costs would be expected to be somewhat less than $25,000 annually for the existing structures.

3.3 Current and Projected Capital Costs

Currently no capital costs are incurred for stormwater management activities; however, retrofitting of existing stormwater management structures is likely to be an area requiring future funding. Estimates of the costs of retrofitting watersheds for the purposes of stream restoration or achievement of Chesapeake Bay nutrient reduction objectives depend on results of future watershed planning activities. No attempt will be made here to estimate the cost of retrofitting watersheds in Cecil County to achieve water quality goals. As watershed plans are developed, retrofitting projects can be identified and the costs can be estimated.

3.4 Trends in Costs for Stormwater Controls

Few data are available to forecast trends in costs for potential programs, which include watershed planning, retrofitting, and improved maintenance. Information from the Cecil County "Data Form for Local Stormwater Management Program Reviews" (1990) provides some indication of past trends from 1985 to 1990. Table 2 summarizes some of these statistics. While it is conceivable that costs for watershed planning could decrease somewhat over time, it is certain that costs to achieve water quality objectives will increase as capital projects are designed and implemented. Maintenance costs also will increase, both because existing facilities will age, and because more facilities will be built. These newer facilities, which will involve more complex designs for quality control, also will be more expensive to maintain. Though it is premature to try to project the costs at this time, decision makers should recognize that the costs of retrofitting and maintenance are likely to increase steadily for the foreseeable future.

Maryland, in coordination with other states in the Chesapeake Bay watershed, has mandated more stringent stormwater management practices and set ambitious nutrient reduction goals. In addition, recent Federal amendments to the Clean Water Act will require NPDES permits for counties and municipalities. Although Cecil County is not presently required to obtain a permit for its municipal storm sewer systems, it may have to in the future. In addition, the County must now obtain permit coverage for its activities that are considered industrial (e.g., landfills, and vehicle maintenance depots). Lands continue to be developed by the private and public sectors; this will result in additional infrastructure maintenance requirements in the future.

Table 2

Trends in Stormwater Management Activities in Cecil County, MD

Trend Indicator	1985	1986	1987	1988	1989	1990
SWM Operating Expenses	N/A	N/A	$91,000	$97,000	$93,000	(est.) $92,000
Acres Served by SWM Facilities	38	117	193	382	810	N/A
Number of SWM Plans Reviewed	N/A	N/A	43	67	127	N/A
Number of SWM Plans Approved	N/A	N/A	34	56	89	N/A

Source:Cecil County "Data Form for Local Stormwater Management Program Reviews," MDE, SSA, April, 1990.

N/A = Data is Not Available

An increasing trend in stormwater management activity is apparent in Table 2; however, this trend is not reflected as an increase in the operating expenses. These divergent trends raise the issue of whether current expenditures are adequate.

It is reasonable to assume that changes in Federal and State regulations discussed above will result in greater demands on the resources of Cecil County, DPW. Table 2 also suggests an increasing trend in stormwater management activities. In addition, Table 2 suggests that general revenues may not be able to meet the increasing needs associated with stormwater management. Alternative options for financing stormwater controls are discussed below in Chapter 4.0.

3.5 Cost Summary

Current annual direct operating costs are approximately $92,000 for stormwater management. Using rules-of-thumb, indirect operating costs associated with current programs are estimated to be $15,640. Hence, total current costs are estimated to be about $108,000. The County has not established any new objectives for its stormwater programs, but, activities and trends at the State level suggest that eventually, maintenance of facilities may need to be improved, and watershed planning and retrofit activities may be required. While the former (improved maintenance) would not represent a significant increase in costs, the latter two (watershed planning and stormwater retrofit activities) could. Capital costs for stormwater controls for FY 1991 are presently not available. Options for financing these programs are discussed in the next two sections.

We have not attempted to estimate costs associated with potential new programs. Although few data are available for projecting future operating and capital costs, it is certain that needs will increase. Table 2 above indicates a qualitative upward trend in stormwater management activities, and increased development suggests an increase in stormwater drainage activities, but it is difficult to determine from readily available data what the actual trend in stormwater control costs have been. In general, it is reasonable to believe that revenue needs will grow at rates higher than inflation.

The anticipated growth of stormwater management revenue needs has several implications. The first is that revenues sufficient to cover present costs is likely to be insufficient in coming years. When additional revenues are needed, decision makers will have to consider several options. First, the general revenues could be increased through increased tax and fee rates. Second, changes could be made in priorities to shift resources from other programs to stormwater management programs. Third, decision makers could choose to ignore stormwater management problems at the risk of violating State and Federal regulations and triggering political and public repercussions. Finally, new sources of revenues, such as the one discussed in this report, could be developed.

4.0 OPTIONS FOR FINANCING STORMWATER CONTROLS

This chapter examines options for financing stormwater control programs in Cecil County. Current sources of revenues are described, and alternatives for financing different activities are evaluated.

4.1 Current Sources of Revenues

Operating funds for stormwater programs come primarily form the County General Fund. Cecil County revenues can be classified into six categories[3]:

- Taxes - Local
- Taxes - State Shared
- Licenses, Permits & Service Charges
- Grants
- Other Revenue
- Debt Proceeds

Taxes (Local & State Shared), which include property taxes, income taxes, sales taxes, and other taxes accounted for approximately 73% of the General Fund Revenues in FY 1989-90. Property taxes accounted for about 57.7% of the tax revenues; income taxes accounted for an additional 35.4% of the tax revenues. Tax revenues are not targeted for any particular purpose; thus, in general it is not possible to state that any specific activity such as stormwater control is financed primarily by a specific type of tax[4] or fee. Data are not available to determine how much of the current revenues for storm drain systems comes from different sources.

According to data sheets filed with MDE, funds for stormwater management funds come from three sources: state grants, plan review fees, and inspection fees; none comes from taxes. In FY 1989-90, a grant from the Maryland Department of Environment (MDE), Sediment and Stormwater Administration for administration and implementation of the County's stormwater management program totaled $53,000. Plan review fees and inspection fees accounted for another $40,000, yielding a total of $93,000 for stormwater management.

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[3] Maryland Association of Counties, 1990.

[4] According to the Maryland Association of Counties, Cecil County collected about $379,000 in service charges in FY 1989-90. Front foot assessments may have contributed to this total. In addition, some of the water and sewer charges may fund storm sewer maintenance.

4.2 Potential Sources of Revenues

MDE has summarized methods for financing stormwater controls in Table 3. A wide variety of options are available; however, only two sources of revenues are adequate for major cost items such as operation and maintenance, and debt service on general obligations or revenue bonds issued to finance retrofit and other capital projects. These two sources are General Fund tax revenue (primarily property taxes) and user charges.

While property taxes are based on the value of property (land and improvements), user charges are based on some surrogate measure that correlates with or is representative of the amount of runoff that leaves a property. Usually the this surrogate is the percentage of impervious area on a property. In the following subsections, the methods used in this study to calculate property tax-based stormwater revenues and user charge-based revenues are illustrated. Both the tax-based and user charge-based approaches impart costs according to different land uses (e.g., industrial, residential, and commercial), but the distribution of the costs varies between the two approaches. These distributions are compared and discussed.

In the following illustrations, revenue requirements for stormwater management in Cecil County are estimated to be $500,000. This number was selected arbitrarily. It is sufficient to cover current stormwater management costs, some unknown fraction of costs for storm drain systems, and/or potential costs for maintenance, watershed planning, and retrofit activities. The figure is illustrative only, and should be replaced with more accurate estimates when they become available.

Table 3 Financing Methods for Stormwater Controls (MDE 1988).

Use of Revenues	Source of Revenues	Developer/ User Pays	Taxpayer Pays	Other Pays
Operations & Maintenance				
	General Fund (property tax)		X	
	Utility Fee or Service Charge	X		
	Interfund Loans (for transition to utility)		X	
Major Capital Improvements				
Redevelopment or New Development				
	General Obligation Bonds		X	
	Revenue Bonds	X		
	Taxes on other utilities			X
	Grants (federal or state; e.g., Community Development Block Grants)			X
	Pay-as-you-go Sinking Fund	X	X	
	Tax Increment Financing		X	
Primarily New Development				
	Subdivision Exactions	X		
	Developer Incentives	X		
	Impact Fees	X		
	System Development Charges	X		
	General Facilities Charge	X		
	In-lieu of Construction Charges	X		
	Latecomer Fees for Extensions	X		
Regulatory Services				
	Plan Review & Inspection Fees	X		
	On-site Facility Inspection Fees	X		
	Penalties and Fines	X		
Special Services & Projects				
	Local Improvement Districts		X	
	Utility Local Improvement Districts		X	
	Area of Special Benefit Financing		X	
	Special Purpose Taxing Districts		X	
	Homeowners' Associations			X
	Voluntary Gifts			X

4.2.1 Estimating Revenues from Property Taxes

Ad valorem taxes levied on the assessed value of real property (i.e., property taxes) are the largest single source of revenues in the County budget. The way in which a property tax works is straight forward: assessors estimate the market value of properties and then determine assessed value at a rate established by law. Currently, properties are assessed at approximately 45% of market value. For example, if a residential property is valued at $100,000, its assessed value is about $45,000. The tax rate is levied per $100 of assessed valuation. If the tax rate were $1.00 per $100 assessed valuation, the annual tax on a property with an assessed value of $45,000 (market value of $100,000) would be $450. The tax on any parcel can be determined from data in the County's tax assessment files.

Table 4 is a worksheet developed to illustrate how potential revenues from property taxes can be estimated for all of Cecil County. The worksheet uses 1990 data from the Assessments and Taxation Files. Because the City of Elkton manages a separate stormwater program, a more accurate estimation would subtract out contributions from this city. This procedure was not performed for this illustration; however, contributions from Elkton were subtracted for the user charge case as a supplementary sensitivity analysis presented at the end of Appendix B.

<u>Column C1</u> is the list of land use categories that Cecil County and the State Department of Assessments and Taxation use to record data about properties.

<u>Column C2</u> contains the number of parcels in each land use category. For example, there were 57 parcels classified as industrial land use in Cecil County in 1990 (these data are for actual land use, not zoning).

<u>Column C3</u> contains estimates of the average value of a parcel in each land use category. The average value of the 57 industrial parcels in 1990 was $1,144,768 per parcel.

<u>Column C4</u> contains estimates of the average assessed value of a parcel in each category. The values in C4 were computed by multiplying the values in C3 by 0.45 (e.g., the average assessed value of an industrial parcel is $515,146 = $1,144,768 * 0.45).

<u>Column C5</u> contains estimates of the taxable base in each category. The taxable base is defined here as the total assessed value. The values in C5 are computed by multiplying the number of parcels (Column C2) by the average assessed value per parcel (Column C4). For example, the tax base for industrial land use is $29,363,299 = 57 * $515,146. (Note that a multiplication by 100 is implied for the presentation of values in this column.)

Column C6 contains an estimate of a revenue requirement. In this case, the requirement is $500,000. This number was selected to represent a rough estimate of Cecil County's operating budget for stormwater control.

Column C7 contains an estimate of the tax rate per $100 of assessed valuation necessary to meet the revenue requirement. This is calculated by dividing the revenue requirement (bottom of Column C6) by the total taxable base (total summation of Column C5) $500,000/$11,316,665 = $0.0442.

Column C8 contains estimates of the annual property taxes for an average-valued parcel in each category that would be required to generate the arbitrary revenue requirement of $500,000. The values in C8 were computed by dividing the average assessed values (Column C4) by 100 and multiplying the result by $0.0442. For example, the average annual tax for an industrial parcel would be about $228 = ($515,146 / 100) * $0.0442.

Column C9 contains estimates of the total tax paid by all parcels in each land use category (to generate $500,000 in revenue). These values were calculated by multiplying the number of parcels (Column C2) by the average annual property tax (Column C8). For example, in sum, the 57 industrial parcels would pay approximately $12,973 = $228 * 57.

Column C10 contains the percent of total tax paid by each land use category. These values were computed by dividing the amounts paid by all parcels in each land use category (Column C9) by the total revenue ($500,000). The portion paid by the Industrial Sector is about 3%.

Table 4

Illustrative Worksheet for Estimating Stormwater Revenues From Property Taxes in Cecil County, Maryland

Property Tax ($500K Revenue Requirement)
(DRAFT - 1990 Data)

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Land Use Category	Number of Parcels	Average Value/ Parcel	Average Assessed Value	Tax Base (x 100)	Revenue Required	Tax Rate Per $100 Valuation	Yearly Tax Per Average Parcel	Total Paid By Category	Fraction Paid By Parcel
Agriculture	900	173,243	77,959	701,634			34.44	31,000	0.06
Commercial	1,049	278,632	125,384	1,315,282			55.40	58,113	0.12
Comm Res	36	131,869	59,341	21,363			26.22	944	0.00
Exempt	479	624,524	281,036	0			0.00	0	0.00
Park									
Playground									
School									
Industrial	57	1,144,768	515,146	293,633			227.60	12,973	0.03
Apartments	51	462,788	208,255	106,210			92.01	4,693	0.01
Not Perc	45	30,871	13,892	6,251			6.14	276	0.00
Residential									
< 1 Acre	15,842	42,490	19,121	3,029,091			8.45	133,833	0.27
> 1 Acre	5,413	184,929	83,218	4,504,583			36.77	199,024	0.40
Res Ag	307	103,450	46,553	142,916			20.57	6,314	0.01
Res Comm	39	103,477	46,565	18,160			20.57	802	0.00
Condominium	338	49,462	22,258	75,232			9.83	3,324	0.01
Condo Comm	0	0	0	0			0.00	0	0.00
Marshlands	0	0	0	0			0.00	0	0.00
Non-standard									
Cooperative	0	0	0	0			0.00	0	0.00
Mobil/Trailer	0	0	0	0			0.00	0	0.00
Group Quar	0	0	0	0			0.00	0	0.00
Motel	0	0	0	0			0.00	0	0.00
Forest Cons	0	0	0	0			0.00	0	0.00
Detached S-F									
0 - .5 Ac	0	0	0	0			0.00	0	0.00
> .5 - 1 Ac	0	0	0	0			0.00	0	0.00
> 1 Acre	0	0	0	0			0.00	0	0.00
Garden Apt.	0	0	0	0			0.00	0	0.00
High Rise	0	0	0	0			0.00	0	0.00
Other	0	0	0	0			0.00	0	0.00
Total (Dev.)	24,556			10,214,356				451,297	0.90
Unimproved	11,460	21,375	9,619	1,102,309			4.25	48,703	0.10
Grand Total	36,016			$11,316,665	$500,000	$0.0442		$500,000	1.00

4.2.2 Estimating Revenues from User Charges

Estimating potential revenues from charges in a jurisdiction is a straight forward process of summing up the individual user charges of all of the rate payers in the rate base. In this context the rate base is defined as the land use categories[5] that will be assessed user charges.

For planning purposes, the procedure is simplified by grouping users according to similar land uses and estimating the average charge based on the average-sized parcel within each land use category. The charge for the average parcel in each land use category is multiplied by the number of parcels within the category yielding a revenue subtotal for that category. These subtotals are then summed across all of the land use categories to give an estimated total revenue for the County.

The worksheet used to implement this procedure is described in further detail in the illustration below. In this particular case, residential user charges (for parcels less than one acre) were set at a rate that would generate $500,000 given an assumption that the average impervious area of these parcels is 3,000 sq.ft. Table 5 is a worksheet used to facilitate the procedure; the purpose of each column is described below.

Because the City of Elkton manages a separate stormwater program, a more accurate estimation would subtract out contributions from this city. This procedure was not performed for this illustration; however, this procedure was conducted as a supplementary sensitivity analysis in Appendix B.

It is not the intent of this section to explore user charge systems in depth. It is worth noting, however, that user charge algorithms allow considerable flexibility in adjusting the distribution of charges among different land use categories. Six alternative user charge systems are presented in Appendix B. These provide a sense of the available options and illustrate different resulting distributions of charges.

Column C1 is the name of the land use category. In the cases of Exempt and Residential land uses, subcategories are defined to allow finer distinctions in stormwater runoff characteristics.

Column C2 is the number of parcels in each land use category.

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[5] Land use categories are standard descriptive classifications (e.g., industrial, commercial, residential, undeveloped, and others). As an approximation, it is assumed that stormwater runoff characteristics per unit area are the same for all parcels in a given land use category.

Column C3 is the average parcel size for each land use category expressed in acres. For the Residential land use category, weighted average parcel sizes were calculated for parcels greater than, and less than one acre using the data displayed in Appendix A.

Column C4 contains the user charge rate factors, which represent the typical percentage of impervious cover on a property. For example, the rate factor for industrial parcels is 0.70 implying that, on average, about 70% of each industrial parcel is covered by impervious material. These factors reflect standard hydrologic runoff coefficients such as those used in the Rational Method of runoff estimation.

For three land use categories (two Residential, and Residential Agriculture) the rate factor is not applicable (na) because the average impervious area was fixed based on information in the engineering literature. This practice is one means of ensuring that user charges for residential parcels greater than one acre do not differ vastly from charges for parcels less than or equal to one acre. Other approaches described in Appendix B do not rely on fixing the area.

This column can also be used to control whether or not a land use category is included in the rate base. Table 5 illustrates a case in which zero values are inserted for agriculture, exempt, and unimproved land use categories thereby excluding them from the rate base.

Column C5 is the average impervious area per parcel for each land use category. This average impervious area is expressed in square feet. The values are calculated as the (average acres per parcel) x (proportion of impervious area) x (43,560 ft/acre). That is, (C3) x (C4) x (43,560 ft/acre). Note, (C4) is the rate factor. As noted in the description of C4, the impervious area was fixed for three of the land use categories rather than being based on this calculation.

Column C6 is the number of Single Family Equivalent (SFE) units. An SFE is defined as the ratio: (impervious area of an average parcel for a given land use) / (average impervious area of a residential parcel less than 1 acre). In the worksheet it is calculated as C5/C5* where C5* is the particular value of C5 for Residential < 1 Acre[6], which in this case is multiples of 3,000 square feet[7].

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[6] Most of the alternative approaches presented in Appendix B of this report define the SFE with respect to the average parcel size among residential parcels less than one acre. In one approach, however, the delineation of the residential land use is much finer. In that case, the SFE is defined with respect to the average parcel size among residential parcels less than 1/4 acre. As a consistent rule, all of the approaches presented in this report define SFEs with respect to the smallest subclassification of residential land use. Furthermore, when referring to the smallest subclass the term "typical residential parcel" is used.

[7] The amount of square feet in an SFE for a given county could be calculated by multiplying a runoff coefficient times the average parcel size. The decision to select a value of 3,000 sq.ft. here was motivated by the desire to standardize SFE charges across all counties for a state-wide study (George, 1991).

For the purposes of this study, this dimensionless unit equals one for a typical single family living on a residential parcel of less than 1 acre. Since most people are familiar with residential land use, SFEs allow a comparison among land use categories based on a familiar measure. Once defined, SFEs also facilitate the user charge calculations, although they are not necessary to meet these ends.

Column C7 is the number of SFEs per land use category. This is equal to the average number SFEs per parcel multiplied by the number of parcels in the given land use category. That is, (C2) x (C6). The column is summed to a total at the bottom.

Column C8 is the Total County Revenue Generated per year. It is the product of $4.41 (the charge per SFE) times the sum of column C7 (the grand total number of SFEs for the county).

Column C9 is the charge per SFE, which in the present case is $4.41/SFE. It is calculated as the fraction (C8*) / (C7*) where the star indicates the values that are used are from the bottom of the respective column.

Column C10 is the typical annual charge for each land use category. It is the amount that would be paid by the owner of an average sized parcel in the given land use category. It is calculated as the typical number of SFEs times the charge per SFE ($4.41), or (C6) x (C9*) where the star indicates the value is from the bottom of the column.

Column C11 is the total amount of revenue generated by a given land use category. It is the product of the average annual charge and the number of parcels for the given land use category. It is calculated as (C10) x (C2).

Column C12 is the percentage of the total revenue paid by the given land use category. It is the total revenue per category divided by the grand total revenue for the entire county. It is calculated as (C11) / (C8*) where the star indicates the value is from the bottom of the column.

Table 5

Illustrative Worksheet for Estimating Revenues From Stormwater User Charges in Cecil County, Maryland

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Land Use Category	Number of Parcels per Land Use	Average Acre/ Parcel	Rate Factor (% Imp.)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs per Parcel	Number of SFEs per Land Use Category	Revenue Requirement ($)	Dollars Per SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,049	5.2	0.82	185,740	61.91	64,947			272.91	286,287	0.57
Comm Res	36	17.2	0.68	509,478	169.83	6,114			748.59	26,949	0.05
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.70	789,743	263.25	15,005			1,160.40	66,143	0.13
Apartments	51	1.9	0.64	52,969	17.66	900			77.83	3,969	0.01
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	na	3,000	1.00	15,842			4.41	69,832	0.14
> 1 Acre	5,413	4.17	na	4,500	1.50	8,120			6.61	35,791	0.07
Res Ag	307	11.6	na	4,500	1.50	461			6.61	2,030	0.00
Res Comm	39	5.2	0.64	144,968	48.32	1,885			213.01	8,307	0.02
Condominium	338	0.05	0.64	1,394	0.46	157			2.05	692	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshlands	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Trailer	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					113,430				$500,000	1.00
Unimproved	11,460	5.6	0.00	0	0.00	0			0.00	0	0.00
Grand Total	36,016					113,430	$500,000	$4.41		$500,000	1.00

4.2.3 Advantages and Disadvantages of Taxes and User Charges

Because property taxes and user charges are based on different measures (i.e., property values and impervious land area, respectively), their respective burdens across land use categories differ. The following illustration explores how much owners of average valued parcels would pay under a property tax system versus how much they would pay for average sized parcels under a user charge system. We applied both approaches under the assumption that it was necessary to generate $ 500,000 in revenues.

Two alternate applications of the user charge system are explored. The first case, presented in Table 6, excludes agricultural and unimproved land uses from the rate base. The second case, presented in Table 7, includes these two land uses. The property tax approach remains unchanged in both cases. The distribution of the total revenues among land use categories is presented as a percentage for both the tax and user charge systems.

As indicated in Table 6, the distribution of payments under the two systems is significantly different. Residential property owners generally would pay less under a charge system, while nonresidential users generally would pay less under a tax system. For example, to raise $500,000 in taxes, the owner of an average priced residential property valued at $42,490 would have to pay $8.45 annually, and the owner of an averaged priced industrial property valued at $1,144,768 would have to pay about $228 annually.

Under a user charge system, the owner of a residential property less than or equal to one acre in size would pay only $4.41 annually, while the owner of an average sized industrial parcel of 25.9 acres would pay about $1,160 annually. In addition, under a charge system the commercial sector would bear the bulk of the cost at 57% with the residential sector bearing the next largest portion at 21%, whereas under a property tax system these proportions would be 12% for the commercial sector and 67% for residential parcels. The largest average annual user charge of $1,160 would be paid by property owners in the industrial sector, while the largest average annual property tax payment would be $228, also paid by owners in the industrial sector. This last comparison also represents the largest difference in payments for the average case between the tax and user charge systems, and is a five fold difference.

The exclusion of agricultural and unimproved land use categories from the rate base for the user charge system accounts in part for the large differences in payment between the two systems in Table 6. This is because agricultural and unimproved land use categories are represented in the tax system rate base, but are not present in the user charge system rate base. Consequently, revenues from these two land use categories must be absorbed by the remaining land use categories under the user charge system. This source of differences in the the distribution of charges between the two systems is eliminated in the second case presented in Table 7 below.

Table 6

Typical Annual Charges and Property Taxes Necessary to Generate $500,000 (Agricultural and Unimproved Parcels Excluded From Rate Base)

Land Use Category	Average User Charge ($/Year)	Average Property Tax ($/Year)	Percent of Total Charges	Percent of Total Taxes
Agriculture	0	34	0%	6%
Commercial	273	55	57%	12%
Comm. Res.	749	26	5%	<1%
Industrial	1,160	228	13%	3%
Apartments	78	92	1%	<1%
Residential < 1 acre	4	8	14%	27%
Residential > 1 acre	7	37	7%	40%
Res Agriculture	7	21	<1%	<1%
Res. Comm.	213	21	2%	<1%
Condominium	2	10	<1%	<1%
Total Developed			100%	90%
Unimproved	0	13	0%	10%
Grand Total			100%	100%

Notes: User charges are based on the illustration summarized in Table 5. The tax data was drawn from the example summarized in Table 4.

Table 7 summarizes the distribution of stormwater program revenues under the assumption that agricultural and undeveloped lands are included in the rate base of a user charge system (Note that columns 2 and 4 in Table 7 associated with the property tax system are identical to those in Table 6). Based on the charge structure used to develop Table 7, agricultural property owners would experience a nine fold increase in payments in going from the tax system to the charge system (i.e., on average $34 property tax, and $309 user

charge)[8]. This result is a direct reflection of the tax system being property-value based, and the user charge system being directly proportional to land area; agricultural property taxes on large parcels (average, 108 acres) of relatively inexpensive land are comparable to the taxes paid on small, high-valued residential parcels (the average residential parcel size among parcels less than one acre is 0.39 acres). However, when the charge is proportionate to parcel size, as it is in the case of user charges, the cost to agricultural property owners naturally increases.

Table 7

Typical Annual Charges and Property Taxes Necessary to Generate $500,000 (Agricultural and Unimproved Parcels Included in Rate Base)

Land Use Category	Average User Charge ($/Year)	Average Property Tax ($/Year)	Percent of Total Charges	Percent of Total Taxes
Agriculture	309	34	41%	6%
Commercial	121	55	19%	12%
Comm. Res.	333	26	2%	<1%
Industrial	516	228	4%	3%
Apartments	35	92	<1%	<1%
Residential < 1 acre	2	8	5%	27%
Residential > 1 acre	3	37	2%	40%
Res Agriculture	3	21	<1%	<1%
Res. Comm.	95	21	1%	<1%
Condominium	1	10	<1%	<1%
Total Developed			73%	90%
Unimproved	16	13	27%	10%
Grand Total			100%	100%

Notes: The user charge data was drawn from a worksheet in Appendix B (Worksheet B-5). The tax data was drawn from the example summarized above in Table 4.

[8] A rate factor of 0.10 was used for agriculture and unimproved parcels. If it were desirable to decrease the contribution from these land use categories, the rate factor could be reduced (e.g., a factor of 0.025 would result in an average annual charge of about $77 for agricultural parcels).

Table 7 shows that with the inclusion of the agricultural and unimproved land use categories, the differences between the user charge system and the tax based system are not as disparate as in the former case in which these land use categories were excluded (Table 6). Nevertheless, it is clear that differences exist between the tax based system and user charge systems that raise a number of issues related to the fairness of the systems. In addition, because the two systems are based on different measures, different administrative costs are implied.

The advantages and disadvantages of property taxes and user charge financing systems can be compared by many measures. Several typical areas for comparison are summarized below:

- Ease and cost of administration;
- Elasticity of the revenue source;
- Deductibility;
- Stability of the revenue source;
- Fairness of the revenue measure; and
- Whether the system provides incentives for environmental controls.

Ease and Cost of Administration

Continued reliance on property taxes to finance stormwater controls would not involve change from existing practice; therefore, a property tax financing system would be easier and cheaper to administer than a user charge system. In addition, creation of a stormwater user charge system could involve reorganization of various departments within the County and new responsibilities for various departments. Significant expenses could be involved with the creation of a new billing system, particularly if the amount of impervious cover on each nonresidential parcel were digitized from aerial photos to determine the appropriate bill. The equivalent of four to six months of the first years revenues could be required to pay for creation of the user charge system. The County Council would have to pass an ordinance to establish the utility and rate structures.

Elasticity of Revenue Source

The elasticity of a revenue source refers to its ability to generate increased revenues without changes in the rate structure. Property taxes generally are considered elastic because the property owners pay more taxes and revenues to the County -- even without increases in the tax rate -- because of appreciation of property values. If property values stagnate or decline, then tax revenues also could decline.

User charges generally are not considered elastic. Although revenues from charges may increase if additional properties are developed, charges to any specific property owner will not inflate over time. Specific decisions by the County Council would be required to

increase rates. While this may be desirable from the perspective of making the Council accountable, opposition to the rate hikes could delay implementation of rate increases necessary for funding essential activities.

Deductibility

Individuals may deduct the cost of property taxes from their income when computing income taxes. Thus, to some degree, the cost of property taxes is offset. User charges such as water and sewer bills generally are not considered deductible. In some cases (e.g, Baltimore County's proposal) stormwater user charge bills appear as line items on property tax bills. If the charges were included on the property tax bill, it is not clear whether they would be considered deductible.

Stability of Revenue Source

Under a property tax system, stormwater control programs must compete with other necessary government functions for limited revenues. Historically, these programs have not fared well in budget allocation processes because they have been given low priority. As a result, stormwater controls have been poorly funded, particularly with respect to maintenance activities (which can be deferred) and water quality programs (because people did not recognize the need for them). Given that competition for limited revenues from property taxes is expected to increase in the future, creation of a dedicated revenue source through a user charge system is considered to be a more stable method of funding than continued reliance on a property tax system. This is because all user charges would be placed into a restricted account that could be used only for stormwater programs.

Fairness of Revenue Measures

The fairness of a charge or tax can be evaluated from a variety of perspectives. One perspective is that a tax or charge is fair if one pays in relation to the extent one uses or benefits from the facilities or programs provided with the revenues from the tax. For example, user fees are considered an equitable method of financing water utilities because it seems fair to charge people for the amount of water they use. A related notion, commonly called the polluter pays principle, is that people should pay to the extent they create a pollution problem that the government must solve. This principle suggests that those who cause water pollution should pay for water quality programs. A different perspective is that a fair charge is one that is somehow related to one's ability to pay (e.g., a progressive income tax).

It is thought that a user charge approach might be more fair than a property tax from all of these perspectives. If owners of property that generate runoff are thought of as "users" of the public drainage and stormwater management system, the user charge approach is clearly more fair than a property tax approach. This is because the size of the parcel and amount of impervious area of a property, which are the bases of the user charge, are determining

factors in the amount of runoff from a property; property value is not as directly related to the amount of runoff from a parcel of land. From the polluter pays perspective, the user charge approach also would be considered more equitable. That is, if new programs are required to control pollution from runoff, it seems fair that the people who generate the runoff should pay. Finally, from the ability to pay perspective, charges may be more fair than taxes. This is shown in Tables 8 and 9 above. Most residential users would pay less under a charge system than they would under a property tax system, while nonresidential property owners such as industrial and commercial would pay more under a charge system. Although it depends on one's perspective, it can be argued that nonresidential property owners (e.g., industrial) have a greater ability to pay than residential owners. Nonresidential property owners, at least, can pass the costs along and the charge can be viewed as cost of running a business in an environmentally sound manner. Overall, financing stormwater controls with user charges is considered to be more fair than financing with property taxes.

Incentives for Environmental Controls

User charge systems are preferable to property tax systems because they provide incentives for property owners to provide environmental controls. That is, if property owners know that they will be charged according to the amount of impervious cover on their property, they have an incentive to minimize cover, thereby reducing runoff. Property tax systems provide no incentives because they are not based on factors related to runoff. One problem with incentives for controls is that if numerous property owners (or a few large ones) reduce the amount of runoff they generate, total revenues might be reduced. Most existing user charge systems allow nonresidential property owners to earn credits against user charges by controlling runoff on-site. Awarding credits is equivalent to reducing the rate base. If credits were granted for on-site controls, either total revenues would decrease, or the charge per unit would have to be increased proportionately for all other property owners.

The development of a stormwater user charge system coupled with a credit system for on-site controls may provide incentives for implementation of best management practices (construction of runoff control structures). For example, if agricultural parcels were in the rate base credits could be extended to owners of agricultural property who implement Soil Conservation District approved conservation plans. A credit system also would make the rate structure more fair. That is, people in new developments who already are required by State law to pay for on-site controls would not have to pay again. While some level of credit is reasonable, it may be desirable not to completely eliminate payment. On-site controls do not eliminate all stormwater discharges. Since downstream water quality is a public good, one approach is to have all property owners pay something. One consistent approach to determining a policy on the minimum payment-after-credit is to have that payment structure equal the amount paid by owners of undeveloped property.

General conclusions about these relative advantages (+) and disadvantages (-) of property tax and user charge financing systems are presented in Table 8. For this discussion, we assume that the user charge system is implemented through the creation of a utility.

Table 8

Advantages and Disadvantages of Taxes and User Charge Systems

Evaluation Criterion	User Charge	Property Tax
Ease of Administration	-	+
Cost of Implementation	-	+
Elasticity of Revenues	-	+
Deductibility	?	+
Stability of Revenues	+	-
Fairness		
User (Polluter) Pays	+	-
Ability to Pay	+	-
Incentives for Controls	+	-

5.0 SUMMARY AND ADDITIONAL CONSIDERATIONS

The preceding sections have covered a wide range of issues associated with financing stormwater controls in Cecil County. The report reviews the administrative organization and responsibilities, estimates the revenues required to fund most stormwater control programs, summarizes primary options for financing stormwater controls (property taxes and user charges), and discusses the advantages and disadvantages of property taxes and user charges.

Cecil County currently spends about $100,000 a year on stormwater management, which is funded by fees and State grants. Current expenditures for storm drain development and maintenance are not available. Trends in development activities and recent environmental legislation suggest that resource needs will increase in the years to come.

For major expense items, (stormwater management facility operations and maintenance, watershed planning, and retrofitting), property taxes and user charges are the most viable options for increasing revenues. Each has advantages and disadvantages. The distribution of fees paid by property owners depends on the type of financing system that is used. Residential property owners typically would pay less under a user charge system than a tax system, while many nonresidential property owners (e.g., industrial and commercial) would pay more under a charge system. The advantages of a property tax includes elasticity of revenues, federal tax deductibility, ease of administration, and lower cost of implementation.

User charges appear to be advantageous for a number or reasons including increased stability of revenues, fairness, and providing incentives for controls that benefit the environment. If a user charge system were implemented, the County Council would have to make a number of significant, complex policy decisions. These would include deciding which land use categories of parcels to include in the rate base[9].

This study is only an initial step in the process of identifying the level of financial resources that will be needed to meet future stormwater control demands. While current financial resource needs are modest enough to be met by fees and State grants, this report considers the viability and desirability of pursuing the use of property taxes or a user charge system in anticipation of growing resource needs.

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[9] As a supplement to this report, MDE has appended several findings of the Baltimore County Stormwater Management Committee, which has recently recommended the formation of a stormwater user charge system (See Appendices C and D). These supplements may help provide insights about issues that are far off on the time horizon from the perspective of Cecil County decision makers.

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GEOGRAPHY: CECIL COUNTY-SUMMARY REDISTRIBUTED

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LAND USE	IMPROVED NO. OF PARCELS ACRES SPEC.	IMPROVED ACRES	IMPROVED AVERAGE ACRES	IMPROVED NO. OF PARCELS ACRES NOT SPEC	IMPROVED TOTAL ACRES	UNIMPROVED NO. OF PARCELS ACRES SPEC.	UNIMPROVED ACRES	UNIMPROVED AVERAGE ACRES	UNIMPROVED NO. OF PARCELS ACRES NOT SPEC	UNIMPROVED TOTAL ACRES	TOTAL PARCELS	TOTAL ACRES
AGRICULTURAL	900	97527	108.4	0	97527	325	23710	73.0	0	23710	1225	121237
COMMERCIAL	1049	5452	5.2	0	5452	684	7353	10.7	0	7353	1733	12805
COMM RES	36	620	17.2	0	620	1	15	15.0	0	15	37	635
EXEMPT	479	19311	40.3	0	19311	436	5518	12.7	0	5518	915	24829
INDUSTRIAL	57	1474	25.9	0	1474	67	844	12.6	0	844	124	2318
APARTMENTS	51	99	1.9	0	99	2	5	2.5	0	5	53	104
NOT PERC	45	117	2.6	0	117	423	1032	2.4	0	1032	468	1149
RESIDENTIAL	21255	28714	1.4	0	28714	9186	22678	2.5	0	22678	30441	51392
RES AGR	307	3568	11.6	0	3568	332	2546	7.7	0	2546	639	6114
RES COMM	39	202	5.2	0	202	0	0	.0	0	0	39	202
CONDOMINIUM	338	17	.1 .05	0	17	3	0	.0	0	0	341	17
CONDO COMM	0	0	.0	0	0	0	0	.0	0	0	0	0
MARSHLAND	0	0	.0	0	0	1	16	16.0	0	16	1	16
DISTRICT TOTAL	24556	157101		0	157101	11460	63717		0	63717	36016	220818

GEOGRAPHY: CECIL COUNTY-SUMMARY REDISTRIBUTED
LAND USE CODE: RESIDENTIAL

TAPE DATE APR 90

IMPROVED PARCELS(ACRES SPECIFIED)

ACREAGE INTERVALS	NUMBER OF PARCELS	PERCENT OF TOTAL PARCELS	CUMULATIVE NUMBER OF PARCELS	CUMULATIVE % OF TOTAL PARCELS	ACREAGE: NUMBER OF ACRES	PERCENT OF TOTAL ACRES	CUMULATIVE NUMBER OF ACRES	CUMULATIVE % OF TOTAL ACRES	AVERAGE ACREAGE	CUMULATIVE AVERAGE ACREAGE
0 - .25	6655	31.31	6655	31.31	882	3.07	882	3.07	.13	.13
>.25 - .5	4319	20.32	10974	51.63	1686	5.87	2568	8.95	.39	.23
>.5 - 1.0	4868	22.90	15842	74.53	3571	12.44	6139	21.38	.73	.39
>1.0 - 1.5	1823	8.58	17665	83.11	2196	7.65	8335	29.03	1.20	.47
>1.5 - 2.0	883	4.15	18548	87.26	1564	5.45	9900	34.48	1.77	.53
>2.0 - 3.0	889	4.18	19437	91.45	2210	7.70	12109	42.17	2.49	.62
>3.0 - 5.0	831	3.91	20268	95.36	3283	11.43	15393	53.61	3.95	.76
>5.0 - 10.0	637	3.00	20905	98.35	4398	15.32	19791	68.92	6.90	.95
>10.0 - 15.0	161	.76	21066	99.11	1953	6.80	21743	75.72	12.13	1.03
>15.0 - 20.0	59	.28	21125	99.39	1017	3.54	22760	79.27	17.24	1.08
>20.0 - 30.0	62	.29	21187	99.68	1547	5.39	24307	84.65	24.95	1.15
>30.0 - 40.0	28	.13	21215	99.81	972	3.38	25279	88.04	34.71	1.19
>40.0 - 50.0	8	.04	21223	99.85	357	1.24	25637	89.28	44.67	1.21
>50.0 - 75.0	17	.08	21240	99.93	1032	3.59	26668	92.88	60.69	1.26
>75.0 - 100.0	5	.02	21245	99.95	437	1.52	27106	94.40	87.50	1.28
>100.0 - 150.0	4	.02	21249	99.97	518	1.80	27624	96.20	129.50	1.30
>150.0 - 200.0	6	.03	21255	100.00	1090	3.80	28714	100.00	181.70	1.35
>200.0 - 300.0	0	.00	21255	100.00	0	.00	28714	100.00	.00	1.35
>300.0 - 500.0	0	.00	21255	100.00	0	.00	28714	100.00	.00	1.35
>500.0 - 750.0	0	.00	21255	100.00	0	.00	28714	100.00	.00	1.35
>750.0 - 1000.0	0	.00	21255	100.00	0	.00	28714	100.00	.00	1.35
>1000.0 - 10,000	0	.00	21255	100.00	0	.00	28714	100.00	.00	1.35
>10,000	0	.00	21255	100.00	0	.00	28714	100.00	.00	1.35

UNIMPROVED PARCELS (ACRES SPECIFIED)

ACREAGE INTERVALS	NUMBER OF PARCELS	PERCENT OF TOTAL PARCELS	CUMULATIVE NUMBER OF PARCELS	CUMULATIVE % OF TOTAL PARCELS	ACREAGE: NUMBER OF ACRES	PERCENT OF TOTAL ACRES	CUMULATIVE NUMBER OF ACRES	CUMULATIVE % OF TOTAL ACRES	AVERAGE ACREAGE	CUMULATIVE AVERAGE ACREAGE
0 - .25	3653	39.77	3653	39.77	401	1.77	401	1.77	.11	.11
>.25 - .5	1516	16.50	5169	56.27	579	2.55	981	4.33	.38	.19
>.5 - 1.0	1457	15.86	6626	72.13	1067	4.71	2048	9.03	.73	.31
>1.0 - 1.5	651	7.09	7277	79.22	791	3.49	2839	12.52	1.22	.39
>1.5 - 2.0	365	3.97	7642	83.19	636	2.81	3475	15.33	1.74	.45
>2.0 - 3.0	445	4.84	8087	88.04	1082	4.77	4558	20.10	2.43	.56
>3.0 - 5.0	392	4.27	8479	92.30	1570	6.92	6128	27.02	4.01	.72
>5.0 - 10.0	331	3.60	8810	95.91	2306	10.17	8434	37.19	6.97	.96
>10.0 - 15.0	107	1.16	8917	97.07	1316	5.81	9751	43.00	12.30	1.09
>15.0 - 20.0	66	.72	8983	97.79	1145	5.05	10896	48.05	17.36	1.21
>20.0 - 30.0	72	.78	9055	98.57	1781	7.85	12677	55.90	24.74	1.40
>30.0 - 40.0	33	.36	9088	98.93	1128	4.98	13806	60.88	34.20	1.52
>40.0 - 50.0	22	.24	9110	99.17	983	4.33	14789	65.21	44.68	1.62
>50.0 - 75.0	39	.42	9149	99.60	2399	10.58	17187	75.79	61.51	1.88
>75.0 - 100.0	19	.21	9168	99.80	1659	7.32	18846	83.11	87.31	2.06
>100.0 - 150.0	8	.09	9176	99.89	980	4.32	19826	87.43	122.52	2.16
>150.0 - 200.0	3	.03	9179	99.92	504	2.22	20330	89.65	167.90	2.21
>200.0 - 300.0	3	.03	9182	99.96	660	2.91	20990	92.56	219.87	2.29
>300.0 - 500.0	3	.03	9185	99.99	1109	4.89	22099	97.45	369.77	2.41
>500.0 - 750.0	1	.01	9186	100.00	578	2.55	22677	100.00	577.80	2.47
>750.0 - 1000.0	0	.00	9186	100.00	0	.00	22677	100.00	.00	2.47
>1000.0 - 10,000	0	.00	9186	100.00	0	.00	22677	100.00	.00	2.47
>10,000	0	.00	9186	100.00	0	.00	22677	100.00	.00	2.47

NO. OF IMP. PARCELS, ACREAGE SPECIFIED 21255 (100.0)
NO. OF IMP. PARCELS, ACREAGE NOT SPEC. 0 (.0)
TOTAL 21255

NO. OF UNIMPROVED PARCELS, ACREAGE SPECIFIED 9186 (100.0)
NO. OF UNIMPROVED PARCELS, ACREAGE NOT SPEC. 0 (.0)
TOTAL 9186

Appendix B

Six Alternative Algorithms for Deducing Stormwater User Charges

Six alternative approaches for estimating revenues generated by a user charge approach are briefly described below. These charge structure algorithms are primarily intended to demonstrate the flexibility of the user charge approach and are not intended to be exhaustive. It should also be noted that these algorithms, while similar to algorithms used to implement an actual user charge system, are solely intended for use in estimating potential revenues.

Summary Descriptions of Six Alternative User Charge Approaches

The six different approaches are identified by simple names and numbers. The six approaches summarized below are: Fixed SFE (3,000), Fixed SFE (4,000), Quantile, Detailed, Simplified, Grouped RF (Rate Factors).

Note that for each approach the rate base can be changed (i.e., assessing or not assessing charges for a particular land use category). This represents another layer of options that could be explored. For our purposes, all six of the approaches were investigated both including and excluding the agricultural and unimproved land use categories.

Approach 1 "Fixed SFE (3,000)": The name of this approach is drawn from the fact that the residential SFEs were fixed by professional judgment to 3,000 square feet for residential parcels less than one acre in area[1].

The residential category is divided into two groups: parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

3,000 sq. ft. impervious for parcels < 1 acre (This defines the unit SFE)
4,500 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

Approximately six different rate factors are used for the different land use categories. This represents a degree of specificity of the rate factors that is mid-ranged with respect to the other approaches.

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[1] This value is based on typical values found in the technical literature. In Approach 2 this value is fixed at 4,000 sq. ft..

Approach 2 "Fixed SFE (4,000)": Like Approach 1, the residential category is divided into two groups: parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

4,000 sq. ft. impervious for parcels < 1 acre (This defines the unit SFE)
6,000 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

Approximately six different rate factors are being used for different land use categories. This represents a degree of specificity of the rate factors is mid-ranged with respect to the other approaches.

From the standpoint of not over estimating the potential revenues, this approach is more conservative than Approach 1. At first glance, it may seem counter intuitive that using a higher impervious area for residential parcels would produce a lower revenue estimate. To see how this works, consider the following example in which a comparison is made between SFEs defined to be 4,000 sq.ft./SFE versus 3,000 sq.ft./SFE.

A commercial parcel of 12,000 sq.ft. of impervious area under the Fixed SFE (4,000) approach pays $20/SFE or (12,000/4,000) x $20/ sq.ft. = $60. Under the Fixed SFE (3,000) approach, the same commercial parcel is assessed (12,000/3,000) x $20/ sq.ft. = $80. In both approaches, the same amount of revenue is generated by the residential parcels because their rates are fixed by definition at $20 and $30 per parcel for the two residential subcategories. Consequently, the residential land use category does not contribute to differences in the projected revenue.

Approach 3 "Quantile": Again, the residential category is divided into two groups: Res. < 1 acre, and Res. > 1 acre. Rate factors are used to determine SFEs for the residential land use category rather than fixing the charge as in Approaches 1 and 2.

This approach corrects for sharp differences in user charges between smaller and larger parcels that arise when the residential land use category is broken into two categories and mean acreage values are used to represent typical parcel size. An alternative to the use of mean acreage values, which are often skewed by infrequent extreme values, is to use the median (50th percentile) parcel size for parcels less than one acre and the 90th percentile size as the typical value for parcels greater than one acre[2].

The level of specificity of rate factors is slightly increased above that of Approaches 1 and 2 with approximately eight different rate factors being used for different land use categories.

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[2] It is the parcel size below which 90 percent of the parcels are smaller, or stated the another way, is the parcel size for which only 10 percent of the parcels are larger.

Approach 4 "Detailed": For this approach, the residential category is divided into about 20 acreage intervals according to the data available (See Appendix A above). In addition to the high level of specificity of the residential category, the rate factors are highly detailed since a different rate factor is assigned to each of the 20 residential acreage categories. The SFEs for residential parcels are all computed using rate factors as opposed to being fixed.

This approach represents the most detailed revenue estimation approach of the study, although it is quite simplified in comparison to actual implementation methods.

Approach 5 "Simplified": This approach was motivated by a key aspect of the approach used in Austin, Texas, which classifies each land use category into one of three rate factor groups 0.10, 0.40, or 0.80.

This approach uses rate factors to determine the SFE for the residential parcels < 1 acre, but fixes the SFE for parcels > 1 acre at 1.5 SFEs. Consequently, the value of the unit SFE can rise and fall for different estimates between counties, while the SFE for parcels > 1 acre follows that rise and fall. This combined use of rate factors to compute the unit SFE and fixed SFEs for the parcels > 1 acre is referred to a hybrid treatment of residential SFEs.

This approach derives its name from the fact that it is characterized by having two simplified features: the collapsed rate factors and only two residential categories.

Approach 6 "Grouped RF": This approach is based loosely on the Ft. Collins, Texas approach, which attempts to minimize administrative burdens and contested charges by aggregating users into relatively broad rate factor categories.

Like the Detailed Approach, the level of specificity of the residential category is highly detailed, and the SFEs for residential parcels are all computed using rate factors. Unlike the Detailed Approach, however, the level of specificity of the rate factors is simplified by grouping (hence the name Grouped RF).

The SFE was calculated as (0.60) x (mean acreage) using the smallest residential acreage interval (0 - 0.25 acres), where 0.60 is the rate factor.

Summary Results of Revenue Estimates Based on the Six Approaches

Table B-1 and Table B-2 present the results of the six revenue estimation approaches under two scenarios. Table B-1 excludes agricultural and unimproved land uses and Table B-2 includes these two land uses. Note that the second case (Table B-2) is directly comparable to the property tax approach, which also levies costs on the agricultural and unimproved lands.

The six revenue estimates were all developed under the assumption that residential parcels less than or equal to 1 acre in size would be charged $20 a year. This assumption contrasts with an approach where by a single revenue target (e.g., $500,000) is specified for all six approaches, and annual residential fees are allowed to vary among approaches to meet the target. Recall that for the Detailed Approach and the Grouped RF Approach residential parcels are divided into numerous subcategories. Residential parcels less than one acre are grouped into one of three categories: those below 0.25 acre, those greater than 0.25 acre and less than 0.5 acre, and those greater than 0.5 acre and less than 1.0 acre. Consequently, the dollar amount in the column for "Residential, < 1 acre" (Tables B-1 and B-2) is the weighted average of the charges associated with these three categories (weighted by number of parcels).

Table B-1

Revenues and Payment Distributions for Six Alternative Stormwater User Charge Structures (Agricultural and Unimproved Land Uses Excluded)

Percentage Paid by Category
(Cost per Average Parcel Size)

	Revenues	Residential < 1 acre	Residential > 1 acre	Commercial	Industrial	All Others
Fixed SFE 3,000	$1,968,080	22% ($20)	17% ($30)	46% ($667)	12% ($2,114)	3%
Fixed SFE 4,000	$1,676,600	26% ($20)	20% ($30)	40% ($500)	10% ($1,586)	4%
Quantile	$1,792,120	25% ($20)	38% ($60)	23% ($310)	6% ($983)	8%
Detailed	$2,132,460	24% ($24)	28% ($51)	30% ($471)	8% ($1,493)	10%
Simplified	$1,316,240	33% ($20)	26% ($30)	24% ($237)	7% ($882)	10%
Grouped RF	$2,448,080	18% ($20)	25% ($53)	28% ($489)	6% ($1,387)	23%

Table B-2

Revenues and Payment Distributions for Six Alternative Stormwater User Charge Structures (Agricultural and Unimproved Land Uses Included[3])

Percentage Paid by Category
(Cost per Average Parcel Size)

	Revenues	Residential <1 acre	Residential >1 acre	Commerc.	Indust.	Agri.	Unimp.	Others
Fixed SFE 3,000	$6,952,100	5% ($20)	2% ($30)	19% ($1,238)	4% ($5,265)	41% ($3,147)	27% ($161)	2%
Fixed SFE 4,000	$5,336,180	6% ($20)	3% ($30)	18% ($928)	4% ($3,949)	40% ($2,361)	26% ($121)	4%
Quantile	$8,155,680	4% ($20)	25% ($374)	14% ($1,096)	3% ($4,661)	31% ($2,787)	20% ($143)	3%
Detailed	$4,654,240	9% ($25)	6% ($51)	12% ($543)	2% ($1,723)	35% ($1,822)	32% ($131)	4%
Simplified	$3,406,920	9% ($20)	5% ($30)	16% ($535)	4% ($2,663)	37% ($1,393)	24% ($71)	5%
Grouped RF	$5,109,460	7% ($21)	7% ($53)	12% ($574)	2% ($1,600)	35% ($1,974)	32% ($143)	5%

Table B-1 and Table B-2 were developed using two sets of worksheets provided at the end of this appendix (Worksheet Set B-1 excludes agricultural and unimproved land uses from the rate base, and Worksheet Set B-2 includes these two land uses in the rate base).

In addition, worksheets for the Fixed SFE (3,000) Approach are provided for three cases in which $500,000 is set as the revenue target. The first case, Worksheet B-3, excludes agricultural and unimproved parcels from the rate base. The second case, Worksheet B-4 brings agriculture into the rate base, but excludes unimproved parcels. The third case, Worksheet B-5, includes both agriculture and unimproved parcels in the rate base.

Finally, two work sheets using the property tax approach are provided. The first case, Worksheet B-6, is designed to meet a $500,000 revenue target, and is directly comparable to the user charge approach presented in Worksheet B-5 noted above. The second property tax case, Worksheet B-7, was developed by fixing the residential rate at $20 per year. This allows comparison with the user charge work sheets that fix

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[3] A relatively small rate factor of 0.10 was used for agricultural land use as compared with 0.80 - 0.82 for commercial, and 0.60 - 0.70 for industrial.

residential charges at $20 per year. It should be remembered when making comparisons that the property tax approaches include both agricultural and unimproved parcels in the rate base, where as some of the cases based on the user charge approach do not include both of these land use categories.

Sensitivity Analysis: Removal of Elkton Parcels From Rate Base

Because the City of Elkton has an independent stormwater control system, Elkton is not likely to participate in a county-wide utility. The impact of removing Elkton from the rate base was assessed by reevaluating four of the six utility charge approaches. This entailed subtracting the appropriate number of parcels for each land use category based on information in property tax assessment tables, and adjusting the average parcel size. In general, the average parcel size of the remaining parcels increased slightly. This seems consistent with the general tendency for lot sizes to be smaller within city limits.

The analysis was based on the assumption that residential parcels less than one acre in size would be assessed a fixed annual charge of $20. This results in each of the alternative approaches generating different revenue totals rather than being fixed to meet a $500,000 revenue target. Depending on the charge approach, the percentage decrease in revenues resulting from the removal of Elkton from the rate base ranged from 3.9% to 5.4%. Since the different charge structures generated varying total revenues prior to the removal of Elkton parcels, the decrease in the dollar amounts are not directly comparable. Table B-3 presents the analysis results.

Table B-3

Sensitivity Analysis: Removal of Elkton Parcels From User Charge Rate Base

Charge Approach	Revenues Generated (Elkton Included)	Revenues Generated (Elkton Excluded)	Revenue Decrease	Percent Decrease
Fixed SFE 3000	$2,268,600	$2,180,600	$88,000	3.9%
Fixed SFE 4000	$1,823,560	$1,745,340	$78,220	4.3%
Quantile	$4,009,720	$3,821,040	$188,680	4.7%
Simplified	$1,333,940	$1,262,520	$71,420	5.4%

FIXED SFE (3,000)
(DRAFT)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,049	5.2	0.82	185,740	61.91	64,947			1,238.27	1,298,941	0.57
Comm Res	36	17.2	0.68	509,478	169.83	6,114			3,396.52	122,275	0.05
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.70	789,743	263.25	15,005			5,264.95	300,102	0.13
Apartments	51	1.9	0.64	52,969	17.66	900			353.13	18,009	0.01
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	na	3,000	1.00	15,842			20.00	316,840	0.14
> 1 Acre	5,413	4.17	na	4,500	1.50	8,120			30.00	162,390	0.07
Res Ag	307	11.6	na	4,500	1.50	461			30.00	9,210	0.00
Res Comm	39	5.2	0.64	144,968	48.32	1,885			966.45	37,692	0.02
Condominium	338	0.05	0.64	1,394	0.46	157			9.29	3,141	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					113,430				$2,268,600	1.00
Unimproved	11,460	5.6	0.00	0	0.00	0			0.00	0	0.00
Grand Total	36,016					113,430	$2,268,600	$20.00		$2,268,600	1.00

FIXED SFE (4,000)
(DRAFT)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,049	5.2	0.82	185,740	46.43	48,710			928.70	974,206	0.53
Comm Res	36	17.2	0.68	509,478	127.37	4,585			2,547.39	91,706	0.05
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.70	789,743	197.44	11,254			3,948.71	225,077	0.12
Apartments	51	1.9	0.64	52,969	13.24	675			264.84	13,507	0.01
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	na	4,000	1.00	15,842			20.00	316,840	0.17
> 1 Acre	5,413	4.17	na	6,000	1.50	8,120			30.00	162,390	0.09
Res Ag	307	11.6	na	6,000	1.50	461			30.00	9,210	0.01
Res Comm	39	5.2	0.64	144,968	36.24	1,413			724.84	28,269	0.02
Condominium	338	0.05	0.64	1,394	0.35	118			6.97	2,356	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					91,178				$1,823,560	1.00
Unimproved	11,460	5.6	0.00	0	0.00	0			0.00	0	0.00
Grand Total	36,016					91,178	$1,823,560	$20.00		$1,823,560	1.00

QUARTILE
(DRAFT)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,049	5.2	0.82	185,740	54.81	57,493			1,096.14	1,149,855	0.29
Comm Res	36	17.2	0.68	509,478	150.33	5,412			3,006.68	108,241	0.03
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.70	789,743	233.03	13,283			4,660.67	265,658	0.07
Apartments	51	1.9	0.64	52,969	15.63	797			312.60	15,942	0.00
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	0.20	3,389	1.00	15,842			20.00	316,840	0.08
> 1 Acre	5,413	12.13	0.12	63,406	18.71	101,275			374.19	2,025,491	0.51
Res Ag	307	11.6	0.10	50,530	14.91	4,577			298.20	91,548	0.02
Res Comm	39	5.2	0.64	144,968	42.78	1,668			855.53	33,366	0.01
Condominium	338	0.05	0.64	1,394	0.41	139			8.23	2,780	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					200,486				$4,009,720	1.00
Unimproved	11,460	5.6	0.00	0	0.00	0			0.00	0	0.00
Grand Total	36,016					200,486	$4,009,720	$20.00		$4,009,720	1.00

SIMPLIFIED
(DRAFT)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,049	5.2	0.80	181,210	26.74	28,045			534.70	560,905	0.42
Comm Res	36	17.2	0.80	599,386	88.43	3,184			1,768.64	63,671	0.05
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.80	902,563	133.16	7,590			2,663.24	151,805	0.11
Apartments	51	1.9	0.80	66,211	9.77	498			195.37	9,964	0.01
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	0.40	6,778	1.00	15,842			20.00	316,840	0.24
> 1 Acre	5,413	4.17	na	10,167	1.50	8,120			30.00	162,390	0.12
Res Ag	307	11.6	0.10	50,530	7.46	2,289			149.10	45,774	0.03
Res Comm	39	5.2	0.80	181,210	26.74	1,043			534.70	20,853	0.02
Condominium	338	0.05	0.80	1,742	0.26	87			5.14	1,738	0.00
Condo Comm	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.80	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					66,697				$1,333,940	1.00
Unimproved	11,460	5.6	0.00	0	0.00	0			0.00	0	0.00
Grand Total	36,016					66,697	$1,333,940	$20.00		$1,333,940	1.00

DETAILED
(DRAFT)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	77.0	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,049	2.8	0.82	100,014	27.17	28,503			543.43	570,063	0.38
Comm Res	36	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	479	18.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	57	10.4	0.70	317,117	86.15	4,911			1,723.09	98,216	0.07
Apartments	51	1.7	0.64	47,393	12.88	657			257.52	13,133	0.01
Not Perc	45	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	6,655	0.13	0.650	3,681	1.00	6,655			20.00	133,101	0.09
>.25 - .5	4,319	0.39	0.250	4,247	1.15	4,983			23.08	99,670	0.07
>.5 - 1	4,868	0.73	0.200	6,360	1.73	8,411			34.56	168,220	0.11
> 1 - 1.5	1,823	1.20	0.160	8,364	2.27	4,142			45.44	82,844	0.06
> 1.5 - 2	883	1.77	0.130	10,023	2.72	2,404			54.46	48,090	0.03
> 2 - 3	889	2.49	0.100	10,846	2.95	2,620			58.94	52,393	0.03
> 3 - 5	831	3.95	0.080	13,765	3.74	3,108			74.79	62,153	0.04
> 5 - 10	637	6.90	0.055	16,531	4.49	2,861			89.82	57,217	0.04
> 10 - 15	161	12.13	0.030	15,851	4.31	693			86.13	13,867	0.01
> 15 - 20	59	17.24	0.020	15,019	4.08	241			81.61	4,815	0.00
> 20 - 30	62	24.95	0.013	14,129	3.84	238			76.77	4,760	0.00
> 30 - 40	28	34.71	0.010	15,120	4.11	115			82.15	2,300	0.00
> 40 - 50	8	44.67	0.006	11,675	3.17	25			63.44	507	0.00
> 50 - 75	17	60.69	0.005	13,218	3.59	61			71.82	1,221	0.00
> 75 - 100	5	87.50	0.004	15,246	4.14	21			82.84	414	0.00
> 100 - 150	4	129.50	0.003	16,923	4.60	18			91.95	368	0.00
> 150 - 200	6	181.70	0.002	15,830	4.30	26			86.01	516	0.00
Res Ag	307	11.5	0.10	50,094	13.61	4,178			272.19	83,563	0.06
Res Comm	39	1.0	0.64	27,878	7.57	295			151.48	5,908	0.00
Condominium	338	0.05	0.64	1,394	0.38	128			7.57	2,560	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					75,295				$1,505,900	1.00
Unimproved	11,460	5.6	0.00	0	0.00	0			0.00	0	0.00
Grand Total	36,016					75,295	$1,505,900	$20.00		$1,505,900	1.00

GROUPED RF
(DRAFT)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	77.0	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,049	2.8	0.80	97,574	28.72	30,125			574.36	602,500	0.35
Comm Res	36	0.0	0.60	0	0.00	0			0.00	0	0.00
Exempt	479	18.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	57	10.4	0.60	271,814	80.00	4,560			1,599.99	91,200	0.05
Apartments	51	1.7	0.60	44,431	13.08	667			261.54	13,338	0.01
Not Perc	45	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	6,655	0.13	0.600	3,398	1.00	6,655			20.00	133,099	0.08
>.25 - .5	4,319	0.39	0.250	3,299	0.97	4,194			19.42	83,879	0.05
>.5 - 1	4,868	0.73	0.250	4,188	1.23	6,000			24.65	120,004	0.07
> 1 - 1.5	1,823	1.20	0.250	5,416	1.59	2,906			31.88	58,121	0.03
> 1.5 - 2	883	1.77	0.250	6,906	2.03	1,795			40.65	35,895	0.02
> 2 - 3	889	2.49	0.250	8,788	2.59	2,299			51.73	45,987	0.03
> 3 - 5	831	3.95	0.250	12,604	3.71	3,083			74.19	61,652	0.04
> 5 - 10	637	6.90	0.250	20,314	5.98	3,808			119.57	76,169	0.04
> 10 - 15	161	12.13	0.250	33,983	10.00	1,610			200.04	32,206	0.02
> 15 - 20	59	17.24	0.250	47,338	13.93	822			278.65	16,440	0.01
> 20 - 30	62	24.95	0.250	67,489	19.86	1,232			397.27	24,630	0.01
> 30 - 40	28	34.71	0.250	92,998	27.37	766			547.42	15,328	0.01
> 40 - 50	8	44.67	0.250	119,030	35.03	280			700.65	5,605	0.00
> 50 - 75	17	60.69	0.250	160,899	47.36	805			947.11	16,101	0.01
> 75 - 100	5	87.50	0.250	230,970	67.98	340			1,359.57	6,798	0.00
> 100 - 150	4	129.50	0.250	340,741	100.29	401			2,005.72	8,023	0.00
> 150 - 200	6	181.70	0.250	477,171	140.44	843			2,808.79	16,853	0.01
Res Ag	307	11.5	0.25	125,235	36.86	11,316			737.18	226,313	0.13
Res Comm	39	1.0	0.60	26,136	7.69	300			153.85	6,000	0.00
Condominium	338	0.05	0.60	1,307	0.38	130			7.69	2,600	0.00
Condo Comm	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					84,937				$1,698,740	1.00
Unimproved	11,460	5.6	0.00	0	0.00	0			0.00	0	0.00
Grand Total	36,016					84,937	$1,698,740	$20.00		$1,698,740	1.00

FIXED SFE (3,000)
(DRAFT - 1990)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.10	472,190	157.40	141,657			3,147.94	2,833,142	0.41
Commercial	1,049	5.2	0.82	185,740	61.91	64,947			1,238.27	1,298,940	0.19
Comm Res	36	17.2	0.68	509,478	169.83	6,114			3,396.52	122,275	0.02
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.70	789,743	263.25	15,005			5,264.95	300,102	0.04
Apartments	51	1.9	0.64	52,969	17.66	900			353.13	18,009	0.00
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	na	3,000	1.00	15,842			20.00	316,840	0.05
> 1 Acre	5,413	4.17	na	4,500	1.50	8,120			30.00	162,390	0.02
Res Ag	307	11.6	na	4,500	1.50	461			30.00	9,210	0.00
Res Comm	39	5.2	0.64	144,968	48.32	1,885			966.45	37,692	0.01
Condominium	338	0.05	0.64	1,394	0.46	157			9.29	3,141	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					255,087				$5,101,741	0.73
Unimproved	11,460	5.6	0.10	24,219	8.07	92,518			161.46	1,850,359	0.27
Grand Total	36,016					347,605	$6,952,100	$20.00		$6,952,100	1.00

FIXED SFE (4,000)
(DRAFT - 1990)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.10	472,190	118.05	106,243			2,360.95	2,124,854	0.40
Commercial	1,049	5.2	0.82	185,740	46.43	48,710			928.70	974,204	0.18
Comm Res	36	17.2	0.68	509,478	127.37	4,585			2,547.39	91,706	0.02
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.70	789,743	197.44	11,254			3,948.71	225,076	0.04
Apartments	51	1.9	0.64	52,969	13.24	675			264.84	13,507	0.00
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	na	4,000	1.00	15,842			20.00	316,840	0.06
> 1 Acre	5,413	4.17	na	6,000	1.50	8,120			30.00	162,390	0.03
Res Ag	307	11.6	na	6,000	1.50	461			30.00	9,210	0.00
Res Comm	39	5.2	0.64	144,968	36.24	1,413			724.84	28,269	0.01
Condominium	338	0.05	0.64	1,394	0.35	118			6.97	2,356	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					197,421				$3,948,412	0.74
Unimproved	11,460	5.6	0.10	24,219	6.05	69,388			121.10	1,387,768	0.26
Grand Total	36,016					266,809	$5,336,180	$20.00		$5,336,180	1.00

QUANTILE
(DRAFT - 1990)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.10	472,190	139.33	125,398			2,786.63	2,507,971	0.31
Commercial	1,049	5.2	0.82	185,740	54.81	57,493			1,096.14	1,149,856	0.14
Comm Res	36	17.2	0.68	509,478	150.33	5,412			3,006.69	108,241	0.01
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.70	789,743	233.03	13,283			4,660.67	265,658	0.03
Apartments	51	1.9	0.64	52,969	15.63	797			312.60	15,942	0.00
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	0.20	3,389	1.00	15,842			20.00	316,840	0.04
> 1 Acre	5,413	12.13	0.12	63,406	18.71	101,275			374.19	2,025,493	0.25
Res Ag	307	11.6	0.10	50,530	14.91	4,577			298.20	91,548	0.01
Res Comm	39	5.2	0.64	144,968	42.78	1,668			855.53	33,366	0.00
Condominium	338	0.05	0.64	1,394	0.41	139			8.23	2,780	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					325,885				$6,517,694	0.80
Unimproved	11,460	5.6	0.10	24,219	7.15	81,899			142.93	1,637,986	0.20
Grand Total	36,016					407,784	$8,155,680	$20.00		$8,155,680	1.00

DETAILED
(DRAFT - 1990)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	77.0	0.10	335,412	91.12	82,012			1,822.49	1,640,237	0.35
Commercial	1,049	2.8	0.82	100,014	27.17	28,503			543.43	570,060	0.12
Comm Res	36	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	479	18.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	57	10.4	0.70	317,117	86.15	4,911			1,723.08	98,215	0.02
Apartments	51	1.7	0.64	47,393	12.88	657			257.51	13,133	0.00
Not Perc	45	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	6,655	0.13	0.650	3,681	1.00	6,655			20.00	133,100	0.03
>.25 - .5	4,319	0.39	0.250	4,247	1.15	4,983			23.08	99,669	0.02
>.5 - 1	4,868	0.73	0.200	6,360	1.73	8,411			34.56	168,220	0.04
> 1 - 1.5	1,823	1.20	0.160	8,364	2.27	4,142			45.44	82,844	0.02
> 1.5 - 2	883	1.77	0.130	10,023	2.72	2,404			54.46	48,090	0.01
> 2 - 3	889	2.49	0.100	10,846	2.95	2,620			58.93	52,393	0.01
> 3 - 5	831	3.95	0.080	13,765	3.74	3,108			74.79	62,153	0.01
> 5 - 10	637	6.90	0.055	16,531	4.49	2,861			89.82	57,217	0.01
> 10 - 15	161	12.13	0.030	15,851	4.31	693			86.13	13,867	0.00
> 15 - 20	59	17.24	0.020	15,019	4.08	241			81.61	4,815	0.00
> 20 - 30	62	24.95	0.013	14,129	3.84	238			76.77	4,760	0.00
> 30 - 40	28	34.71	0.010	15,120	4.11	115			82.15	2,300	0.00
> 40 - 50	8	44.67	0.006	11,675	3.17	25			63.44	507	0.00
> 50 - 75	17	60.69	0.005	13,218	3.59	61			71.82	1,221	0.00
> 75 - 100	5	87.50	0.004	15,246	4.14	21			82.84	414	0.00
> 100 - 150	4	129.50	0.003	16,923	4.60	18			91.95	368	0.00
> 150 - 200	6	181.70	0.002	15,830	4.30	26			86.01	516	0.00
Res Ag	307	11.5	0.10	50,094	13.61	4,178			272.19	83,562	0.02
Res Comm	39	1.0	0.64	27,878	7.57	295			151.48	5,908	0.00
Condominium	338	0.05	0.64	1,394	0.38	128			7.57	2,560	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					157,306				$3,146,130	0.68
Unimproved	11,460	5.6	0.10	24,219	6.58	75,405			131.60	1,508,110	0.32
Grand Total	36,016					232,712	$4,654,240	$20.00		$4,654,240	1.00

SIMPLIFIED
(DRAFT - 1990)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.10	472,190	69.67	62,699			1,393.32	1,253,986	0.37
Commercial	1,049	5.2	0.80	181,210	26.74	28,045			534.70	560,905	0.16
Comm Res	36	17.2	0.80	599,386	88.43	3,184			1,768.64	63,671	0.02
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.80	902,563	133.16	7,590			2,663.24	151,805	0.04
Apartments	51	1.9	0.80	66,211	9.77	498			195.37	9,964	0.00
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	0.40	6,778	1.00	15,842			20.00	316,840	0.09
> 1 Acre	5,413	4.17	na	10,167	1.50	8,120			30.00	162,390	0.05
Res Ag	307	11.6	0.10	50,530	7.46	2,289			149.10	45,774	0.01
Res Comm	39	5.2	0.80	181,210	26.74	1,043			534.70	20,853	0.01
Condominium	338	0.05	0.80	1,742	0.26	87			5.14	1,738	0.00
Condo Comm	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.80	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					129,396				$2,587,927	0.76
Unimproved	11,460	5.6	0.10	24,219	3.57	40,950			71.47	818,993	0.24
Grand Total	36,016					170,346	$3,406,920	$20.00		$3,406,920	1.00

GROUPED RF
(DRAFT - 1990)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid b/ Category
Agriculture	900	77.0	0.10	335,412	98.72	88,846			1,974.36	1,776,925	0.35
Commercial	1,049	2.8	0.80	97,574	28.72	30,125			574.36	602,503	0.12
Comm Res	36	0.0	0.60	0	0.00	0			0.00	0	0.00
Exempt	479	18.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	57	10.4	0.60	271,814	80.00	4,560			1,600.00	91,200	0.02
Apartments	51	1.7	0.60	44,431	13.08	667			261.54	13,338	0.00
Not Perc	45	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	6,655	0.13	0.600	3,398	1.00	6,655			20.00	133,100	0.03
>.25 - .5	4,319	0.39	0.250	3,299	0.97	4,194			19.42	83,879	0.02
>.5 - 1	4,868	0.73	0.250	4,188	1.23	6,000			24.65	120,005	0.02
> 1 - 1.5	1,823	1.20	0.250	5,416	1.59	2,906			31.88	58,122	0.01
> 1.5 - 2	883	1.77	0.250	6,906	2.03	1,795			40.65	35,895	0.01
> 2 - 3	889	2.49	0.250	8,788	2.59	2,299			51.73	45,987	0.01
> 3 - 5	831	3.95	0.250	12,604	3.71	3,083			74.19	61,652	0.01
> 5 - 10	637	6.90	0.250	20,314	5.98	3,808			119.57	76,169	0.01
> 10 - 15	161	12.13	0.250	33,983	10.00	1,610			200.04	32,206	0.01
> 15 - 20	59	17.24	0.250	47,338	13.93	822			278.65	16,440	0.00
> 20 - 30	62	24.95	0.250	67,489	19.86	1,232			397.27	24,631	0.00
> 30 - 40	28	34.71	0.250	92,998	27.37	766			547.42	15,328	0.00
> 40 - 50	8	44.67	0.250	119,030	35.03	280			700.65	5,605	0.00
> 50 - 75	17	60.69	0.250	160,899	47.36	805			947.11	16,101	0.00
> 75 - 100	5	87.50	0.250	230,970	67.98	340			1,359.58	6,798	0.00
> 100 - 150	4	129.50	0.250	340,741	100.29	401			2,005.73	8,023	0.00
> 150 - 200	6	181.70	0.250	477,171	140.44	843			2,808.81	16,853	0.00
Res Ag	307	11.5	0.25	125,235	36.86	11,316			737.18	226,314	0.04
Res Comm	39	1.0	0.60	26,136	7.69	300			153.85	6,000	0.00
Condominium	338	0.05	0.60	1,307	0.38	130			7.69	2,600	0.00
Condo Comm	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					173,784				$3,475,674	0.68
Unimproved	11,460	5.6	0.10	24,219	7.13	81,689			142.56	1,633,786	0.32
Grand Total	36,016					255,473	$5,109,460	$20.00		$5,109,460	1.00

Worksheet B-3

FIXED SFE (3,000)
($500K DRAFT - 1990)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,049	5.2	0.82	185,740	61.91	64,947			272.91	286,287	0.57
Comm Res	36	17.2	0.68	509,478	169.83	6,114			748.59	26,949	0.05
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.70	789,743	263.25	15,005			1,160.40	66,143	0.13
Apartments	51	1.9	0.64	52,969	17.66	900			77.83	3,969	0.01
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	na	3,000	1.00	15,842			4.41	69,832	0.14
> 1 Acre	5,413	4.17	na	4,500	1.50	8,120			6.61	35,791	0.07
Res Ag	307	11.6	na	4,500	1.50	461			6.61	2,030	0.00
Res Comm	39	5.2	0.64	144,968	48.32	1,885			213.01	8,307	0.02
Condominium	338	0.05	0.64	1,394	0.46	157			2.05	692	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					113,430				$500,000	1.00
Unimproved	11,460	5.6	0.00	0	0.00	0			0.00	0	0.00
Grand Total	36,016					113,430	$500,000	$4.41		$500,000	1.00

Worksheet Set B-4

FIXED SFE (3,000)
($500K DRAFT - 1990)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.10	472,190	157.40	141,657			308.52	277,664	0.56
Commercial	1,049	5.2	0.82	185,740	61.91	64,947			121.36	127,304	0.25
Comm Res	36	17.2	0.68	509,478	169.83	6,114			332.88	11,984	0.02
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.70	789,743	263.25	15,005			516.00	29,412	0.06
Apartments	51	1.9	0.64	52,969	17.66	900			34.61	1,765	0.00
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	na	3,000	1.00	15,842			1.96	31,052	0.06
> 1 Acre	5,413	4.17	na	4,500	1.50	8,120			2.94	15,915	0.03
Res Ag	307	11.6	na	4,500	1.50	461			2.94	903	0.00
Res Comm	39	5.2	0.64	144,968	48.32	1,885			94.72	3,694	0.01
Condominium	338	0.05	0.64	1,394	0.46	157			0.91	308	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					255,087				$500,000	1.00
Unimproved	11,460	5.6	0.00	0	0.00	0			0.00	0	0.00
Grand Total	36,016					255,087	$500,000	$1.96		$500,000	1.00

Worksheet B-5

FIXED SFE (3,000)
($500K DRAFT - 1990)
(Inclues Ag. and Unimp.)

Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	900	108.4	0.10	472,190	157.40	141,657			226.40	203,762	0.41
Commercial	1,049	5.2	0.82	185,740	61.91	64,947			89.06	93,421	0.19
Comm Res	36	17.2	0.68	509,478	169.83	6,114			244.28	8,794	0.02
Exempt	479	40.3	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	57	25.9	0.70	789,743	263.25	15,005			378.66	21,584	0.04
Apartments	51	1.9	0.64	52,969	17.66	900			25.40	1,295	0.00
Not Perc	45	2.6	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	15,842	0.39	na	3,000	1.00	15,842			1.44	22,787	0.05
> 1 Acre	5,413	4.17	na	4,500	1.50	8,120			2.16	11,679	0.02
Res Ag	307	11.6	na	4,500	1.50	461			2.16	662	0.00
Res Comm	39	5.2	0.64	144,968	48.32	1,885			69.51	2,711	0.01
Condominium	338	0.05	0.64	1,394	0.46	157			0.67	226	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	24,556					255,087				$366,921	0.73
Unimproved	11,460	5.6	0.10	24,219	8.07	92,518			11.61	133,079	0.27
Grand Total	36,016					347,605	$500,000	$1.44		$500,000	1.00

Worksheet B-6

Stormwater Revenue Estimation for Cecil County, Maryland

(DRAFT - 1990)

Property Tax ($500K Rev. Requirment)

Land Use	Number of Parcels	Average Value/ Parcel	Average Assessed Value	Tax Base (x 100)	Revenue Required	Tax Rate Per $100 Valuation	Yearly Tax Per Average Parcel	Total Paid By Parcel	Percent Paid By Parcel
Agriculture	900	173,243	77,959	701,634			34.44	31,000	0.06
Commercial	1,049	278,632	125,384	1,315,282			55.40	58,113	0.12
Comm Res	36	131,869	59,341	21,363			26.22	944	0.00
Exempt	479	624,524	281,036	0			0.00	0	0.00
Park									
Playground									
School									
Industrial	57	1,144,768	515,146	293,633			227.60	12,973	0.03
Apartments	51	462,788	208,255	106,210			92.01	4,693	0.01
Not Perc	45	30,871	13,892	6,251			6.14	276	0.00
Residential									
< 1 Acre	15,842	42,490	19,121	3,029,091			8.45	133,833	0.27
> 1 Acre	5,413	184,929	83,218	4,504,583			36.77	199,024	0.40
Res Ag	307	103,450	46,553	142,916			20.57	6,314	0.01
Res Comm	39	103,477	46,565	18,160			20.57	802	0.00
Condominium	338	49,462	22,258	75,232			9.83	3,324	0.01
Condo Comm	0	0	0	0			0.00	0	0.00
Marshland	0	0	0	0			0.00	0	0.00
Non-standard									
Cooperative	0	0	0	0			0.00	0	0.00
Mobil/Traile	0	0	0	0			0.00	0	0.00
Group Quar	0	0	0	0			0.00	0	0.00
Motel	0	0	0	0			0.00	0	0.00
Forest Cons	0	0	0	0			0.00	0	0.00
Detached S-F									
0 - .5 Ac	0	0	0	0			0.00	0	0.00
> .5 - 1 Ac	0	0	0	0			0.00	0	0.00
> 1 Acre	0	0	0	0			0.00	0	0.00
Garden Apt.	0	0	0	0			0.00	0	0.00
High Rise	0	0	0	0			0.00	0	0.00
Other	0	0	0	0			0.00	0	0.00
Total (Dev.)	24,556			10,214,356				451,297	0.90
Unimproved	11,460	21,375	9,619	1,102,309			4.25	48,703	0.10
Grand Total	36,016			$11,316,665	$500,000	$0.0442		$500,000	1.00

Worksheet B-7

Stormwater Revenue Estimation for Cecil County, Maryland

Property Tax ($20 / Res. parcel < 20 Acres)
(DRAFT)

Land Use	Number of Parcels	Average Value/ Parcel	Average Assessed Value	Tax Base (x 100)	Revenue Required	Tax Rate Per $100 Valuation	Yearly Tax Per Average Parcel	Total Paid By Parcel	Percent Paid By Parcel
Agriculture	900	173,243	77,959	701,634			82	73,382	0.06
Commercial	1,049	278,632	125,384	1,315,282			131	137,561	0.12
Comm Res	36	131,869	59,341	21,363			62	2,234	0.00
Exempt	479	624,524	281,036	0			0	0	0.00
Park									
Playground									
School									
Industrial	57	1,144,768	515,146	293,633			539	30,710	0.03
Apartments	51	462,788	208,255	106,210			218	11,108	0.01
Not Perc	45	30,871	13,892	6,251			15	654	0.00
Residential									
< 1 Acre	15,842	42,490	19,121	3,029,091			20	316,804	0.27
> 1 Acre	5,413	184,929	83,218	4,504,583			87	471,121	0.40
Res Ag	307	103,450	46,553	142,916			49	14,947	0.01
Res Comm	39	103,477	46,565	18,160			49	1,899	0.00
Condominium	338	49,462	22,258	75,232			23	7,868	0.01
Condo Comm	0	0	0	0			0	0	0.00
Marshland	0	0	0	0			0	0	0.00
Non-standard									
Cooperative	0	0	0	0			0	0	0.00
Mobil/Traile	0	0	0	0			0	0	0.00
Group Quar	0	0	0	0			0	0	0.00
Motel	0	0	0	0			0	0	0.00
Forest Cons	0	0	0	0			0	0	0.00
Detached S-F									
0 - .5 Ac	0	0	0	0			0	0	0.00
> .5 - 1 Ac	0	0	0	0			0	0	0.00
> 1 Acre	0	0	0	0			0	0	0.00
Garden Apt.	0	0	0	0			0	0	0.00
High Rise	0	0	0	0			0	0	0.00
Other	0	0	0	0			0	0	0.00
Total (Dev.)	24,556			10,214,356				1,068,289	0.90
Unimproved	11,460	21,375	9,619	1,102,309			10	115,287	0.10
Grand Total	36,016			11,316,665	$1,183,576	0.1046		$1,183,576	1.00

Appendix C

Additional Considerations In Implementing A Stormwater Utility System

Overview

Maryland Department of Environment, Sediment and Stormwater Administration has published a sample stormwater utility that could serve as a guide for the development of an ordinance for Cecil County. The MDE sample ordinance is based on a review of 20 ordinances adopted by other municipalities and counties. The sample ordinance includes 12 basic sections which are typical of the points that must be addressed when a user charge system is formed:

1. A statement of findings, intent, and authority.
2. Definitions.
3. Provisions for the creation and administration of a user charge system.
4. References to master stormwater or watershed plans.
5. Provisions for the imposition and calculation of stormwater charges.
6. Creation of a restricted fund for collection and disbursement of stormwater charges and fees.
7. Provisions for credits, exemptions, or surcharges.
8. Provisions for billing procedures.
9. Provisions for enforcement and penalties.
10. Provisions for appeals of charges.
11. A severability clause.
12. Limitations of liability in the event of floods.

The following paragraphs outline the types of charges that the County Council would have to make to the County Code.

Findings, Intent, and Authority

Findings sections of utility ordinances typically state that all people (property owners) in a community generate runoff, that stormwater management is necessary to protect the public health, safety, and welfare, that all benefit from control of stormwater, and that all should pay for control of stormwater in relation to the reasons for creating a utility. For example, one reason for a utility may be to consolidate responsibilities for different aspects of stormwater control.

While sections concerning findings and intent are general in nature, they are important in establishing the basis for a utility, and courts may look to them in the event of litigation over creation of the utility. The necessary section(s) of the County Code would have to be modified to include language specific to the rationale for creating a utility.

The County also would have to reference provisions in State law which grant authority for imposition of stormwater charges. The Stormwater Management Act (Title 4, Subtitle 2, Annotated Code of Maryland 1987) states:

> Each county or municipality may adopt a fee system to cover the cost of reviewing stormwater management plans and implementing stormwater management programs. The fee shall take effect upon enactment by the local governing body.

The County Code would have to be amended to include a reference to this provision.

Definitions

The MDE sample ordinance includes definitions for 12 terms that currently are not defined in the County Code. These and other terms would have to be added to the existing County Code if a utility were established.

Creation and Administration of the Utility

Utility ordinances usually describe how the utility will be managed. The position of the utility with the local administration is specified (e.g., within DNRP). The responsibilities of specific staff (e.g., County Executive, the Director of DNRP, The Director of Finance), including their relation to the County Council, may be described.

Specific clauses of ordinances may:

- create Stormwater Boards comprised of appointed citizens, establish terms of office, and

assign authority, duties, and responsibilities (e.g., require benefit-cost analyses for all projects);

- State responsibilities of local staff

  - authorize Department of Finance to collect charges;
  - authorize the appropriate Department to hear appeals and petitions;
  - clarify the relations of the county executive with the utility staff;

- Clarify the relation between public and private facilities;

- Specify the type of facilities that the utility will construct and maintain and the types of private facilities that the utility will accept;

- Specify the types of maintenance for which the utility will be responsible;

- Establish the procedures by which various departments will implement the utility.

Master Stormwater or Watershed Plans

Stormwater ordinances typically require that utilities operate in the context of a master stormwater plan; they may specify the minimum contents of plans. For example, ordinances may require that all capital improvements be mapped by basin and that they be budgeted according to priorities established in individual basin plans. The existence of a master plan reinforces the idea that stormwater management is a service to be financed by users like water supply and wastewater treatment. Operating within the context of a master plan or a set of watershed plans also strengthens the position of a utility in the even of a suit challenging its legitimacy.

Imposition and Calculation of Stormwater Charges

Utility ordinances typically include several sections related to the establishment and calculation of utility fees. These are coordinated with other sections of ordinances concerning fees, such as those that establish plan review or permit fees. Usually, separate section establish the fees, explain how they will be calculated, and set the levels of the charges. The rationale for all fees and the purposes of the fees are explained carefully. Items usually specified include:

- References to authorization for imposing fees;

- Amount to be generated by fees (e.g., charges shall cover all stormwater management costs);

- Uses of fees (e.g., planning, design, acquisition of right-of-way, construction, routine and remedial maintenance, and reconstruction); and

- Basis for charges (land use classification, runoff coefficients, billing algorithm, rate schedules and provisions for increasing fees).

- The rationale for standardized residential charges.

Stormwater Fund

Utility ordinances require that a separate fund be established for all revenues collected by the utility (generally referred to as an enterprise fund). The ordinances usually specify permissible disbursements from the fund (e.g., some utilities allow payments to developers to reimburse costs of constructing facilities designed to serve areas larger than the immediate development). Ordinances also clarify the relationship between the stormwater fund and the general fund (e.g., funds may be used to pay for a proportionate share of municipal accounting expenses but funds may not be commingled).

Credits, Exemptions, or Surcharges

Some utilities provide credits, reductions, or exemptions for charges if stormwater is retained on-site or if other criteria are met. These special features usually are specified in separate sections of the ordinance. The particular section could be amended to include exemptions form utility charges and procedures for credits from charges, if any. For example, residential developments consisting of single family houses each on a lot of two acres or greater presently are exempt from permits; consideration must be given as to whether these homes would be charged by the utility.

Billing

Utility ordinances specify how frequently bills will be issued and who will be responsible for collecting them.

The model ordinance includes no references to mechanisms for charging users of systems. Sections about billing would need to be added; options in billing are discussed below.

Enforcement and Penalties

Most utility ordinances specify actions that can be taken to collect delinquent bills. Officials responsible for collection (e.g., Director of Finance) may be specified. Ordinances may provide for liens against property in the event of failure to pay. References to other sections of the local code that specify procedures for the collection of bills may be made. Penalties for failure to comply with the ordinance may be included.

Provisions for Appeals of Charges

Ordinances typically include a separate section that establishes the procedures that people can use to appeal stormwater charges. For example, hearings could be requested with the appropriate County Department, and the Department decisions appealed to a stormwater board or to the local council.

Severability

Severability clauses specify that the entire ordinance does not become invalid if a single section is found to be invalid.

Limitations of Liability

Utility ordinances typically specify that the existence of a stormwater utility does not ensure that floods will not occur and that the local jurisdiction assumes no liability for any damages caused by flooding.

Summary

The sample ordinance available from MDE provides an overview of the basic legal requirements for establishing a utility. MDE also can make available to the County copies of ordinances adopted by approximately 20 jurisdictions. The language of an ordinance is extremely important in the event of a suit challenging the legitimacy of the utility. Support from the County's Office of Law would be required during development.

Billing Considerations

Development of a billing system can begin after local officials have selected a rate structure and specified the types of data to be used in the calculation of charges. Practical considerations in the development of a billing system are reviewed in this section. Specific factors include:

- o Methods and frequency of billing;
- o Data requirements for billing; and
- o Costs of billing.

Methods and Frequency of Billing

Options for billing in Cecil County would include:

1. Adding stormwater charges to existing bills for water and sewer service;

2. Adding stormwater charges to annual property tax bills as a line item; and

2. Creating a new, separate billing system.

Most utilities add stormwater charges to existing water and sewer bills that are mailed monthly or quarterly rather than to property tax bills that are mailed annually or semiannually. This method reportedly is favored because it reinforces the notion that the fees are user charges and not taxes. The benefit of adding the stormwater charges to existing bills is that the cost of developing and maintaining a new billing system can be significant. The most likely billing option in the County would be to add the stormwater charges to an existing billing system. This could be done very cheaply if the information in the tax assessor's files is sufficient for calculating the charges.

Data Requirements for Billing

The types of information that must be coded in a billing system are presented in table 19. Much of this information already is in the Cecil County tax files.

Table C-1

Data Needs For a Stormwater Utility Billing System

Data Needed	Data Needed
Account Number	Equivalent Runoff Units
Service Address (site)	Drainage Basin Code
Map and Parcel Number (from working maps)	Floodplain Location Code
Billing Address	Billing Cycle Code
Tax Assessor's Number	Billing History Summary
Parcel Area (estimate or measured)	Delinquency Action Code
Land Use Code	Special Charge Code
Intensity of Development Factor (rate factor)	Special Charges
	Impervious Area (if measured)
	Credits

This information must be readily accessible so that utility staff can respond to inquiries about accounts from customers.

Costs of Billing

The development of the billing system can be one of the most time consuming and costly tasks in establishing a utility, particularly if all nonresidential parcels are digitized to determine the amount of impervious area. Cyre (1986, 1987) estimates that between six and 10 months may be required to develop and implement a billing system and that the costs to develop and implement a system can range from $50,000 to $150,000 for professional services plus $3 to $10 per account. Utilities surveyed by MDE reported annual billing costs per account ranging from $1 to $8.64; for these utilities, billing costs accounted for between 1.4% to 16.3% of total revenues. If an existing billing system is used, the most significant cost the County would incur would be modification of existing databases to include information for calculating charges (e.g., runoff coefficients, percent of impervious area per parcel).

Public Relations

Opposition to proposals for stormwater management utilities (i.e., to new fees or to the magnitude of new fees) almost always emerges. Some utilities have been stalled or defeated because of opposition. Hence, most local officials with experience in the formation of utilities stress the need for carefully planned, vigorous public information programs.

Elements of public information programs include:

- news release;
- letters to business associations and community groups;
- public service announcements;
- mailing of brochures to all accounts;
- public meetings; and
- meetings with influential community leaders.

An example of a brochure used in Denver, Colorado to explain the utility concept to residents is included as Figure 1. An approach to gain public support, used successfully in Cincinnati, was to relate proposed capital improvements to complaints. Public works staff logged over 10,000 complaints about stormwater. The locations of the problems were noted on maps of 48 recognized communities or neighborhoods in Cincinnati, Ohio. Meetings then were held with the executive boards of each of the community councils to explain the need for the utility. Stitt (1986) reports that constituency development through the meetings was important to the success of the proposed utility.

Figure 1. Utility Informational brochure, Denver, Colorado (Denver Wastewater Division, no date).

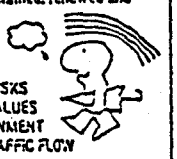
when it rains

THE NEED FOR STORM DRAINAGE

Before people settled in the front range area of Denver, the natural state of the land was rolling prairie covered by grass. When it rained, the water soaked into the land or naturally flowed to the streams and rivers.

When people did come to Denver and settle in the area, they built homes, stores, offices, churches and apartment houses. They paved the land with streets, parking lots, sidewalks and driveways. Now, when it storms, the ground cannot absorb the water as easily and many flow patterns have been changed.

As development of the land continued, it became increasingly important to control the storm water. Storm drainage facilities had to be built, operated, maintained, renewed and replaced in order to:

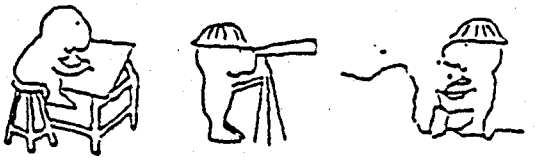


PROTECT PEOPLE
PROTECT PROPERTY
REDUCE INSURANCE RISKS
IMPROVE PROPERTY VALUES
ENHANCE THE ENVIRONMENT
PROVIDE FOR SAFE TRAFFIC FLOW

To control storm waters and receive the benefits of that control, there is a cost. Since everyone in the City benefits, the Denver City Council passed an ordinance which authorizes a Storm Drainage Service Charge to be collected from all improved parcels of land in the City.

The Wastewater Management Division of the Department of Public Works has been given the responsibility to manage this important function for the Citizens of Denver.

HOW WILL THE MONEY BE USED?



(1) Denver is a vital and growing City, and planning for future as well as present storm sewer needs is extremely important. A Storm Drainage Master Plan has been developed and is continuously upgraded so that information is always available to determine:

- Where and when repairs, changes and enlargement of the existing storm drainage system are needed to solve the present problems.
- Where and when future storm sewers will be needed so that new problems do not develop as Denver grows.
- What the costs will be to construct, operate and maintain the needed storm drainage system, including the best and least expensive method of paying those costs.

(2) In addition to the money needed to operate and maintain the present storm drainage system, a large portion of the storm drainage service charge will be used to:

- Renew the existing storm facilities so they operate properly for a longer period of time.
- Replace existing storm facilities that have become unusable over the years due to the natural deterioration process.

(3) Management of new land development in the City is required to provide for a proper and adequate storm drainage system. Some of the money will be used for this important function in the review of plans for new subdivisions, buildings, parking lots, driveways, etc. to insure that these requirements are met by new construction.

THE EXISTING STORM SYSTEM

The Storm Drainage System is complex. There are many parts which make up this system from underground pipelines, which gather the water as it first enters the system, to the gulches and natural waterways which control and carry the storm water away. The existing storm drainage system, presently valued at approximately $73 million consists of:

12,200 Catch Basins
950 Siphons
375 miles of underground lines and structures
40 miles of Ditches
20 miles of Gulches & natural waterways

This System must be maintained on a year around basis so that when needed, it will operate to safely control and dispose of the storm waters.

QUESTIONS??? AND ANSWERS!!!

WHO WILL PAY FOR THE SYSTEM?
The owners of every improved parcel of land within the City of Denver will help share the cost of Denver's Storm Drainage System in an equitable manner.

HOW WILL THE CHARGE BE FIGURED?
The annual charge to a land owner will be determined by the overall need of the land parcel to use the Storm Sewer System. For instance, a parking lot will have more storm runoff than a grassy area of the same size. The annual charge will be based on the total amount of impervious surface on a parcel in relation to its total area.

WHAT IS IMPERVIOUS SURFACE?
Impervious surface is a manmade area that will not readily absorb rain water as it falls. Examples would be roof tops and paved areas.

CITY AND COUNTY OF DENVER

DEPARTMENT OF PUBLIC WORKS
WASTEWATER MANAGEMENT DIV

WASTEWATER MANAGEMENT DIVISION
P.O. Box 17827 Terminal Annex
Denver, Colorado 80217

PRE-SORTED
FIRST CLASS
U.S. POSTAGE
PAID
Permit No. 1056
Denver, CO

STORM DRAINAGE
SERVICE CHARGE
ADVANCE NOTIFICATION

OWNER/OCCUPANT

WHAT IS MY SHARE OF THE COST?

The probability of storm water runoff from a specific parcel of land using the storm drainage system of the City is directly related to the amount of impervious surface area on that parcel. The Storm Drainage Service Charge is based on the percentage of impervious surface area to the total parcel area. For instance, to determine the rate and annual charge for a specific parcel of land: (1) divide the impervious area by the parcel area, the answer is the ratio of impervious area to parcel area; (2) go the rate table and find the proper ratio group and rate which applies to that parcel; (3) then, multiply the rate times the impervious area and divide by 100; the answer to the above will be the annual Storm Drainage Service Charge for that parcel of land.

The information shown below is for the listed service address and will be used to determine the storm drainage service charge for the parcel. Space has been provided for you to check the accuracy of our information. In the event your figures differ from those of record, please fill in the boxes and return the section below the dotted line to this office for further checking, and if necessary, a field survey.

The date you may expect to receive a bill for the Storm Drainage Service Charge is shown on the last line of the page. Please do not send money at this time.

RATE TABLE	
Ratio Group	Rate
0 to .10	$0.37
.11 to .20	0.47
.21 to .30	0.57
.31 to .40	0.67
.41 to .50	0.77
.51 to .60	0.77
.61 to .70	0.87
.71 to .80	0.97
.81 to .90	1.07
.91 to 1.00	1.17
(Minimum $3.70/Parcel)	

IF YOU NEED MORE INFORMATION!!

Should you have any questions or want more information about the storm drainage service charge, please call the Wastewater Management Division, Customer Services at 629-1451, extension 235.

THIS IS NOT A BILL

MAILING ADDRESS: ACCOUNT NUMBER: SERVICE ADDRESS:

	PARCEL AREA	IMPERVIOUS AREA	RATIO
RECORDS INDICATE	SQ. FT.	SQ. FT.	
ENTER FROM YOUR RECORDS			

YOU WILL RECEIVE A BILL FOR THE ABOVE PARCEL ON OR ABOUT:

There is some evidence, however, that public relations programs have only a limited effect on the success of a proposal and that the most important factor is the size of the proposed charge. Proposals for utilities with fees in the range of $1 to $2 per month for single family residences seem to be accepted, while proposals for higher fees seem to have been rejected. In Tampa, Florida, for example, a proposal for a utility with monthly residential fees in excess of $4 was stopped by public opposition despite (Wallace 1986):

- 77 letters to business, civic, and professional groups
- 6 news articles;
- 9 public announcements in three newspapers;
- public meetings in each of seven districts;
- 70,000 utility bill messages; and
- responses to 75 telephone inquiries.

Cyre (1986) suggests that users seem to be willing to pay from one-third to one-half as much as they pay for water or sewer bills, whichever is lower, and that there "seems to be a psychological ceiling on stormwater charges of $3 per month for residences." The City of Bellevue, however, charges more than $4 per month to single family residences. Fees in Bellevue, however, have been increased gradually over time.

There also is evidence that the timing of a proposal may affect its success. Utilities in Austin, Texas and Tulsa, Oklahoma were established after severe floods resulted in the drowning of several people. Stitt (1986) declares flatly:

> You need a storm. Nothing was more helpful for stimulating public interest in the stormwater problem than the two 100 year storms that Cincinnati experienced in 1982.

Regardless of the effectiveness of a public information program in explaining the utility, the first bill is certain to generate inquiries that the county should be prepared for. Some communities have installed extra telephone lines and hired additional temporary help to respond to calls. Stitt (1986) reports that the Cincinnati Stormwater Division received 1,000 calls the day the bills were first issued, but that the number of calls declined to "only about 100" per day after a week.

Appendix D

While the report to which this supplement is appended includes an overview of issues that would arise in the implementation of a user charge system (e.g., the need for a public relations program), several pragmatic political issues have not been addressed with the attention that would be required in the event a decision were made to pursue a utility. These include a host of issues that may be thought of as strategic: how the County Executive ought "package" a utility proposal, how issues of equity ought be characterized publicly, the timing of implementation, or ways to adjust runoff coefficients (which are controls) to achieve other equity objective or to make administration of the system cheaper and easier. These issues are far off on the time horizon, and do not require direct attention unless a decision is made in favor of pursing a utility. Never the less, it may be important to keep these long-term matters in mind when considering the issue of utilities in general.

It may be insightful to consider the findings of the Baltimore County Stormwater Management Committee, convened by the Director of Environmental Protection and Resource Management. They have recently recommended the formation of a stormwater utility to finance stormwater controls. In doing so, they suggested that guidance from the Administration would be essential in addressing the following issues, which in view of geographic proximity may be relevant to Cecil County.

1. Justification for a Utility People will question the need for a utility. A utility is needed for two reasons: current funding for maintenance is inadequate and new programs are needed to help achieve water quality goals related to cleaning up the Chesapeake Bay and its tributaries. While documentation to support these two reasons is adequate, each has political implications. For example, the statement that current funding for maintenance is inadequate could be construed as a criticism of budgetary or allocation decisions made by elected officials. The proposition that the only way for maintenance to be funded is to establish a separate fee that is placed into a restricted account is a more direct criticism. On the other hand, this alternative approach to financing is consistent with the Administration's stated goals of looking into sources of revenue other than property tax.

2. Equity of the Rate Structure The example in Chapters 4 and 5 is illustrative of the way in which utility financing works. Although most residential users would be better off paying user chances, most nonresidential property owners, particularly owners of industrial, agricultural, and tax exempt property would be better off under a property tax system. It is likely that classes of users will contest elements of the rate base. Based on expected responses to a utility proposal, official could modify the rate structure in ways to mute objections while leaving basic principles intact. For example, rather than using engineering based runoff coefficients themselves as charge rate factors, the coefficients could be grouped so that there would only be a few rate classifications (the Grouped RF (Rate Factor) Approach is an example of this concept). This would minimize the number of different rates and could reduce the disparity between types of property owners.

   Another issue pertains to credits. Most utilities offer waivers or credits, at least partial ones, to owners of nonresidential properties who control stormwater on-site. The Committee believes that it is unfair to impose charges on the owner of property who already has paid for the construction of stormwater management facilities and is responsible for maintaining them. In addition, the development and implementation of a credit system is considered essential for the success of proposals to include agricultural properties in the rate base. Agricultural land is the largest single source of non-point source pollution. Although aid is available to assist farmers in the implementation of conservation plans, the cost of implementation still is high. Although utility charges to owners of agricultural land could be significant, formation of a utility that included credits for implementation of best management practices would provide an additional incentive for farmers. Although the Committee believes that credits should be available, the Committee does not believe that charges for runoff should be waived completely for any property owner. Stormwater discharges occur even from properties that control water on-site. In general, the Committee believes that property owners who receive credits should continue to pay at the rate at which owners of undeveloped property are charged.

   While a credit system provides incentives for on-site controls and is important front eh perspective of equity, credits reduce total revenues. The impact of a credit system on potential utility revenues and on charges paid by people not eligible for credits needs to be investigated. Design of a credit system will be a major task in implementation of a utility.

3. Scope of Utility System While the costs of current stormwater programs represent a relatively small portion of the County's total budget (about 2%), the costs are significant (about $20,000,000). The costs of proposed new programs ($1.9 million) would represent an increase of almost 10% in current expenditures. If the new programs (watershed planning and maintenance) were assigned to DEPRM, DEPRM's operating budget would increase by 135%. An increase of this magnitude could be difficult to manage in the short term.

   A utility could be established to fund all or only a few of the existing and proposed activities. If

all stormwater activities were to be financed with at utility, current tax revenues would be freed for other activities or, theoretically, property taxes could be cut. While this may seem an unlikely scenario, several municipalities have done this when implementing utilities. Locally, the City of Baltimore recently dropped the tax rate by five cents, recognizing that the action was largely symbolic. Determining the scope of programs to be funded by a utility involves numerous political as well as technical considerations.

4. Implementation Creation of a utility typically requires a substantial period of time. Utility managers responding to a survey by MDE reported planning periods prior to Council authorization ranging from seven months to 2.5 years. The planning period reported most frequently was 1.5 to 2 years. Most (75%) of the utilities reported that utilities were implemented within six months following council authorization to proceed. In Baltimore County, the Committee has been studying the utility concept for nearly a year; pre-implementation studies have been completed. Overall, the Committee believes that the data available to them is sufficient for the Council to determine whether a utility ought be implemented in Baltimore County. Depending on when a proposal could be presented to the Council, a utility could be implemented as early as 1991.

This brief list of issues illustrates the types of problems that will be encountered in the implementation of a utility. Systematic considerations should be given to these and other issues prior to and during implementation. Consultants may need to be hired during the implementation phase.

FINANCING STORMWATER CONTROLS IN CARROLL COUNTY: A PRELIMINARY INVESTIGATION

FINAL REPORT

July 26, 1991

Prepared By:

Jim George
Greg Lindsey

Sediment and Stormwater Administration
Maryland Department of the Environment
2500 Broening Highway
Baltimore, Maryland 21224

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1.0 INTRODUCTION

The State of Maryland passed the Stormwater Management Act in 1982. Regulations promulgated in 1983 required all incorporated counties and municipalities to adopt stormwater management ordinances by 1984. The local programs are to provide controls that will "maintain after development, as nearly as possible, the predevelopment runoff characteristics." In addition, local governments must manage programs to implement provisions of the State's Sediment Control Law, and Maryland's Critical Areas Laws where applicable.

In 1987 Congress passed the Water Quality Act, a comprehensive overhaul of the Clean Water Act. Section 319 of the Act requires all states to develop assessment and management reports that outline strategies to control nonpoint source pollution. In response, Maryland's primary goal has been to implement the Nutrient Reduction Plan for which quantitative goals already were in place (i.e., a 40% reduction in nutrient loadings to the Chesapeake Bay by the year 2000).

These statues, regulations, and policies reflect concerns about the negative impacts of stormwater runoff on the quality of streams and rivers in Carroll County that are tributaries of the Chesapeake Bay. A number of stormwater policies, programs, and projects have been identified to control the quantity and improve the quality of runoff. This report focuses on options available for financing these activities.

Since the initiation of this report the Carroll County Government has reclassified the Department of Natural Resources as an Office, and moved several of its functions to other government units. Because the organizational structure is in flux, certain sections of this report are out-of-date. When stormwater control responsibilities stabilize under suitable agencies, sections of this report may need to be revised.

Contents of Report

This report begins with a description of administrative and managerial considerations for collection and management of stormwater. County departments responsible for various aspects of stormwater management are identified. This description is followed by a discussion of revenue requirements for stormwater controls. Costs are estimated for existing and proposed activities, including expanded maintenance programs. To the extent possible, costs are presented by administrative department and function.

Next, current and potential sources of revenue are described. Two major potential sources, property taxes and user charges, are evaluated against several criteria including ease and cost of administration and fairness. Legal requirements, options for billing, and other issues related to the formation and implementation of a user charge system are reviewed in the appendices.

Definitions

The stormwater control system includes structures and natural waterways used for the collection, conveyance, storage, treatment, and disposal of stormwater runoff in a manner that prevents accelerated channel erosion, increased flood damage, and/or degradation of water quality. The stormwater control system conventionally has comprised two distinct elements: (1) storm drain systems and (2) stormwater management structures.

The storm drain system, which includes facilities used primarily to collect and convey runoff, includes two basic elements:

(a) open systems consisting of natural watercourses, and

(b) closed systems consisting of pipes and other structures constructed specifically for the purpose of transporting runoff.

The Carroll County Stormwater Management Ordinance provides a specific definition of stormwater management, which distinguishes it from stormwater drainage or conveyance. This definition of stormwater management also includes two basic elements:

(a) for Quantitative control, a system of vegetative and structural measures may be used to counter the increased volume and rate of surface runoff caused by man-made changes to the land.

(b) for Qualitative control, a system of vegetative and structural measures may be used to reduce or eliminate pollutants that might otherwise be carried by surface runoff.

In this report, the terms stormwater control systems, stormwater controls, and stormwater system are used to refer to both stormwater management and storm drainage. Consistent use of these definitions will help avoid confusion. The term flood control occasionally is used interchangeably with quantity control and refers mainly to control of the peak and duration of runoff flows. In general, the discussion of financing options that follows applies to both storm drain systems and stormwater management.

2.0 ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITIES

Development of a stormwater management financing plan depends on the ways in which responsibilities are shared by the County agencies and private parties involved. The Carroll County Government is comprised of operational departments and their bureaus (e.g., Public Works), administrative support offices (e.g., Finance), and other semi-autonomous agencies funded in part or in whole by the County (e.g., Soil Conservation District) (Figure 1 - County Organization Chart).

Overview

Historically, the DPW, Bureau of Engineering has had primary responsibility for stormwater controls, including stormwater management plan review, and the DRP, Bureau of Parks & Facilities conducted maintenance of stormwater management structures. Sediment control inspections were performed by the Department of Permits and Regulations, Bureau of Permits and Inspections (DPR, P&I). In July of 1990 the functions of stormwater management plan review, and sediment control inspection were transferred to the newly created Deparment of Natural Resource Protecion, Bureau of Stormwater Management and Sediment Control (DPNR, SMSC). DPW retained responsibilities for storm drainage. As noted in the Introduction, Carroll County reorganized in Spring of 1991. The following material is dated in that it does not incorporate the most recent reorganization.

Prior to the most recent reorganization, four departments and one district had primary responsibility for stormwater management, sediment control and storm drainage:

- Department of Natural Resource Protection (DNRP)
  Bureaus: - Stormwater Management & Sediment Control
  - Water Resources

- Department of Permits & Regulations (DPR)
  Bureaus: - Permits and Inspections
  - Development Review

- Department of Public Works (DPW)
  Bureaus: - Roads
  - Engineering

- Department of Recreation & Parks (DRP)
  Bureau: - Parks & Facilities

- Soil Conservation District, reviews erosion and sediment control plans.

CARROLL COUNTY GOVERNMENT

Organizational Chart

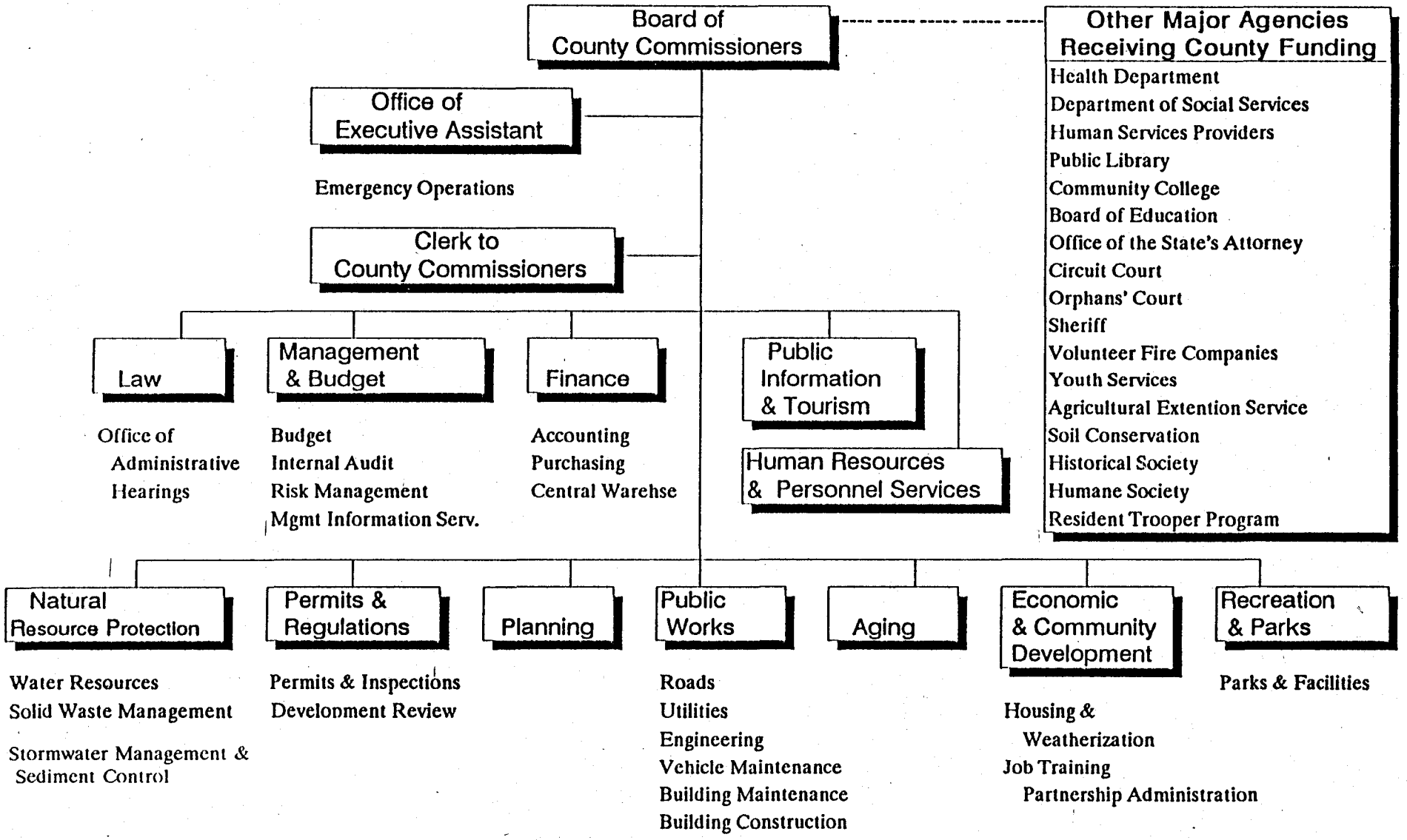

Fig. 1

The Department of Natural Resources, Bureau of Stormwater Management and Sediment Control (SMSC) was assuming the lead role in coordinating county wide stormwater control activities. The primary objective of SMSC is to minimize the adverse impact that new land development and urbanization will have on stormwater runoff characteristics. SMSC is also concerned with retrofitting existing developments with controls to correct existing problems caused by runoff. Table 1 is a list of the current and contemplated responsibilities for SMSC. The three major areas addressed by SMSC include:

- Stormwater Management
- Sediment and Erosion Control
- Grading

Primary responsibilities include stormwater management plan review and inspection of stormwater management structures. Many administrative activities, such as managing bond monies, acting on State and Federal grants, and responding to citizen inquiries, also make significant demands on staff time but are not elaborated upon in this report.

The DNRP, Bureau of Water Resources was part of the Department of Permits and Inspections until the formation of the Department of Natural Resource Protection in May, 1990. This bureau is charged with development of watershed management plans.

Storm drain plans are reviewed by the DPR, Bureau of Development Review. Storm drain maintenance is performed primarily by the DPW, Bureau of Roads. The DPW, Bureau of Engineering provides design services for storm drainage on capital projects and required storm drain repairs on County systems.

The DRP, Bureau of Parks and Facilities is charged with performing necessary maintenance on all County owned structures. Privately owned stormwater management structures must be maintained by the owners. The County has authority to maintain private structures and assess the owners for the costs if the owners maintenance practices are substandard.

The Soil Conservation District reviews all erosion and sediment control plans. Once a sediment control plan is approved, SMSC issues a grading permit and performs site inspections on any site requiring sediment control during construction.

Developers in the private sector have primary responsibility for stormwater management and storm drainage design and construction at new development sites. These responsibilities include contracting a registered Professional Engineer to design facilities, providing stormwater management inspections during construction, certifying that structures are constructed correctly, and providing certified as-built plans for each stormwater management practice. In addition, many private entities are responsible for maintenance of stormwater management structures.

Table 1 - Responsibilities of the Stormwater Management and Sediment Control Bureau

STORMWATER MANAGEMENT

Current Responsibilities

* County review and certification as required by the State.
* Revision of the County stormwater management ordinances as required by the State.
* Expedite Stormwater management plan review and approval:
  - Consult with developers prior to and during design phase,
  - Review plans for Subdivision Advisory Committee meetings,
  - Meet with consultants to discuss comments,
  - Review stormwater management changes at final plans stage,
  - Make determination on stormwater management design approval,
  - Inspect final stormwater management facilities.
* Take ownership of noncommercial stormwater management sites.
* Investigate and resolve drainage complaints.
* Monitoring the maintenance of stormwater management sites by private parties, and the DRP, Bureau of Parks and Facilities.

Future Responsibilities

* Retrofitting existing stormwater management structures.
* Regional stormwater management planning
* Stormwater management dam certification
* Providing stormwater management construction inspectors

SEDIMENT AND EROSION CONTROL

Current Responsibilities

* Prepare and refine existing Ordinance No. 5 (Grading and Sediment Control).
* Inspect sediment and erosion control measures during construction-approved plans and single lot construction (Inspection authority delegated by the State).
* Assurance of the structural integrity of sediment control devices and enforce site stabilization.
* Investigate sediment and erosion complaints.
* Liaison with the soil conservation district.

Future Responsibilities

* Review and approve sediment and erosion control plans.

GRADING Responsibilities

* Prepare ordinance revisions.
* Consult with and advise developers during design.
* Review grading plans and present comments to the Subdivision Advisory Committee.
* Make determination on approval of final grading design.
* Issue grading permits, and conduct inspections during construction.
* Enforce plans as approved.
* Investigate grading complaints.

Currently, Carroll County will accept ownership of all non-commercial or non-industrial stormwater management structures two years after the as-built plans have been approved. The County inspects each structure to ensure it is functioning properly before it accepts ownership. In the past the County did not take ownership of all non-commercial and non-industrial ponds. The owners of the remaining non-County ponds are responsible for their maintenance.

The relationships and responsibilities of the various operating agencies and the private sector discussed in this section are summarized in Table 2. The table is a matrix which pairs general environmental objectives (e.g., Runoff Quality, Quantity Control, etc.) with operational functions (e.g., Watershed Planning, Design & Construction, Inspection, etc.). At least one responsible party is identified for each cell in the matrix.

The departments work together through the Subdivision Advisory Committee (SAC) and informal meetings. However, new regulations and public awareness regarding stormwater management are forcing rapid changes in management practices. It is clear that several different County bureaus must interact to manage the essential components of the stormwater control system. Because of overlapping responsibilities and the recent department reorganizations, procedures for coordinating activities are in transition. From a financial perspective, the division of responsibilities makes it difficult to determine the total costs of existing stormwater management programs and to estimate or project the costs of functions that the County presently is not performing.

As explained below, past budgets and the estimated FY 91-92 budget probably are not sufficient to support comprehensive, effective stormwater management programs. The small size of past and present budgets reflects the realities of limited funding mechanisms (e.g., the tax base), rather than actual needs. The key programmatic objective requiring expansion is the area of water quality control.

Table 2

SUMMARY OF RELATIONSHIPS AND RESPONSIBILITIES

FUNCTION	GENERAL OBJECTIVES: QUALITY CONTROL	QUANTITY CONTROL	DRAINAGE/ CONVEYANCE	SEDMNT. & EROSION CONTROL
Watershed Planning	DNRP	DNRP	DPW	N/A
Design & Construction				
Private	Developer	Developer	Developer	Developer
Public	DPW	DPW	DPW	DPW
Regional	DNRP,DPW	DNRP,DPW	DPW	DNRP
Redevelopment/ Retrofit				
Private	DNRP/ Developer	DNRP/ Developer	Developer	N/A
Public	DNRP	DNRP	DPW	N/A
Regulation & Plan Review	DNRP	DNRP	P&I	SCD,DNRP
Operations & Maintenance				
Private	DNRP/ Owner	DNRP/ Owner	Owner	Developer
Public	DNRP, P&F	DNRP, P&F	DPW	Contractor/ DPW
Inspection	DNRP/ Developer	DNRP/ Developer	DPW	DNRP

DNRP: Department of Natural Resource Protection
DPW: Department of Public Works
P&I: Department of Permits & Regulation, Bureau of Permits & Inspections
P&F: Department of Recreation & Parks, Bureau of Parks & Facilities
SCD: Soil Conservation District

Notes:

- Both DNRP and DPW could be involved with design and construction of regional stormwater management facilities. The design function would be completed by DNRP, and the construction function may be completed by DPW.
- Private stormwater retrofit work may be performed by the DNRP if funds are available, and the general environmental health of the County is expected to be improved by the retrofit.

3.0 REVENUE REQUIREMENTS

Revenue requirements are the costs of all stormwater control programs and functions. There are two basic components of revenue requirements: (1) the cost of existing programs and functions and (2) the cost of new programs considered necessary for achieving stormwater control objectives. Both can include operating and capital costs. A good estimate of the total costs is necessary to establish priorities for financing and to determine the amount of revenues from different sources necessary to pay for the programs.

A difficulty in determining the cost of existing programs is that costs generally are reported by administrative unit (department), not by program or function. For example, the County budget includes a line item for the Department of Public Works, Bureau of Engineering - Construction Inspection and, for that Program, has a breakdown of expenditures by object (personal services, supplies and materials, etc.). Although the budget notes that the Program is responsible for, among other things, "inspecting and approving ... storm drain ... construction," it does not specify how much of the total Program costs are for stormwater functions. Similarly, no stormwater function costs are available in the Budget for the other key departments specified in Section 2.0. Because of limitations of data in the Budget documents, estimates of costs for stormwater functions in most of the key departments were compiled by the Bureau of Stormwater Management and Sediment Control. Methods for estimating costs for maintenance of structures are described below. A rough estimate can be generated using recent MDE site-survey information and general engineering data (these costs are to be borne by the Department of Recreation and Parks, Bureau of Parks and Facilities).

A difficulty in estimating costs of potential functions not currently performed by the County is that the County has few data on which to base such cost estimates. The cost estimates for new functions were developed from a variety of data sources and are considered accurate only within an order of magnitude.

3.1 Current Operating Costs

Direct Operating Costs

The estimated direct operating costs for stormwater management programs for Fiscal Year (FY) 1991-92 are presented in Table 3. These are presented by bureau and function based on data from SMSC. Total current costs, exclusive of maintenance costs, are $1,568,712.

Table 3 - Estimated Costs of Stormwater Programs in FY 1991-92

Operating Costs

		Department Subtotal
DEPARTMENT OF NATURAL RESOURCE PROTECTION		
Bureau of Stormwater Management and Sediment Control		
• Stormwater Management Review	$ 81,386	
• Stormwater Management Inspection	$ 44,108	
• Sediment Control/Drainage Complaint Inspection	$140,782	
• Stormwater Management Retrofit Program	$ 88,407	
• Regional Stormwater Management Program (Proposed)	$ 63,407*	
• Stormwater Management Dam Certification (Proposed)	Not Available*	
Bureau of Water Resources Management		
• Current Watershed Management	$ 50,000	
• New Watershed Planning (Proposed)	$750,000*	
Department Indirect Costs (Proposed)	$152,645*	
Department Indirect Costs (Current)	$ 78,792	$1,218,090
DEPARTMENT OF PERMITS AND REGULATIONS		
Bureau of Development Review		
• Storm Drainage Design Review[1]	$ 29,715	
Department Indirect Costs	$ 5,510	$ 35,225
DEPARTMENT OF PUBLIC WORKS		
Bureau of Roads		
• Storm Drainage Maintenance	$412,224	
Bureau of Engineering		
• Flood Studies and Culvert Redesign	$ 50,000	
• Small Drainage Pipe Replacement Structures	$200,000	
Department Indirect Costs	$101,334	$ 763,558
DEPARTMENT OF RECREATION AND PARKS		
Bureau of Parks & Facilities		
• SW Management Structure Maintenance (Proposed)	Not Available*	
Department Indirect Costs	Not Available	$ Not Available
SOIL CONSERVATION DISTRICT		
• Sediment Control Review	$ 54,000	
Department Indirect Costs	$ 10,260	$1,218,090

Capital Costs - (Not Currently Available)

Current Program Total	$ 1,568,712
Proposed Program Total	$ 813,407*
Current Indirect Cost	$ 195,896
Proposed Indirect Cost	$ 152,645*
Capital Cost Total	$ Not Available
GRAND TOTAL	$ 2,730,660

* = Proposed Costs

[1] Based on staff time spent on storm drainage reviews in 1990 using average salary figures that include benefits.

Indirect Operating Costs

Indirect operating costs are those incurred by County staff agencies that provide support services (Legal, Financial, etc.) to operating agencies, which provide direct services to County residents. These include costs incurred by the Office of Finance, the Office of Management and Budget, The Office of Law, the Office of Public Information, and the Office of Human Resources and Personnel Services. As a rule-of-thumb, overhead costs may be estimated as 20 percent of total payroll costs of the operating agencies.

Personnel services or payroll costs account for roughly anywhere from 75% to 95% of total expenditures for all items related to controlling stormwater depending on the department. Estimated indirect costs are also shown in Table 3. An estimate of the payroll costs for current programs is $979,480 or approximately 80% of the current costs. An estimate of the payroll costs for proposed programs is $1,742,705 or approximately 80% of the proposed costs. Using the rule-of-thumb that 20 percent of these figures yields an estimated overhead cost, we calculate an indirect cost of $195,896 for current programs, and 152,645 for proposed programs for a total estimate of $348,541 in indirect costs.

3.2 Costs of Proposed and Potential Programs

County staff now consider some stormwater management functions to be deficient. Staff has targeted program needs in the areas of watershed planning, improved maintenance, and regional stormwater management. Cost estimates summarized in Table 3 above are discussed below. Proposed retrofit projects are discussed in Section 3.3 on Current and Proposed Capital Costs.

Watershed Planning

Watershed planning is necessary to establish water quality goals and to identify actions that can be taken to achieve the goals. A major component of a watershed plan is the identification of retrofit projects that can reduce pollution from areas of existing development. Due to physiographic differences, objectives and projects necessarily will vary by watershed. The cost of watershed planning can vary significantly depending on the problems that exist within a given watershed and the level of detail needed in the plans.

No watershed specific estimates of the costs of preparing plans are available for this report. Prince George's County estimates that a watershed plan for an area approximately 100 square miles in size costs approximately $500,000. There are 455 square miles in Carroll County. Based on Prince George's County rule-of-thumb, the cost of completing watershed planning for Carroll County could be about $2,275,000. Because Carroll County is rural and Prince George's County is more urban, this rule-of-thumb may over estimate the cost of watershed planning.

In the analyses that follow, it will be assumed that the annual cost of watershed planning in Carroll County would be $750,000 (about one-third of the total). This presumes that studies would be phased in. Regardless of whether planning was conducted in-house or by consultants, it initially may be difficult for the responsible agency (DNRP, Bureau of Water Resources) to manage projects costing $750,000. However, after initial demonstration projects, several studies probably could be undertaken concurrently. While costs for planning would decline in the future, these costs would be replaced by costs for design and construction of retrofit projects.

Improved Maintenance

The County has two basic responsibilities with respect to maintenance:

(1) the County must inspect private facilities and use its regulatory authority to require necessary maintenance; and

(2) the County must physically inspect and maintain facilities that the County constructs or has assumed ownership of.

State regulations require that all existing facilities be inspected for maintenance at least once every three years. The County's inventory and records, which were updated in 1990, are in good order and generally of high quality. The information is in a computer inventory and is easily accessible. Bureau of Stormwater Management staff, burdened with the responsibility for post-construction inspection of new facilities, has not made maintenance inspections and enforcement a priority. Although an additional staff position is identified in the 1992 budget, it is unclear whether the additional personnel will be sufficient to meet the needs of inspecting both the older structures and newly developed ones.

During the summer of 1990, MDE inspected 62 of approximately 280 sites to ascertain their condition. While inspectors found that 76% of the sites were functioning hydrologically, most (81%) needed routine maintenance. Inspectors reported that about a third warrant immediate enforcement action (i.e., there were major repairable problems that prevent proper function, lesser repairable problems that influence function, or problems that are hazards to human safety or property).

Accurate estimation of the costs of maintaining stormwater facilities in Carroll County would require an inspection to ascertain the condition of each facility. In addition, information on the costs of different maintenance activities would be required. These data are not available. Rough estimates of maintenance costs could be developed from experience and historical records including inventory data and data from the MDE inspections, or by using engineering rules-of-thumb. The latter approach is appropriate for rough planning purposes, and is most appropriate in the present situation since historical records may not be well developed. Schuler (1986) has suggested that three to

five percent of construction costs for stormwater management facilities be allocated annually for routine and nonroutine maintenance. In Carroll County, maintenance costs are expected to be expensive at least initially because little maintenance has been performed at most of the facilities. No estimates are included herein, however, because bureaucratic responsibilities for maintenance are not well defined.

Stormwater Management National Pollutant Discharge and Elimination System (NPDES) Permits

Pursuant to Federal regulations adopted in November 1990, Carroll County must obtain NPDES permits for stormwater discharges from County facilities considered industrial activity. These include discharges from landfills, sewage treatment plants, maintenance garages, and other facilities. In addition, the County eventually may be required to obtain a NPDES permit for discharges from the separate storm sewer system maintained by the County. County staff will develop the cost estimates for these activities at an appropriate time.

3.3 Current and Projected Capital Costs

In addition to the pollution control needs identified in the previous section, County staff identified the retrofitting of existing stormwater management structures as an area that probably will require funding in the future. Estimates of the costs of retrofitting watersheds for the purposes of stream restoration or achievement of Chesapeake Bay nutrient reduction objectives depend on results of future watershed planning activities. No attempt will be made here to estimate the cost of retrofitting watersheds in Carroll County to achieve water quality goals. As watershed plans are developed, retrofitting projects can be identified and the costs can be estimated.

3.4 Trends in Costs for Stormwater Controls

Few data are available to forecast trends in costs for potential programs -- watershed planning, retrofitting, and improved maintenance. While it is conceivable that costs for watershed planning could decrease somewhat over time, it is certain that costs to achieve water quality objectives will increase as capital projects are designed and implemented. Maintenance costs also will increase, both because existing facilities will age and because more facilities will be built. These newer facilities, which will involve more complex designs for quality control, also will be more expensive to maintain. Though it is premature to try to project the costs at this time, decision makers should recognize that the costs of retrofitting and maintenance are likely to increase steadily for the foreseeable future.

Maryland, in coordination with other states in the Chesapeake Bay watershed, has mandated more stringent stormwater management practices and set ambitious nutrient reduction goals. Recent Federal amendments to the Clean Water Act will require

NPDES permits for counties and municipalities. Although Carroll County is not presently required to obtain a permit for its municipal separate storm sewer system, it may have to in the future. In addition, lands continue to be developed by the private and public sectors; this will result in additional infrastructure maintenance requirements in the future.

The recent reorganization of Carroll County's stormwater management administration complicates analysis of past trends. Data available for this report are limited, but it is possible to get a rough sense of past trends by considering trends in the two key Bureaus in DPW that handle stormwater management matters, the Bureau of Roads, and the Bureau of Engineering. These trends are very rough since they represent the totality of the bureau costs rather than just stormwater costs. Nevertheless, since the work loads of both bureaus are based on development activity, they serve as reasonable trend indicators.

Between FY 1989 (actual) and FY 91 (budget) a $256,000 (11%) increase[2] in the budget of the Bureau of Roads was recorded. During the same period, the Bureau of Engineering experienced a budget increase of 24%. It is difficult to draw firm conclusions from these figures; however, it should be noted that the newly created Bureau of Stormwater Management is taking on responsibilities once held by the Bureau of Engineering, suggesting that the effective increase in functions previously conducted solely by the Bureau of Engineering is greater than 24% over the two year period.

Indications are that maintenance of stormwater management structures has been a low funding priority for the Bureau of Parks and Facilities over the past several years. Since the County assumes ownership of all non-commercial and non-industrial structures two years after the as-built plans have been approved, it is reasonable to assume the need for maintenance funds will increase in the future. Moreover, it is likely that stormwater management costs during the next few years will increase in response to setting up and implementing the administrative apparatus needed to respond to new regulations after which costs may level off.

3.5 Cost Summary

Current direct operating costs for stormwater control are approximately $1,568,712. Proposed watershed planning could cost $750,000 annually. Annual costs for new maintenance inspection programs and maintenance of public facilities are not presently available. Costs of potential new programs are not presently available, but could be substantial depending on the scope of programs undertaken. Indirect operating costs are estimated to be $195,869 for current programs and $152,645 for proposed programs amounting to a total of $348,541. Capital costs for stormwater controls for FY 1991 are

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[2] Changes presented in this section are not adjusted for inflation.

also not presently available. Thus, the best estimate of total current and proposed operating and capital costs is $2,730,660. Options for financing these programs are discussed in the next two sections.

Although few data are available for projecting future operating and most capital costs, it is certain that costs will increase. Increases in operating budgets of key Bureaus that administer stormwater programs have been observed in recent years, but it is difficult to determine from readily available data what the actual trend in stormwater management costs have been. In general, it is reasonable to believe that costs will grow at rates higher than inflation. This has several implications, the first one being that revenues sufficient to cover present costs will be insufficient in subsequent years. Local decision makers have several options; the general revenues can be increased through increased tax or fee rates, priority changes can be made to shift resources from other programs to the stormwater management program, or new sources of revenues can be developed.

4.0 OPTIONS FOR FINANCING STORMWATER CONTROLS

This chapter examines options for financing stormwater control programs in Carroll County. Current sources of revenues are described, and alternatives for financing different activities are evaluated.

4.1 Current Sources of Revenues

Operating funds for stormwater programs come primarily form the County General Fund. Carroll County classifies all revenues in its General Fund in six categories:

- Taxes - Local
- Taxes - State Shared
- Licenses & Permits
- Grants
- Other Revenue
- Prior Year Surplus

Taxes (Local & State Shared), which include property taxes, income taxes, sales taxes, and other taxes, accounted for over 83% of the General Fund Revenues in FY 1991. Property taxes account for 40% of the tax revenues; income taxes account for an additional 31% of the tax revenues. Tax revenues are not targeted for any particular purpose; thus, it is not possible to state that any specific activity such as stormwater control is financed primarily by a specific type of tax.

These current sources of revenues for stormwater control programs are shown in Table 4 along with the functions they support. Fees and service charges have been combined in a single category and, for simplicity, the other categories have been omitted. Taxes are the largest source of revenues and are used to pay for all activities now undertaken except the construction of new stormwater management facilities, which is done by private developers (i.e., the construction of new facilities is an exaction).

Due to the lack of detail in the budget documents, it is not clear how much of current revenues for stormwater controls comes from sources other than taxes. The Maryland Department of Environment (MDE), Sediment and Stormwater Administration provides grants to the County for administration and implementation of its stormwater management program. Annual grants from MDE for stormwater management have been increasing over the past few years to $47,900 for FY 1990-91. It is uncertain whether this trend will continue in the future. With the exception of these state grants, most of the non-tax revenues come from fees for services; these cover only a fraction of the costs of regulation.

Carroll County is currently revising its fee structure for permits and plan reviews. No specific references are made in the FY 1990-91 operating budget document regarding

fees for stormwater management, and historical figures for total revenues from fees are not available. In general, relative to tax revenues and expenditures for stormwater controls, revenues from grants and service fees are small. These sources of revenues will not be discussed further in this report.

4.2 Potential Sources of Revenues

MDE has summarized methods for financing stormwater controls in Table 5. A wide variety of options seemingly are available; however, only two sources of revenues are adequate for major cost items such as operation and maintenance and debt service on general obligation or revenue bonds issued to finance retrofit and other capital projects. These are general fund tax revenue (primarily property taxes) and user charges. While property taxes are based on the value of property (land and improvements), user charges are based on some measure, usually the percentage of impervious area on a property, that correlates with or is representative of the amount of runoff that leaves a property.

In the following subsections, methods used to calculate property taxes and user charges are described and illustrated. The difference in distribution of the burden of taxes and user charges is discussed. In the illustrations, $1.5 Million dollars is used as a target figure. This figure corresponds roughly to the current operating costs (exclusive of indirect costs), and was selected to serve as a baseline value for illustrative purposes only.

Table 4

Current Sources of Revenues for Stormwater Controls

Use of Funds	Taxes	Grants, Revenue From Other Agencies	Developers, Exactions, Permits, Licenses, Service Charges
Operating Budget			
Watershed Planning Administration, Design, & Reg. Services	X	X[3]	X
Maintenance			
Conveyance System	X		
Quality Controls			
Quantity Controls	X		
Capital Budget[4]			
Retrofits			
Conveyance	X		
Quantity Controls	X		
Quality Controls	X		
New Development			
Conveyance Controls	X		X
Quantity Controls			X
Quality Controls			X

[3] Grant From SSA.

[4] Major projects may be financed with debt proceeds (i.e., bonds). Since property taxes are ultimately used to pay off bonds, taxes are listed as a source of revenue.

Table 5 Financing Methods for Stormwater Controls (MDE 1988).

Use of Revenues	Source of Revenues	Developer/ User Pays	Taxpayer Pays	Other Pays
Operations & Maintenance				
	General Fund (property tax)		X	
	Utility Fee or Service Charge	X		
	Interfund Loans (for transition to utility)		X	
Major Capital Improvements				
Redevelopment or New Development				
	General Obligation Bonds		X	
	Revenue Bonds	X		
	Taxes on other utilities			X
	Grants (federal or state; e.g., Community Development Block Grants)			X
	Pay-as-you-go Sinking Fund	X	X	
	Tax Increment Financing		X	
Primarily New Development				
	Subdivision Exactions	X		
	Developer Incentives	X		
	Impact Fees	X		
	System Development Charges	X		
	General Facilities Charge	X		
	In-lieu of Construction Charges	X		
	Latecomer Fees for Extensions	X		
Regulatory Services				
	Plan Review & Inspection Fees	X		
	On-site Facility Inspection Fees	X		
	Penalties and Fines	X		
Special Services & Projects				
	Local Improvement Districts		X	
	Utility Local Improvement Districts		X	
	Area of Special Benefit Financing		X	
	Special Purpose Taxing Districts		X	
	Homeowners' Associations			X
	Voluntary Gifts			X

4.2.1 Estimating Revenues from Property Taxes

Ad valorem taxes levied on the assessed value of real property (i.e., property taxes) are the largest single source of revenues in the County budget. The way in which a property tax works is straightforward: assessors estimate the market value of properties and then determine assessed value at a rate established by law. Currently, properties are assessed at approximately 45% of market value. For example, if a residential property is valued at $100,000, its assessed value is about $45,000. The tax rate is levied per $100 of assessed valuation. If the tax rate were $1.00 per $100 assessed valuation, the annual tax on a property with an assessed value of $45,000 (market value of $100,000) would be $450. The tax on any parcel can be determined from data in the County's tax assessment files.

Table 6 is a worksheet developed to illustrate how potential revenues from property taxes can be estimated for all of Carroll County. The worksheet uses 1990 data from the Assessments and Taxation Files.

Column C1 is the list of land use categories that Carroll County and the State Department of Assessments and Taxation use to record data about properties.

Column C2 contains the number of parcels in each land use category. For example, there were 110 parcels classified as industrial land use in Carroll County in 1990 (these data are for actual land use, not zoning).

Column C3 contains estimates of the average value of a parcel in each land use category. The average value of the 110 industrial parcels in 1990 was $1,172,636 per parcel.

Column C4 contains estimates of the average assessed value of a parcel in each category. The values in C4 were computed by multiplying the values in C3 by 0.45 (e.g., the average assessed value of an industrial parcel is $527,686 = $1,172,636 * 0.45).

Column C5 contains estimates of the taxable base in each category. The taxable base is defined here as the total assessed value. The values in C5 are computed by multiplying the number of parcels (Column C2) by the average assessed value per parcel (Column C4). For example, the tax base for industrial land use is $58,045,500 = 110 * $527,686.

Column C6 contains an estimate of a revenue requirement. In this case, the requirement is $1,500,000, a number selected to represent a rough estimate of Carroll County's operating budget for stormwater control.

Column C7 contains an estimate of the tax rate per $100 of assessed valuation necessary to meet the revenue requirement. This is calculated by dividing the revenue requirement (bottom of Column C6) by the total taxable base (total summation of Column C5) $1,500,000/$22,103,926 = $0.0679.

Column C8 contains estimates of the annual property taxes for an average-valued parcel in each category that would be required to generate the revenue requirement of $1,500,000. The values in C8 were computed by dividing the average assessed values (Column C4) by 100 and multiplying the result by $0.01. For example, the average annual tax for an industrial parcel would be $358 = ($527,686 / 100) * $0.0679.

Column C9 contains estimates of the total tax paid by all parcels in each land use category (to generate $1,500,000 in revenue). These values were calculated by multiplying the number of parcels (Column C2) by the average annual property tax (Column C8). For example, in sum, the 110 industrial parcels would pay $39,390 = $358 * 110.

Column C10 contains the percent of total tax paid by each land use category. These values were computed by dividing the amounts paid by all parcels in each land use category (Column C9) by the total revenue ($1,500,000). In sum, industrial parcels would pay $39,390.

Table 6

Illustrative Worksheet for Estimating Stormwater Revenues From Property Taxes in Carroll County, Maryland

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Land Use Category	Number of Parcels	Average Value/ Parcel	Average Assessed Value	Tax Base (x 100)	Revenue Required	Tax Rate Per $100 Valuation	Yearly Tax Per Average Parcel	Total Paid By Category	Fraction Paid By Parcel
Agriculture	1,909	128,930	58,019	1,107,573			39.37	75,161	-0.05
Commercial	1,354	355,785	160,103	2,167,798			108.65	147,109	0.10
Comm Res	0	0	0	0			0.00	0	0.00
Exempt	608	799,182	359,632	0			0.00	0	0.00
Park									
Playground									
School									
Industrial	110	1,172,636	527,686	580,455			358.09	39,390	0.03
Apartments	88	675,100	303,795	267,340			206.16	18,142	0.01
Not Perc	0	0	0	0			0.00	0	0.00
Residential									
< 1 Acre	21,973	96,452	43,403	9,537,029			29.45	647,195	0.43
> 1 Acre	11,202	130,308	58,639	6,568,696			39.79	445,760	0.30
Res Ag	888	108,881	48,996	435,088			33.25	29,526	0.02
Res Comm	1	83,100	37,395	374			25.38	25	0.00
Condominium	278	61,808	27,814	77,322			18.87	5,247	0.00
Condo Comm	0	0	0	0			0.00	0	0.00
Marshlands	0	0	0	0			0.00	0	0.00
Non-standard									
Cooperative	0	0	0	0			0.00	0	0.00
Mobil/Trailer	0	0	0	0			0.00	0	0.00
Group Quar	0	0	0	0			0.00	0	0.00
Motel	0	0	0	0			0.00	0	0.00
Forest Cons	0	0	0	0			0.00	0	0.00
Detached S-F									
0 - .5 Ac	0	0	0	0			0.00	0	0.00
> .5 - 1 Ac	0	0	0	0			0.00	0	0.00
> 1 Acre	0	0	0	0			0.00	0	0.00
Garden Apt.	0	0	0	0			0.00	0	0.00
High Rise	0	0	0	0			0.00	0	0.00
Other	0	0	0	0			0.00	0	0.00
Total (Dev.)	38,411			20,741,675				1,407,556	0.94
Unimproved	9,663	31,328	14,098	1,362,251			9.57	92,444	0.06
Grand Total	48,074			22,103,926	$1,500,000	0.0679		$1,500,000	1.00

Note: This illustration was developed under the assumption of a $1.5 Million revenue requirement (1990 Data).

4.2.2 Estimating Revenues from User Charges

Estimating potential revenues from charges in a jurisdiction is a straightforward process of summing up the individual user charges for all of the rate payers in the rate base. In this context the rate base is defined as the land use categories[5] that will be assessed charges.

For planning purposes, the procedure is simplified by grouping users according to similar land uses and estimating the average charge based on the average-sized parcel within each land use category. The charge for the average parcel in each land use category is multiplied by the number of parcels within its category yielding total revenue by category. These are then summed across categories to give an estimated total revenues for the jurisdiction.

This procedure is described in further detail in the example below. In this particular case, residential user charges (for parcels less than one acre) were fixed at a rate that would generate $1.5 Million. This will allow a direct comparison with the property tax procedure described in the previous section. Table 7 is a worksheet used to facilitate the procedure; the purpose of each column is described below.

It is not the intent of this section to explore user charge systems in depth. It is worth noting, however, that user charge algorithms allow considerable flexibility in adjusting the distribution of charges among different land use categories. Six alternative user charge systems are presented in Appendix B. These provide a sense of the available options and illustrate different resulting distributions of charges.

Column C1 is the name of the land use category. In the cases of Exempt and Residential land uses, subcategories are defined to allow finer distinctions in stormwater runoff characteristics.

Column C2 is the number of parcels in each land use category.

Column C3 is the average parcel size for each land use category expressed in acres. For the Residential land use category, weighted average parcel sizes were calculated for parcels greater than, and less than one acre using the data displayed in Appendix A.

Column C4 contains the user charge rate factors, which represent the typical percentage of impervious cover on a property. For example, the rate factor for industrial parcels is 0.70 implying that, on average, about 70% of each industrial parcel is covered by impervious material. These factors reflect standard hydrologic runoff coefficients such as those used in the Rational Method of runoff estimation.

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5 Land use categories are standard descriptive classifications (e.g., industrial, commercial, residential, undeveloped, and others). As an approximation, it is assumed that stormwater runoff characteristics per unit area are the same for all parcels in a given land use category.

For three land use categories (two Residential, and Residential Agriculture) the rate factor is not applicable (na) because the average impervious area was fixed based on information in the engineering literature. This practice is one means of ensuring that user charges for residential parcels greater than one acre do not differ vastly from charges for parcels less than or equal to one acre. Other approaches described in Appendix B do not rely on fixing the area.

This column can also be used to control whether or not a land use category is included in the rate base. Table 7 illustrates a case in which zero values are inserted for agriculture, exempt, and unimproved land use categories thereby excluding them from the rate base.

Column C5 is the average impervious area per parcel for each land use category. This average impervious area is expressed in square feet. The values are calculated as the (average acres per parcel) x (proportion of impervious area) x (43,560 ft/acre). That is, (C3) x (C4) x (43,560 ft/acre). Note, (C4) is the rate factor. As noted in the description of C4, the impervious area was fixed for three of the land use categories rather than being based on this calculation.

Column C6 is the number of Single Family Equivalent (SFE) units. An SFE is defined as the ratio: (impervious area of an average parcel for a given land use) / (average impervious area of a residential parcel less than 1 acre). In the worksheet it is calculated as C5/C5* where C5* is the particular value of C5 for Residential < 1 Acre[6], which in this case is 3,000 square feet[7].

For the purposes of this study, this dimensionless unit equals one for a typical single family living on a residential parcel of less than 1 acre. Since most people are familiar with residential land use, SFEs allow a comparison among land use categories based on a familiar measure. Once defined, SFEs also facilitate the user charge calculations, although they are not necessary to meet these ends.

Column C7 is the number of SFEs per land use category. This is equal to the average number SFEs per parcel multiplied by the number of parcels in the given land use category. That is, (C2) x (C6). The column is summed to a total at the bottom.

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[6] Most of the alternative approaches presented in Appendix B of this report define the SFE with respect to the average parcel size among residential parcels less than one acre. In one approach, however, the delineation of the residential land use is much finer. In that case, the SFE is defined with respect to the average parcel size among residential parcels less than 1/4 acre. As a consistent rule, all of the approaches presented in this report define SFEs with respect to the smallest subclassification of residential land use. Furthermore, when referring to the smallest subclass the term "typical residential parcel" is used.

[7] The amount of square feet in an SFE for a given county could be calculated by multiplying a runoff coefficient times the average parcel size. The decision to select a value of 3,000 sq.ft. here was motivated by the desire to standardize SFE charges across all counties for a state-wide study (George, J., 1991).

Column C8 is the Total County Revenue Generated per year. It is the product of $15.24 (the charge per SFE) times the sum of column C7 (the grand total number of SFEs for the county).

Column C9 is the charge per SFE, which in the present case is $15.24/SFE. It is calculated as the fraction (C8*) / (C7*) where the star indicates the values that are used are from the bottom of the respective column.

Column C10 is the typical annual charge for each land use category. It is the amount that would be paid by the owner of an average sized parcel in the given land use category. It is calculated as the typical number of SFEs times the charge per SFE ($15.24), or (C6) x (C9*) where the star indicates the value is from the bottom of the column.

Column C11 is the total amount of revenue generated by a given land use category. It is the product of the average annual charge and the number of parcels for the given land use category. It is calculated as (C10) x (C2).

Column C12 is the percentage of the total revenue paid by the given land use category. It is the total revenue per category divided by the grand total revenue for the entire county. It is calculated as (C11) / (C8*) where the star indicates the value is from the bottom of the column.

Table 7

Illustrative Worksheet for Estimating Revenues from Stormwater User Charges in Carroll County, Maryland

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Land Use Category	Number of Parcels per Land Use	Average Acre/ Parcel	Rate Factor (% Imp.)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs per Parcel	Number of SFEs per Land Use Category	Revenue Requirement ($)	Dollars Per SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,354	2.8	0.82	100,014	33.34	45,140			508.18	688,076	0.46
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	105.71	11,628			1,611.30	177,243	0.12
Apartments	88	1.7	0.64	47,393	15.80	1,390			240.81	21,191	0.01
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.46	na	3,000	1.00	21,973			15.24	334,941	0.22
> 1 Acre	11,202	3.14	na	4,500	1.50	16,803			22.86	256,133	0.17
Res Ag	888	11.5	na	4,500	1.50	1,332			22.86	20,304	0.01
Res Comm	1	1.0	0.64	27,878	9.29	9			141.65	142	0.00
Condominium	278	0.05	0.64	1,394	0.46	129			7.08	1,969	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshlands	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Trailer	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					98,404				$1,500,000	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					98,404	$1,500,000	$15.24		$1,500,000	1.00

Note: This illustration was developed under the assumption of a $1.5 Million revenue requirement (1990 Data).

4.2.3 Advantages and Disadvantages of Taxes and User Charges

Because property taxes and user charges are based on different measures (i.e., property values and impervious area, respectively), their respective burdens on any particular property owner differ. Table 8 was developed to illustrate how much owners of average valued and average sized parcels would have to pay under each system. Table 8 also includes data about the percentage of total revenues that would be paid by each land use category.

The distribution of payments under the two systems is significantly different. Residential property owners generally would pay less under a charge system, while nonresidential users generally would pay less under a tax system. For example, to raise $1,500,000 in taxes, the owner of a residential property valued at $96,452 would have to pay $29 annually, while the owner of an industrial property valued at $1,172,636 would have to pay $358 annually.

Under a charge system, the owner of a residential property less than or equal to one acre in size would pay only $15.24 annually, while the owner of an industrial property 10.4 acres in size would pay about $1,611 annually. This scenario indicates that the commercial sector would bear the bulk of the cost at 46% with the residential sector bearing 39%. The largest annual user charges of $1,611 would be paid by property owners in the industrial sector. The largest change in payments between the tax and user charge systems would fall equally on both the commercial and industrial sectors, and would be a four fold increase.

A prominent feature of Table 8 is the exclusion of Agricultural and Unimproved land use categories from the rate base for the charge system. Whereas the current scenario explores the case in which these two land uses are not charged, Table 9 below specifically explores the case in which they are included in the rate base.

An alternative distribution of charges is presented in Table 9 under the assumption that agricultural and undeveloped lands are included in the rate base. While it is unlikely that agricultural property owners would be charged, this example is useful because it illustrates the flexibility of the user charge approach. Based on the charge structure used to develop Table 9, agricultural property owners would experience a ten fold increase in payments in going from the tax system to the charge system (i.e., on average $39 property tax, and $413 user charge)[8]. This result is a direct reflection of the tax system being property-value based, and the user charge system being directly proportional to runoff characteristics. Agricultural property taxes on large parcels (average, 77 acres) of relatively inexpensive land are comparable to the taxes paid on small, high valued residential parcels (average, 0.46 acres); however, when land size is taken into consideration, as it is in the case of user charges, the cost to agricultural property owners naturally increases.

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[8] It is important to note that a rate factor of 0.10 was used for agriculture. If it were desirable to decrease the contribution from this land use category, the rate factor could be reduced (e.g., a factor of 0.025 would result in an average annual charge of about $104).

Table 8

Typical Annual Charges and Property Taxes Necessary to Generate $1,500,000 (Agricultural and Unimproved Parcels Excluded From Rate Base)

Land Use Category	Average User Charge ($/Year)	Average Property Tax ($/Year)	Percent of Total Charges	Percent of Total Taxes
Agriculture	0	39	0%	5%
Commercial	508	109	46%	10%
Industrial	1,611	358	12%	3%
Apartments	58	206	1%	1%
Residential < 1 acre	15	29	22%	43%
Residential > 1 acre	23	40	17%	30%
Res Agriculture	23	33	1%	2%
Condominium	7	19	<1%	<1%
Total Developed			100%	94%
Unimproved	0	10	0%	6%
Grand Total			100%	100%

Notes: Data is based on the illustrations summarized in Tables 6 and 7.

Table 9

Typical Annual Charges and Property Taxes Necessary to Generate $1,500,000 (Agricultural and Unimproved Parcels Included In Rate Base)

Land Use Category	Average User Charge ($/Year)	Average Property Tax ($/Year)	Percent of Total Charges	Percent of Total Taxes
Agriculture	413	39	53%	5%
Commercial	123	109	11%	10%
Industrial	390	358	3%	3%
Apartments	58	206	<1%	1%
Residential < 1 acre	4	29	5%	43%
Residential > 1 acre	6	40	4%	30%
Res Agriculture	6	33	<1%	2%
Condominium	2	19	<1%	<1%
Total Developed			77%	94%
Unimproved	36	10	23%	6%
Grand Total			100%	100%

Notes: The user charge data was drawn from Worksheet B-5 in Appendix B. The tax data was drawn from the example summarized above in Table 6.

The differences that exist between the tax based system and user charge systems raise a number of issues related to the fairness of the systems. In addition, because the two systems are based on different measures, different administrative costs are implied.

The advantages and disadvantages of property taxes and user charge financing systems can be compared by many measures. Several typical areas for comparison are summarized below:

- Ease and cost of administration;
- Elasticity of the revenue source;
- Deductibility;
- Stability of the revenue source;
- Fairness of the revenue measure; and
- Whether the system provides incentives for environmental controls.

Ease and Cost of Administration

Continued reliance on property taxes to finance stormwater controls would involve no change from existing practice; therefore, a property tax financing system would be easier and cheaper to administer than a user charge system. Creation of a stormwater user charge system could involve reorganization of various departments within the County and new responsibilities for various departments. Significant expenses could be involved with creation of a new billing system, particularly if the amount of impervious cover on each nonresidential parcels were digitized from aerial photos to determine the appropriate bill. The equivalent of four to six months of the first year's revenues could be required to pay for creation of the user charge system. The County Board of Commissioners would have to enact ordinances that establish the utility and rate structures.

Elasticity of Revenue Source

The elasticity of a revenue source refers to its ability to generate increased revenues without changes in the rate structure. Property taxes generally are considered elastic because the property owners pay more taxes and revenues to the County increase -- even without increases in the tax rate -- because of appreciation of property values. If property values stagnate or decline, then tax revenues also could decline.

User charges generally are not considered elastic. Although revenues from charges may increase if additional properties are developed, charges to any specific property owner will not inflate over time. Specific decisions by the County Council would be required to increase rates. While this may be desirable from the perspective of making the Council accountable, opposition to the rate hikes could delay implementation of rate increases necessary for funding essential activities.

Deductibility

Individuals may deduct the cost of property taxes from their income when computing income taxes. Thus, to some degree, the cost of property taxes is offset. User charges such as water and sewer bills generally are not considered deductible. In some cases stormwater user charge bills appear as line items on property tax bills. If the charges were included on the property tax bill, it is not clear whether they would be considered deductible.

Stability of Revenue Source

Under a property tax system, stormwater control programs must compete with other necessary government functions for limited revenues. Historically, these programs have not fared well in budget allocation processes because they have been given low priority. As a result, stormwater controls have been poorly funded, particularly with respect to maintenance activities (which can be deferred) and water quality programs (because people did not recognize the need for them). Given that competition for limited revenues from property taxes is expected to increase in the future, creation of a dedicated revenue source through a user charge system is considered to be a more stable method of funding than continued reliance on a property tax system. This is because all user charges would be placed into a restricted account that could be used only for stormwater programs.

Fairness of Revenue Measures

The fairness of a charge or tax can be evaluated from a variety of perspectives. One perspective is that a tax or charge is fair if one pays in relation to the extent one uses or benefits from the facilities or programs provided with the revenues from the tax. For example, user fees are considered an equitable method of financing water utilities because it seems fair to charge people for the amount of water they use. A related notion, commonly called the polluter pays principle, is that people should pay to the extent they create a pollution problem that the government must solve. This principle suggests that those who cause water pollution should pay for water quality programs. A different perspective is that a fair charge is one that is somehow related to one's ability to pay (e.g., a progressive income tax).

It is thought that a user charge approach might be more fair than a property tax from all of these perspectives. If owners of property that generate runoff are thought of as "users" of the public drainage and stormwater management system, the user charge approach is clearly more fair than a property tax approach. This is because the size of the parcel and amount of impervious area of a property, which are the bases of the user charge, are determining factors in the amount of runoff from a property; property value is not as directly related to the amount of runoff from a parcel of land. From the polluter pays perspective, the user charge approach also would be considered more equitable. That is, if new programs are required to control pollution from runoff, it seems fair that the people who generate the runoff should pay. Finally, from the ability to pay perspective, charges may be more fair

than taxes. This is shown in Tables 8 and 9 above. Most residential users would pay less under a charge system than they would under a property tax system, while nonresidential property owners such as industrial and commercial would pay more under a charge system. Although it depends on one's perspective, it can be argued that nonresidential property owners (e.g., industrial) have a greater ability to pay than residential owners. Nonresidential property owners, at least, can pass the costs along and the charge can be viewed as cost of running a business in an environmentally sound manner. Overall, financing stormwater controls with user charges is considered to be more fair than financing with property taxes.

Incentives for Environmental Controls

User charge systems are preferable to property tax systems because they provide incentives for property owners to provide environmental controls. That is, if property owners know that they will be charged according to the amount of impervious cover on their property, they have an incentive to minimize cover, thereby reducing runoff. Property tax systems provide no incentives because they are not based on factors related to runoff. One problem with incentives for controls is that if numerous property owners (or a few large ones) reduce the amount of runoff they generate, total revenues might be reduced. Most existing user charge systems allow nonresidential property owners to earn credits against user charges by controlling runoff on-site. Awarding credits is equivalent to reducing the rate base. If credits were granted for on-site controls, either total revenues would decrease, or the charge per unit would have to be increased proportionately for all other property owners.

The development of a stormwater user charge system coupled with a credit system for on-site controls may provide incentives for implementation of best management practices (construction of runoff control structures). For example, if agricultural parcels were in the rate base, credits could be extended to owners of agricultural property who implement Soil Conservation District approved conservation plans. A credit system also would make the rate structure more fair. That is, people in new developments who already are required by State law to pay for on-site controls would not have to pay again. While some level of credit is reasonable, it may be desirable not to completely eliminate payment. On-site controls do not eliminate all stormwater discharges. Since downstream water quality is a public good, one approach is to have all property owners pay something. One consistent approach to determining a policy on the minimum payment-after-credit is to have that payment structure equal the amount paid by owners of undeveloped property.

General conclusions about these relative advantages (+) and disadvantages (-) of property tax and user charge financing systems are presented in Table 10. For this discussion, we assume that the user charge system is implemented through the creation of a utility.

Table 10 - Advantages and Disadvantages of Taxes and User Charge Systems

Evaluation Criterion	User Charge	Property Tax
Ease of Administration	-	+
Cost of Implementation	-	+
Elasticity of Revenues	-	+
Deductibility	?	+
Stability of Revenues	+	-
Fairness		
User (Polluter) Pays	+	-
Ability to Pay	+	-
Incentives for Controls	+	-

4.3 Summary, Conclusions, and Recommendations

Carroll County presently finances most operating expenses for stormwater controls with revenues from the General Fund. Taxes are the single largest source of revenues in the General Fund. Property taxes account for about 51% of all taxes in the Fund, and 42% of all operating budget revenues. Income taxes are the second major source of revenues. Grants, fees, and service charges account for a small portion of the revenues currently used to finance stormwater controls.

For major expense items, particularly those functions currently considered deficient (operations and maintenance, watershed planning, and retrofitting), property taxes and user charges are the most viable options for increasing revenues. Each has advantages and disadvantages. The distribution of fees paid by property owners depends on the type of financing system that is used. Residential property owners typically would pay less under a charge system than a tax system, while many nonresidential property owners (e.g., industrial and commercial) would pay more under a charge system. The amount of charges under a user charge system depends on the categories of land uses included in the rate base. If a user charge system were implemented, the County Board would have to make a number of significant, complex policy decisions. These would include deciding which land use categories of parcels to include in the rate base[9].

[9] As a supplement to this report, MDE has appended several findings of the Baltimore County Stormwater Management Committee, which has recently recommended the formation of a stormwater user charge system (See Appendices C and D). These supplements may help provide insights about issues that are far off on the time horizon from the perspective of Carroll County decision makers.

5.0 SUMMARY AND ADDITIONAL CONSIDERATIONS

The preceding sections have covered a wide range of issues associated with financing stormwater controls in Carroll County. The report reviews the administrative organization and responsibilities, estimates the revenues required to fund most stormwater control programs, summarizes primary options for financing stormwater controls (property taxes and user charges), and discusses the advantages and disadvantages of property taxes and user charges. Due to the Carroll County organizational structure being in flux, some of the material in this report is dated. Revenue requirements for stormwater controls cannot be estimated accurately until the structure has been established and administrative experience has been acquired.

While the primary intent of this document is to facilitate the decision making process with regard to alternative stormwater control financing options, this document also has the potential to encourage internal discussion of particular agency roles and relationships that can lead to more efficient operations.

The two primary alternatives available for financing stormwater controls are property taxes and stormwater utility charges. Charges appear to be advantageous for a number or reasons including increased stability of revenues, fairness, and providing incentives for controls that benefit the environment. The advantages of a property tax includes elasticity of revenues, federal tax deductibility, ease of administration and resulting lower cost of implementation.

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Appendix B

Six Alternative Algorithms for Deducing Stormwater User Charges

Six alternative approaches for estimating revenues generated by a user charge approach are briefly described below. These charge structure algorithms are primarily intended to demonstrate the flexibility of the user charge approach and are not intended to be exhaustive. It should also be noted that these algorithms, while similar to algorithms used to implement an actual user charge system, are solely intended for use in estimating potential revenues.

Summary Descriptions of Six Alternative User Charge Approaches

The six different approaches are identified by simple names and numbers. The six approaches summarized below are: Fixed SFE (3,000), Fixed SFE (4,000), Quantile, Detailed, Simplified, Grouped RF (Rate Factors).

Note that for each approach the rate base can be changed (i.e., assessing or not assessing charges for a particular land use category). This represents another layer of options that could be explored. For our purposes, all six of the approaches were investigated both including and excluding the agricultural and unimproved land use categories.

Approach 1 "Fixed SFE (3,000)": The name of this approach is drawn from the fact that the residential SFEs were fixed by professional judgment to 3,000 square feet for residential parcels less than one acre in area[1].

The residential category is divided into two groups: parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

3,000 sq. ft. impervious for parcels < 1 acre (This defines the unit SFE)
4,500 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

Approximately six different rate factors are used for the different land use categories. This represents a degree of specificity of the rate factors that is mid-ranged with respect to the other approaches.

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1 This value is based on typical values found in the technical literature. In Approach 2 this value is fixed at 4,000 sq. ft..

Approach 2 "Fixed SFE (4,000)": Like Approach 1, the residential category is divided into two groups: parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

4,000 sq. ft. impervious for parcels < 1 acre (This defines the unit SFE)
6,000 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

Approximately six different rate factors are being used for different land use categories. This represents a degree of specificity of the rate factors is mid-ranged with respect to the other approaches.

From the standpoint of not over estimating the potential revenues, this approach is more conservative than Approach 1. At first glance, it may seem counter intuitive that using a higher impervious area for residential parcels would produce a lower revenue estimate. To see how this works, consider the following example in which a comparison is made between SFEs defined to be 4,000 sq.ft./SFE versus 3,000 sq.ft./SFE.

A commercial parcel of 12,000 sq.ft. of impervious area under the Fixed SFE (4,000) approach pays $20/SFE or (12,000/4,000) x $20/ sq.ft. = $60. Under the Fixed SFE (3,000) approach, the same commercial parcel is assessed (12,000/3,000) x $20/ sq.ft. = $80. In both approaches, the same amount of revenue is generated by the residential parcels because their rates are fixed by definition at $20 and $30 per parcel for the two residential subcategories. Consequently, the residential land use category does not contribute to differences in the projected revenue.

Approach 3 "Quantile": Again, the residential category is divided into two groups: Res. < 1 acre, and Res. > 1 acre. Rate factors are used to determine SFEs for the residential land use category rather than fixing the charge as in Approaches 1 and 2.

This approach corrects for sharp differences in user charges between smaller and larger parcels that arise when the residential land use category is broken into two categories and mean acreage values are used to represent typical parcel size. An alternative to the use of mean acreage values, which are often skewed by infrequent extreme values, is to use the median (50th percentile) parcel size for parcels less than one acre and the 90th percentile size as the typical value for parcels greater than one acre[2].

The level of specificity of rate factors is slightly increased above that of Approaches 1 and 2 with approximately eight different rate factors being used for different land use categories.

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[2] It is the parcel size below which 90 percent of the parcels are smaller, or stated the another way, is the parcel size for which only 10 percent of the parcels are larger.

Approach 4 "Detailed": For this approach, the residential category is divided into about 20 acreage intervals according to the data available (See Appendix A above). In addition to the high level of specificity of the residential category, the rate factors are highly detailed since a different rate factor is assigned to each of the 20 residential acreage categories. The SFEs for residential parcels are all computed using rate factors as opposed to being fixed.

This approach represents the most detailed revenue estimation approach of the study, although it is quite simplified in comparison to actual implementation methods.

Approach 5 "Simplified": This approach was motivated by a key aspect of the approach used in Austin, Texas, which classifies each land use category into one of three rate factor groups 0.10, 0.40, or 0.80.

This approach uses rate factors to determine the SFE for the residential parcels < 1 acre, but fixes the SFE for parcels > 1 acre at 1.5 SFEs. Consequently, the value of the unit SFE can rise and fall for different estimates between counties, while the SFE for parcels > 1 acre follows that rise and fall. This combined use of rate factors to compute the unit SFE and fixed SFEs for the parcels > 1 acre is referred to a hybrid treatment of residential SFEs.

This approach derives its name from the fact that it is characterized by having two simplified features: the collapsed rate factors and only two residential categories.

Approach 6 "Grouped RF": This approach is based loosely on the Ft. Collins, Texas approach, which attempts to minimize administrative burdens and contested charges by aggregating users into relatively broad rate factor categories.

Like the Detailed Approach, the level of specificity of the residential category is highly detailed, and the SFEs for residential parcels are all computed using rate factors. Unlike the Detailed Approach, however, the level of specificity of the rate factors is simplified by grouping (hence the name Grouped RF).

The SFE was calculated as (0.60) x (mean acreage) using the smallest residential acreage interval (0 - 0.25 acres), where 0.60 is the rate factor.

Summary Results of Revenue Estimates Based on the Six Approaches

Table B-1 and Table B-2 present the results of the six revenue estimation approaches under two scenarios. Table B-1 excludes agricultural and unimproved land uses and Table B-2 includes these two land uses. Note that the second case (Table B-2) is directly comparable to the property tax approach, which also levies costs on the agricultural and unimproved lands.

The six revenue estimates were all developed under the assumption that residential parcels less than or equal to 1 acre in size would be charged $20 a year. This assumption contrasts with an approach where by a single revenue target (e.g., $1.5 Million) is specified for all six approaches, and annual residential fees are allowed to vary to meet the target. Recall that for the Detailed Approach the Grouped RF Approach residential parcels are divided into numerous subcategories. For residential parcels less than one acre are grouped into one of three categories: those below 0.25 acre, those greater than 0.25 acre and less than 0.5 acre, and those greater than 0.5 acre and less than 1.0 acre. Consequently, the dollar amount in the column for "Residential, < 1 acre" (Tables B-1 and B-2) is the weighted averages of the charges associated with these three categories (weighted by number of parcels).

Table B-1

Revenues and Payment Distributions for Six Alternative Stormwater User Charge Structures (Agricultural Land Use Excluded)

Percentage Paid by Category
(Cost per Average Parcel Size)

	Revenues	Residential <1 acre	Residential >1 acre	Commercial	Industrial	All Others
Fixed SFE 3,000	$1,968,080	22% ($20)	17% ($30)	46% ($667)	12% ($2,114)	3%
Fixed SFE 4,000	$1,676,600	26% ($20)	20% ($30)	40% ($500)	10% ($1,586)	4%
Quantile	$1,792,120	25% ($20)	38% ($60)	23% ($310)	6% ($983)	8%
Detailed	$2,132,460	24% ($24)	28% ($51)	30% ($471)	8% ($1,493)	10%
Simplified	$1,316,240	33% ($20)	26% ($30)	24% ($237)	7% ($882)	10%
Grouped RF	$2,448,080	18% ($20)	25% ($53)	28% ($489)	6% ($1,387)	23%

Table B-2

Revenues and Payment Distributions for Six Alternative Stormwater User Charge Structures (Agricultural Land Use Included[3])

Percentage Paid by Category
(Cost per Average Parcel Size)

	Revenues	Residential <1 acre	Residential >1 acre	Commercial	Industrial	Agricultural	All Others
Fixed SFE 3,000	$6,236,760	7% ($20)	5% ($30)	14% ($667)	4% ($2,114)	68% ($2,236)	2%
Fixed SFE 4,000	$4,878,100	9% ($20)	7% ($30)	14% ($500)	4% ($1,586)	66% ($1,677)	1%
Quantile	$3,778,520	12% ($20)	18% ($60)	11% ($310)	3% ($983)	53% ($1,040)	3%
Detailed	$5,147,700	10% ($24)	12% ($51)	12% ($471)	3% ($1,493)	59% ($1,579)	4%
Simplified	$2,874,400	15% ($20)	12% ($30)	11% ($489)	3% (1,387)	54% ($816)	5%
Grouped RF	$5,714,580	7% ($20)	9% ($53)	12% ($489)	3% ($1,387)	57% ($1,711)	12%

Table B-1 and Table B-2 were developed using two sets of worksheets provided on the following pages (Worksheet Set B-1 excludes agricultural land use from the rate base, and Worksheet Set B-2 includes agricultural land use in the rate base).

In addition, worksheets for the Fixed SFE (3,000) Approach are provided for three cases in which $1.5M is set as the revenue target. The first case, Worksheet B-3, excludes agricultural and unimproved parcels from the rate base. The second case, Worksheet B-4 brings agriculture into the rate base, but excludes unimproved parcels. The third case, Worksheet B-5, includes both agriculture and unimproved parcels in the rate base.

Finally, two work sheets using the property tax approach are provided. The first case, Worksheet B-6, is designed to meet a $1.5M revenue target, and is directly comparable to the user charge approach presented in Worksheet B-5 noted above. The second property tax case, Worksheet B-7, was developed by fixing the residential rate at $20 per year. This allows comparison with the user charge work sheets that fix residential charges at $20 per year. It should be remembered when making comparisons that the property tax approaches include both agricultural and unimproved parcels in the rate base, where as some of the cases based on user charge approaches do not include both of these land use categories.

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[3] A relatively small rate factor of 0.10 was used for agricultural land use as compared with 0.80 - 0.82 for commercial, and 0.60 - 0.70 for industrial.

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ACREAGE INTERVALS	IMPROVED PARCELS(ACRES SPECIFIED) NUMBER OF PARCELS	PERCENT OF TOTAL PARCELS	CUMULATIVE NUMBER OF PARCELS	CUMULATIVE % OF TOTAL PARCELS	ACREAGE NUMBER OF ACRES	PERCENT OF TOTAL ACRES	CUMULATIVE NUMBER OF ACRES	CUMULATIVE % OF TOTAL ACRES	AVERAGE ACREAGE	CUMULATIVE AVERAGE ACREAGE
0 - .25	6662	20.08	6662	20.08	973	2.15	973	2.15	.15	.15
>.25 - .5	6602	19.90	13264	39.98	2597	5.74	3570	7.89	.39	.27
>.5 - 1.0	8709	26.25	21973	66.23	6436	14.22	10006	22.10	.74	.46
>1.0 - 1.5	4172	12.58	26145	78.81	4948	10.93	14953	33.03	1.19	.57
>1.5 - 2.0	1509	4.55	27654	83.36	2641	5.83	17594	38.86	1.75	.64
>2.0 - 3.0	1736	5.23	29390	88.59	4261	9.41	21855	48.28	2.45	.74
>3.0 - 5.0	2188	6.60	31578	95.19	8086	17.86	29941	66.14	3.70	.95
>5.0 - 10.0	1228	3.70	32806	98.89	7999	17.67	37939	83.80	6.51	1.16
>10.0 - 15.0	223	.67	33029	99.56	2649	5.85	40589	89.66	11.88	1.23
>15.0 - 20.0	72	.22	33101	99.78	1223	2.70	41812	92.36	16.99	1.26
>20.0 - 30.0	36	.11	33137	99.89	849	1.87	42660	94.23	23.57	1.29
>30.0 - 40.0	13	.04	33150	99.92	437	.97	43098	95.20	33.65	1.30
>40.0 - 50.0	9	.03	33159	99.95	411	.91	43509	96.11	45.72	1.31
>50.0 - 75.0	7	.02	33166	99.97	444	.98	43953	97.09	63.37	1.33
>75.0 - 100.0	3	.01	33169	99.98	246	.54	44199	97.63	81.97	1.33
>100.0 - 150.0	3	.01	33172	99.99	414	.92	44613	98.55	138.10	1.34
>150.0 - 200.0	2	.01	33174	100.00	312	.69	44925	99.24	156.00	1.35
>200.0 - 300.0	0	.00	33174	100.00	0	.00	44925	99.24	.00	1.35
>300.0 - 500.0	1	.00	33175	100.00	346	.76	45271	100.00	345.90	1.36
>500.0 - 750.0	0	.00	33175	100.00	0	.00	45271	100.00	.00	1.36
>750.0 - 1000.0	0	.00	33175	100.00	0	.00	45271	100.00	.00	1.36
>1000.0 - 10,000	0	.00	33175	100.00	0	.00	45271	100.00	.00	1.36
>10,000	0	.00	33175	100.00	0	.00	45271	100.00	.00	1.36
	UNIMPROVED PARCELS (ACRES SPECIFIED)				ACREAGE					
0 - .25	1469	21.28	1469	21.28	209	1.20	209	1.20	.14	.14
>.25 - .5	977	14.15	2446	35.43	361	2.07	569	3.27	.37	.23
>.5 - 1.0	1003	14.53	3449	49.96	755	4.34	1325	7.62	.75	.38
>1.0 - 1.5	830	12.02	4279	61.99	1000	5.75	2325	13.37	1.20	.54
>1.5 - 2.0	381	5.52	4660	67.51	669	3.85	2994	17.21	1.76	.64
>2.0 - 3.0	550	7.97	5210	75.47	1378	7.92	4372	25.14	2.51	.84
>3.0 - 5.0	873	12.65	6083	88.12	3220	18.52	7592	43.66	3.69	1.25
>5.0 - 10.0	531	7.69	6614	95.81	3596	20.68	11188	64.33	6.77	1.69
>10.0 - 15.0	151	2.19	6765	98.00	1856	10.67	13045	75.01	12.29	1.93
>15.0 - 20.0	58	.84	6823	98.84	989	5.69	14033	80.69	17.05	2.06
>20.0 - 30.0	47	.68	6870	99.52	1122	6.45	15155	87.15	23.87	2.21
>30.0 - 40.0	12	.17	6882	99.70	403	2.32	15558	89.46	33.57	2.26
>40.0 - 50.0	8	.12	6890	99.81	352	2.02	15910	91.49	43.99	2.31
>50.0 - 75.0	6	.09	6896	99.90	352	2.03	16262	93.51	58.72	2.36
>75.0 - 100.0	2	.03	6898	99.93	177	1.02	16440	94.53	88.65	2.38
>100.0 - 150.0	3	.04	6901	99.97	312	1.79	16751	96.32	103.87	2.43
>150.0 - 200.0	1	.01	6902	99.99	177	1.02	16929	97.34	177.40	2.45
>200.0 - 300.0	0	.00	6902	99.99	0	.00	16929	97.34	.00	2.45
>300.0 - 500.0	1	.01	6903	100.00	462	2.66	17391	100.00	462.00	2.52
>500.0 - 750.0	0	.00	6903	100.00	0	.00	17391	100.00	.00	2.52
>750.0 - 1000.0	0	.00	6903	100.00	0	.00	17391	100.00	.00	2.52
>1000.0 - 10,000	0	.00	6903	100.00	0	.00	17391	100.00	.00	2.52
>10,000	0	.00	6903	100.00	0	.00	17391	100.00	.00	2.52

NO. OF IMP. PARCELS, ACREAGE SPECIFIED 33175 (100.0)
NO. OF IMP. PARCELS, ACREAGE NOT SPEC. 0 (.0)
TOTAL 33175

NO. OF UNIMPROVED PARCELS, ACREAGE SPECIFIED 6903 (100.0)
NO. OF UNIMPROVED PARCELS, ACREAGE NOT SPEC. 0 (.0)
TOTAL 6903

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LAND USE	IMPROVED NO. OF PARCELS ACRES SPEC.	IMPROVED ACRES	IMPROVED AVERAGE ACRES	IMPROVED NO. OF PARCELS ACRES NOT SPEC	IMPROVED TOTAL ACRES	UNIMPROVED NO. OF PARCELS ACRES SPEC.	UNIMPROVED ACRES	UNIMPROVED AVERAGE ACRES	UNIMPROVED NO. OF PARCELS ACRES NOT SPEC	UNIMPROVED TOTAL ACRES	TOTAL PARCELS	TOTAL ACRES
AGRICULTURAL	1909	146961	77.0	0	146961	589	30467	51.7	0	30467	2498	177428
COMMERCIAL	1354	3751	2.8	0	3751	371	1339	3.6	0	1339	1725	5090
COMM RES	0	0	.0	0	0	0	0	.0	0	0	0	0
EXEMPT	608	10955	18.0	0	10955	524	7040	13.4	0	7040	1132	17995
INDUSTRIAL	110	1142	10.4	0	1142	113	672	5.9	0	672	223	1814
APARTMENTS	88	147	1.7	0	147	4	5	1.3	0	5	92	152
NOT PERC	0	0	.0	0	0	0	0	.0	0	0	0	0
RESIDENTIAL	33175	45270	1.4	0	45270	6903	17391	2.5	0	17391	40078	62661
RES AGR	888	10229	11.5	0	10229	1159	8240	7.1	0	8240	2047	18469
RES COMM	1	1	1.0	0	1	0	0	.0	0	0	1	1
CONDOMINIUM	278	14	.1	0	14	0	0	.0	0	0	278	14
CONDO COMM	0	0	.0	0	0	0	0	.0	0	0	0	0
MARSHLAND	0	0	.0	0	0	0	0	.0	0	0	0	0
DISTRICT TOTAL	38411	218470		0	218470	9663	65154		0	65154	48074	283624

Appendix B

Six Alternative Algorithms for Deducing Stormwater User Charges

Six alternative approaches for estimating revenues generated by a user charge approach are briefly described below. These charge structure algorithms are primarily intended to demonstrate the flexibility of the user charge approach and are not intended to be exhaustive. It should also be noted that these algorithms, while similar to algorithms used to implement an actual user charge system, are solely intended for use in estimating potential revenues.

Summary Descriptions of Six Alternative User Charge Approaches

The six different approaches are identified by simple names and numbers. The six approaches summarized below are: Fixed SFE (3,000), Fixed SFE (4,000), Quantile, Detailed, Simplified, Grouped RF (Rate Factors).

Note that for each approach the rate base can be changed (i.e., assessing or not assessing charges for a particular land use category). This represents another layer of options that could be explored. For our purposes, all six of the approaches were investigated both including and excluding the agricultural land use category.

Approach 1 "Fixed SFE (3,000)": The name of this approach is drawn from the fact that the residential SFEs were fixed by professional judgment to 3,000 square feet for residential parcels less than one acre in area[9].

The residential category is divided into two groups: parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

3,000 sq. ft. impervious for parcels < 1 acre (This defines the unit SFE)
4,500 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

Approximately six different rate factors being used for different land use categories. This represents a degree of specificity of the rate factors is mid-ranged with respect to the other approaches.

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[9] This value is based on typical values found in the technical literature. In Approach 2 this value is fixed at 4,000 sq. ft..

Approach 2 "Fixed SFE (4,000)": Like Approach 1, the residential category is divided into two groups: parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

4,000 sq. ft. impervious for parcels < 1 acre (This defines the unit SFE)
6,000 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

Approximately six different rate factors being used for different land use categories. This represents a degree of specificity of the rate factors is mid-ranged with respect to the other approaches.

From the standpoint of not over estimating the potential revenues, this approach is more conservative than Approach 1. At first glance, it may seem counter intuitive that using a higher impervious area for residential parcels would produce a lower revenue estimate. To see how this works, consider the following example in which a comparison is made between SFEs defined to be 4,000 sq.ft./SFE versus 3,000 sq.ft./SFE.

A commercial parcel of 12,000 sq. ft of impervious area under the Fixed SFE (4,000) approach pays $20/SFE or (12,000/4,000)x$20 sq.ft. = $60. Under the Fixed SFE (3,000) approach, the same commercial parcel is assessed (12,000/3,000x$20 sq.ft. = $80. In both approaches, the same amount of revenue is generated by the residential parcels because their rates are fixed by definition at $20 and $30 per parcel for the two residential subcategories. Consequently, the residential land use category does not contribute to differences in the projected revenue.

Approach 3 "Quantile": Again, the residential category is divided into two groups: Res. < 1 acre, and Res. > 1 acre. Rate factors are used to determine SFEs for the residential land use category.

This approach corrects for sharp differences in user charges between smaller and larger parcels that arise when the residential land use category is broken into two categories and mean acreage values are used to represent typical parcel size. An alternative to use of mean acreage values, which are often skewed by infrequent extreme values, is to use the median (50th percentile) parcel size (for parcels less than one acre) and the 90th percentile size as the typical value for parcels greater than one acre[10].

The level of specificity of rate factors is slightly increased above that of Approaches 1 and 2 with approximately eight different rate factors being used for different land use categories.

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[10] It is the parcel size below which 90 percent of the parcels are smaller, or stated the another way, is the parcel size for which only 10 percent of the parcels are larger.

Approach 4 "Detailed": For this approach, the residential category is divided into about 20 acreage intervals according to the data available (See Appendix A above). In addition to the high level of specificity of the residential category, the rate factors are highly detailed since a different rate factor is assigned to each of the 20 residential acreage categories. The SFEs for residential parcels are all computed using rate factors as opposed to being fixed.

This approach represents the most detailed revenue estimation approach of the study, although it is quite simplified in comparison to actual implementation methods.

Approach 5 "Simplified": This approach was motivated by a key aspect of the approach used in Austin, Texas, which classifies each land use category into one of three rate factor groups 0.10, 0.40, or 0.80.

This approach uses rate factors to determine the SFE for the residential parcels < 1 acre, but fixes the SFE for parcels > 1 acre at 1.5 SFEs. Consequently, the value of the unit SFE can rise and fall for different estimates between counties, while the SFE for parcels > 1 acre follows that rise and fall. This combined use use of rate factors to compute the unit SFE and fixed SFEs for the parcels > 1 acre is referred to a hybrid treatment of residential SFEs.

This approach derives its name from the fact that it is characterized by having two simplified features; the collapsed rate factors and only two residential categories.

Approach 6 "Grouped RF": This approach is based loosely on the Ft. Collins, Texas approach, which attempts to minimize administrative burdens and contested charges by aggregating users into relatively broad rate factor categories.

Like the Detailed Approach, the level of specificity of the residential category is highly detailed, and the SFEs for residential parcels are all computed using rate factors. Unlike the Detailed Approach, however, the level of specificity of the rate factors is simplified by grouping (hence the name Grouped RF).

The SFE was calculated as (0.60) x (mean acreage) using the smallest residential acreage interval (0 - 0.25 acres), where 0.60 is the rate factor.

Summary Results of Revenue Estimates Based on the Six Approaches

Table B-1 and Table B-2 compare the results of the six revenue estimation approaches excluding and including agricultural land use respectively. The revenue estimates were all developed under the assumption that residential parcels less than or equal to 1 acre in size would be charged 20$ a year (for the Detailed Approach the assumption corresponded to residential parcels less than or equal to one quarter acre in size).

Table B-1

Revenues and Payment Distributions for Six Alternative Stormwater User Charge Structures (Agricultural Land Use Excluded)

Percentage Paid by Category
(Cost per Average Parcel Size)

	Revenues	Residential <1 acre	Residential >1 acre	Commercial	Industrial	All Others
Fixed SFE 3,000	$1,968,080	22% ($20)	17% ($30)	46% ($667)	12% ($2,114)	3%
Fixed SFE 4,000	$1,676,600	26% ($20)	20% ($30)	40% ($500)	10% ($1,586)	4%
Quantile	$1,792,120	25% ($20)	38% ($60)	23% ($310)	6% ($983)	8%
Detailed	$2,132,460	24% ($24)	28% ($51)	30% ($471)	8% ($1,493)	10%
Simplified	$1,316,240	33% ($20)	26% ($30)	24% ($237)	7% ($882)	10%
Grouped RF	$2,448,080	18% ($20)	25% ($53)	28% ($489)	6% ($1,387)	23%

Table B-2

Revenues and Payment Distributions for Six Alternative Stormwater User Charge Structures (Agricultural Land Use Included[11])

Percentage Paid by Category
(Cost per Average Parcel Size)

	Revenues	Residential <1 acre	Residential >1 acre	Commercial	Industrial	Agricultural	All Others
Fixed SFE 3,000	$6,236,760	7% ($20)	5% ($30)	14% ($667)	4% ($2,114)	68% ($2,236)	2%
Fixed SFE 4,000	$4,878,100	9% ($20)	7% ($30)	14% ($500)	4% ($1,586)	66% ($1,677)	1%
Quantile	$3,778,520	12% ($20)	18% ($60)	11% ($310)	3% ($983)	53% ($1,040)	3%
Detailed	$5,147,700	10% ($24)	12% ($51)	12% ($471)	3% ($1,493)	59% ($1,579)	4%
Simplified	$2,874,400	15% ($20)	12% ($30)	11% ($489)	3% (1,387)	54% ($816)	5%
Grouped RF	$5,714,580	7% ($20)	9% ($53)	12% ($489)	3% ($1,387)	57% ($1,711)	12%

Table B-1 and Table B-2 were developed using two sets of worksheets provided on the following pages (Worksheet Set B-1 excludes agricultural land use from the rate base, and Worksheet Set B-2 includes agricultural land use in the rate base).

In addition, worksheets for the Fixed SFE (3,000) Approach are provided for three cases in which $1.5M is set as the revenue target. The first case, Worksheet B-3, excludes agricultural and unimproved parcels from the rate base. The second case, Worksheet B-4 brings agriculture into the rate base, but excludes unimproved parcels. The third case, Worksheet B-5, includes both agriculture and unimproved parcels in the rate base.

Finally, two work sheets using the property tax approach are provided. The first case, Worksheet B-6, is designed to meet a $1.5M revenue target, and is directly comparable to the user charge approach presented in Worksheet B-5 noted above. The second property tax case, Worksheet B-7, was developed by fixing the residential rate at $20 per year. This allows comparison with the user charge work sheets that fix residential charges at 20$ per year. It should be remembered when making comparisons that the property tax approaches include both agricultural and unimproved parcels in the rate base, where as some of the cases based on user charge approaches do not include both of these land use categories.

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[11] A relatively small rate factor of 0.10 was used for agricultural land use as compared with 0.80 - 0.82 for commercial, and 0.60 - 0.70 for industrial.

FIXED SFE (3,000)
(DRAFT)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,354	2.8	0.82	100,014	33.34	45,140			666.76	902,792	0.46
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	105.71	11,628			2,114.12	232,553	0.12
Apartments	88	1.7	0.64	47,393	15.80	1,390			315.96	27,804	0.01
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.46	na	3,000	1.00	21,973			20.00	439,461	0.22
> 1 Acre	11,202	3.14	na	4,500	1.50	16,803			30.00	336,061	0.17
Res Ag	888	11.5	na	4,500	1.50	1,332			30.00	26,640	0.01
Res Comm	1	1.0	0.64	27,878	9.29	9			185.86	186	0.00
Condominium	278	0.05	0.64	1,394	0.46	129			9.29	2,583	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					98,404				$1,968,080	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					98,404	$1,968,080	$20.00		$1,968,080	1.00

B-6

FIXED SFE (4,000)
(DRAFT)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,354	2.8	0.82	100,014	25.00	33,855			500.07	677,094	0.40
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	79.28	8,721			1,585.59	174,415	0.10
Apartments	88	1.7	0.64	47,393	11.85	1,043			236.97	20,853	0.01
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.46	na	4,000	1.00	21,973			20.00	439,461	0.26
> 1 Acre	11,202	3.14	na	6,000	1.50	16,803			30.00	336,061	0.20
Res Ag	888	11.5	na	6,000	1.50	1,332			30.00	26,640	0.02
Res Comm	1	1.0	0.64	27,878	6.97	7			139.39	139	0.00
Condominium	278	0.05	0.64	1,394	0.35	97			6.97	1,938	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					83,830				$1,676,600	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					83,830	$1,676,600	$20.00		$1,676,600	1.00

QUARTILE
(DRAFT)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,354	2.8	0.82	100,014	15.51	21,005			310.27	420,104	0.23
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	49.19	5,411			983.78	108,216	0.06
Apartments	88	1.7	0.64	47,393	7.35	647			147.03	12,938	0.01
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.74	0.20	6,447	1.00	21,973			20.00	439,458	0.25
> 1 Acre	11,202	3.70	0.12	19,341	3.00	33,606			60.00	672,117	0.38
Res Ag	888	11.5	0.10	50,094	7.77	6,900			155.40	137,999	0.08
Res Comm	1	1.0	0.64	27,878	4.32	4			86.49	86	0.00
Condominium	278	0.05	0.64	1,394	0.22	60			4.32	1,202	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					89,606				$1,792,120	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					89,606	$1,792,120	$20.00		$1,792,120	1.00

DETAILED
(DRAFT)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,354	2.8	0.82	100,014	23.55	31,885			470.97	637,698	0.30
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	74.67	8,213			1,493.33	164,266	0.08
Apartments	88	1.7	0.64	47,393	11.16	982			223.18	19,640	0.01
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	6,662	0.15	0.650	4,247	1.00	6,662			20.00	133,240	0.06
>.25 - .5	6,602	0.39	0.250	4,247	1.00	6,602			20.00	132,040	0.06
>.5 - 1	8,709	0.74	0.200	6,447	1.52	13,220			30.36	264,396	0.12
> 1 - 1.5	4,172	1.19	0.160	8,294	1.95	8,147			39.06	162,943	0.08
> 1.5 - 2	1,509	1.75	0.130	9,910	2.33	3,521			46.67	70,420	0.03
> 2 - 3	1,736	2.45	0.100	10,672	2.51	4,362			50.26	87,245	0.04
> 3 - 5	2,188	3.70	0.080	12,894	3.04	6,643			60.72	132,851	0.06
> 5 - 10	1,228	6.51	0.055	15,597	3.67	4,510			73.45	90,192	0.04
> 10 - 15	223	11.88	0.030	15,525	3.66	815			73.11	16,303	0.01
> 15 - 20	72	16.99	0.020	14,802	3.49	251			69.70	5,019	0.00
> 20 - 30	36	23.57	0.013	13,347	3.14	113			62.85	2,263	0.00
> 30 - 40	13	33.65	0.010	14,658	3.45	45			69.03	897	0.00
> 40 - 50	9	45.72	0.006	11,949	2.81	25			56.27	506	0.00
> 50 - 75	7	63.37	0.005	13,802	3.25	23			64.99	455	0.00
> 75 - 100	3	81.97	0.004	14,282	3.36	10			67.26	202	0.00
> 100 - 150	3	138.10	0.003	18,047	4.25	13			84.98	255	0.00
> 150 - 200	2	156.00	0.002	13,591	3.20	6			64.00	128	0.00
> 200 - 300	0	0.00	0.001	0	0.00	0			0.00	0	0.00
> 300 - 500	1	345.90	0.001	15,067	3.55	4			70.95	71	0.00
Res Ag	888	11.5	0.10	50,094	11.79	10,474			235.90	209,476	0.10
Res Comm	1	1.0	0.64	27,878	6.56	7			131.28	131	0.00
Condominium	278	0.05	0.64	1,394	0.33	91			6.56	1,825	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					106,623				$2,132,460	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					106,623	$2,132,460	$20.00		$2,132,460	1.00

SIMPLIFIED
(DRAFT)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,354	2.8	0.80	97,574	11.87	16,075			237.45	321,503	0.24
Comm Res	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.80	362,419	44.10	4,851			881.95	97,014	0.07
Apartments	88	1.7	0.80	59,242	7.21	634			144.16	12,686	0.01
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.47	0.40	8,219	1.00	21,973			20.00	439,462	0.33
> 1 Acre	11,202	3.13	na	12,328	1.50	16,803			30.00	336,061	0.26
Res Ag	888	11.5	0.10	50,094	6.10	5,412			121.90	108,250	0.08
Res Comm	1	1.0	0.80	34,848	4.24	4			84.80	85	0.00
Condominium	278	0.05	0.80	1,742	0.21	59			4.24	1,179	0.00
Condo Comm	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.80	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					65,812				$1,316,240	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					65,812	$1,316,240	$20.00		$1,316,240	1.00

GROUPED RF
(DRAFT)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,354	2.8	0.80	97,574	24.89	33,700			497.78	673,992	0.28
Comm Res	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.60	271,814	69.33	7,627			1,386.67	152,533	0.06
Apartments	88	1.7	0.60	44,431	11.33	997			226.67	19,947	0.01
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	6,662	0.15	0.600	3,920	1.00	6,662			20.00	133,240	0.05
>.25 - .5	6,602	0.39	0.250	3,299	0.84	5,556			16.83	111,121	0.05
>.5 - 1	8,709	0.74	0.250	4,214	1.07	9,361			21.50	187,227	0.08
> 1 - 1.5	4,172	1.19	0.250	5,390	1.37	5,736			27.50	114,722	0.05
> 1.5 - 2	1,509	1.75	0.250	6,854	1.75	2,638			34.96	52,762	0.02
> 2 - 3	1,736	2.45	0.250	8,683	2.21	3,845			44.30	76,902	0.03
> 3 - 5	2,188	3.70	0.250	11,950	3.05	6,670			60.96	133,391	0.05
> 5 - 10	1,228	6.51	0.250	19,295	4.92	6,044			98.43	120,874	0.05
> 10 - 15	223	11.88	0.250	33,330	8.50	1,896			170.03	37,917	0.02
> 15 - 20	72	16.99	0.250	46,685	11.91	857			238.17	17,148	0.01
> 20 - 30	36	23.57	0.250	63,883	16.29	587			325.90	11,732	0.00
> 30 - 40	13	33.65	0.250	90,228	23.01	299			460.30	5,984	0.00
> 40 - 50	9	45.72	0.250	121,774	31.06	280			621.23	5,591	0.00
> 50 - 75	7	63.37	0.250	167,904	42.83	300			856.57	5,996	0.00
> 75 - 100	3	81.97	0.250	216,517	55.23	166			1,104.57	3,314	0.00
> 100 - 150	3	138.10	0.250	363,218	92.65	278			1,852.97	5,559	0.00
> 150 - 200	2	156.00	0.250	410,002	104.58	209			2,091.63	4,183	0.00
> 200 - 300	0	0.00	0.250	0	0.00	0			0.00	0	0.00
> 300 - 500	1	345.90	0.250	906,324	231.18	231			4,623.64	4,624	0.00
Res Ag	888	11.5	0.25	125,235	31.94	28,367			638.89	567,334	0.23
Res Comm	1	1.0	0.60	26,136	6.67	7			133.33	133	0.00
Condominium	278	0.05	0.60	1,307	0.33	93			6.67	1,853	0.00
Condo Comm	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					122,404				$2,448,080	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					122,404	$2,448,080	$20.00		$2,448,080	1.00

FIXED SFE (3,000)
(DRAFT w/Ag.)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.10	335,412	111.80	213,434			2,236.08	4,268,681	0.68
Commercial	1,354	2.8	0.82	100,014	33.34	45,140			666.76	902,792	0.14
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	105.71	11,628			2,114.11	232,553	0.04
Apartments	88	1.7	0.64	47,393	15.80	1,390			315.96	27,804	0.00
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.46	na	3,000	1.00	21,973			20.00	439,460	0.07
> 1 Acre	11,202	3.14	na	4,500	1.50	16,803			30.00	336,060	0.05
Res Ag	888	11.5	na	4,500	1.50	1,332			30.00	26,640	0.00
Res Comm	1	1.0	0.64	27,878	9.29	9			185.86	186	0.00
Condominium	278	0.05	0.64	1,394	0.46	129			9.29	2,583	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					311,838				$6,236,760	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					311,838	$6,236,760	$20.00		$6,236,760	1.00

FIXED SFE (4,000)
(DRAFT w/ Ag.)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.10	335,412	83.85	160,075			1,677.06	3,201,504	0.66
Commercial	1,354	2.8	0.82	100,014	25.00	33,855			500.07	677,092	0.14
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	79.28	8,721			1,585.58	174,414	0.04
Apartments	88	1.7	0.64	47,393	11.85	1,043			236.97	20,853	0.00
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.46	na	4,000	1.00	21,973			20.00	439,460	0.09
> 1 Acre	11,202	3.14	na	6,000	1.50	16,803			30.00	336,060	0.07
Res Ag	888	11.5	na	6,000	1.50	1,332			30.00	26,640	0.01
Res Comm	1	1.0	0.64	27,878	6.97	7			139.39	139	0.00
Condominium	278	0.05	0.64	1,394	0.35	97			6.97	1,938	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					243,905				$4,878,100	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					243,905	$4,878,100	$20.00		$4,878,100	1.00

QUARTILE
(DRAFT w/ Ag.)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.10	335,412	52.03	99,320			1,040.54	1,986,391	0.53
Commercial	1,354	2.8	0.82	100,014	15.51	21,005			310.27	420,106	0.11
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	49.19	5,411			983.78	108,216	0.03
Apartments	88	1.7	0.64	47,393	7.35	647			147.03	12,938	0.00
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.74	0.20	6,447	1.00	21,973			20.00	439,460	0.12
> 1 Acre	11,202	3.70	0.12	19,341	3.00	33,606			60.00	672,120	0.18
Res Ag	888	11.5	0.10	50,094	7.77	6,900			155.41	138,000	0.04
Res Comm	1	1.0	0.64	27,878	4.32	4			86.49	86	0.00
Condominium	278	0.05	0.64	1,394	0.22	60			4.32	1,202	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					188,926				$3,778,520	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					188,926	$3,778,520	$20.00		$3,778,520	1.00

DETAILED
(DRAFT w/ Ag.)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.10	335,412	78.97	150,762			1,579.49	3,015,237	0.59
Commercial	1,354	2.8	0.82	100,014	23.55	31,885			470.97	637,699	0.12
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	74.67	8,213			1,493.33	164,266	0.03
Apartments	88	1.7	0.64	47,393	11.16	982			223.18	19,640	0.00
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	6,662	0.15	0.650	4,247	1.00	6,662			20.00	133,240	0.03
>.25 - .5	6,602	0.39	0.250	4,247	1.00	6,602			20.00	132,040	0.03
>.5 - 1	8,709	0.74	0.200	6,447	1.52	13,220			30.36	264,396	0.05
> 1 - 1.5	4,172	1.19	0.160	8,294	1.95	8,147			39.06	162,943	0.03
> 1.5 - 2	1,509	1.75	0.130	9,910	2.33	3,521			46.67	70,420	0.01
> 2 - 3	1,736	2.45	0.100	10,672	2.51	4,362			50.26	87,245	0.02
> 3 - 5	2,188	3.70	0.080	12,894	3.04	6,643			60.72	132,851	0.03
> 5 - 10	1,228	6.51	0.055	15,597	3.67	4,510			73.45	90,192	0.02
> 10 - 15	223	11.88	0.030	15,525	3.66	815			73.11	16,303	0.00
> 15 - 20	72	16.99	0.020	14,802	3.49	251			69.70	5,019	0.00
> 20 - 30	36	23.57	0.013	13,347	3.14	113			62.85	2,263	0.00
> 30 - 40	13	33.65	0.010	14,658	3.45	45			69.03	897	0.00
> 40 - 50	9	45.72	0.006	11,949	2.81	25			56.27	506	0.00
> 50 - 75	7	63.37	0.005	13,802	3.25	23			64.99	455	0.00
> 75 - 100	3	81.97	0.004	14,282	3.36	10			67.26	202	0.00
> 100 - 150	3	138.10	0.003	18,047	4.25	13			84.98	255	0.00
> 150 - 200	2	156.00	0.002	13,591	3.20	6			64.00	128	0.00
> 200 - 300	0	0.00	0.001	0	0.00	0			0.00	0	0.00
> 300 - 500	1	345.90	0.001	15,067	3.55	4			70.95	71	0.00
Res Ag	888	11.5	0.10	50,094	11.79	10,474			235.90	209,477	0.04
Res Comm	1	1.0	0.64	27,878	6.56	7			131.28	131	0.00
Condominium	278	0.05	0.64	1,394	0.33	91			6.56	1,825	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					257,385				$5,147,700	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					257,385	$5,147,700	$20.00		$5,147,700	1.00

SIMPLIFIED
(DRAFT W/ Ag.)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.10	335,412	40.81	77,908			816.22	1,558,165	0.54
Commercial	1,354	2.8	0.80	97,574	11.87	16,075			237.45	321,502	0.11
Comm Res	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.80	362,419	44.10	4,851			881.94	97,014	0.03
Apartments	88	1.7	0.80	59,242	7.21	634			144.16	12,686	0.00
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.47	0.40	8,219	1.00	21,973			20.00	439,460	0.15
> 1 Acre	11,202	3.13	na	12,328	1.50	16,803			30.00	336,060	0.12
Res Ag	888	11.5	0.10	50,094	6.10	5,412			121.90	108,250	0.04
Res Comm	1	1.0	0.80	34,848	4.24	4			84.80	85	0.00
Condominium	278	0.05	0.80	1,742	0.21	59			4.24	1,179	0.00
Condo Comm	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.80	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					143,720				$2,874,400	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					143,720	$2,874,400	$20.00		$2,874,400	1.00

GROUPED RF
(DRAFT w/ Ag.)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.10	335,412	85.56	163,326			1,711.11	3,266,506	0.57
Commercial	1,354	2.8	0.80	97,574	24.89	33,700			497.78	673,990	0.12
Comm Res	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.60	271,814	69.33	7,627			1,386.66	152,533	0.03
Apartments	88	1.7	0.60	44,431	11.33	997			226.67	19,947	0.00
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
0 - .25	6,662	0.15	0.600	3,920	1.00	6,662			20.00	133,240	0.02
>.25 - .5	6,602	0.39	0.250	3,299	0.84	5,556			16.83	111,121	0.02
>.5 - 1	8,709	0.74	0.250	4,214	1.07	9,361			21.50	187,227	0.03
> 1 - 1.5	4,172	1.19	0.250	5,390	1.37	5,736			27.50	114,722	0.02
> 1.5 - 2	1,509	1.75	0.250	6,854	1.75	2,638			34.96	52,762	0.01
> 2 - 3	1,736	2.45	0.250	8,683	2.21	3,845			44.30	76,901	0.01
> 3 - 5	2,188	3.70	0.250	11,950	3.05	6,670			60.96	133,391	0.02
> 5 - 10	1,228	6.51	0.250	19,295	4.92	6,044			98.43	120,874	0.02
> 10 - 15	223	11.88	0.250	33,330	8.50	1,896			170.03	37,917	0.01
> 15 - 20	72	16.99	0.250	46,685	11.91	857			238.16	17,148	0.00
> 20 - 30	36	23.57	0.250	63,883	16.29	587			325.90	11,732	0.00
> 30 - 40	13	33.65	0.250	90,228	23.01	299			460.30	5,984	0.00
> 40 - 50	9	45.72	0.250	121,774	31.06	280			621.23	5,591	0.00
> 50 - 75	7	63.37	0.250	167,904	42.83	300			856.56	5,996	0.00
> 75 - 100	3	81.97	0.250	216,517	55.23	166			1,104.56	3,314	0.00
> 100 - 150	3	138.10	0.250	363,218	92.65	278			1,852.96	5,559	0.00
> 150 - 200	2	156.00	0.250	410,002	104.58	209			2,091.63	4,183	0.00
> 200 - 300	0	0.00	0.250	0	0.00	0			0.00	0	0.00
> 300 - 500	1	345.90	0.250	906,324	231.18	231			4,623.62	4,624	0.00
Res Ag	888	11.5	0.25	125,235	31.94	28,367			638.89	567,332	0.10
Res Comm	1	1.0	0.60	26,136	6.67	7			133.33	133	0.00
Condominium	278	0.05	0.60	1,307	0.33	93			6.67	1,853	0.00
Condo Comm	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Cooperative	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.80	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.60	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.40	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					285,729				$5,714,580	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					285,729	$5,714,580	$20.00		$5,714,580	1.00

Worksheet B-3

FIXED SFE (3,000)
(DRAFT)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,354	2.8	0.82	100,014	33.34	45,140			508.18	688,076	0.46
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	105.71	11,628			1,611.30	177,243	0.12
Apartments	88	1.7	0.64	47,393	15.80	1,390			240.81	21,191	0.01
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.46	na	3,000	1.00	21,973			15.24	334,941	0.22
> 1 Acre	11,202	3.14	na	4,500	1.50	16,803			22.86	256,133	0.17
Res Ag	888	11.5	na	4,500	1.50	1,332			22.86	20,304	0.01
Res Comm	1	1.0	0.64	27,878	9.29	9			141.65	142	0.00
Condominium	278	0.05	0.64	1,394	0.46	129			7.08	1,969	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					98,404				$1,500,000	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					98,404	$1,500,000	$15.24		$1,500,000	1.00

Worksheet B-4

FIXED SFE (3,000)
(DRAFT w/Ag.)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.10	335,412	111.80	213,434			537.80	1,026,658	0.68
Commercial	1,354	2.8	0.82	100,014	33.34	45,140			160.36	217,130	0.14
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	105.71	11,628			508.46	55,931	0.04
Apartments	88	1.7	0.64	47,393	15.80	1,390			75.99	6,687	0.00
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.46	na	3,000	1.00	21,973			4.81	105,694	0.07
> 1 Acre	11,202	3.14	na	4,500	1.50	16,803			7.22	80,826	0.05
Res Ag	888	11.5	na	4,500	1.50	1,332			7.22	6,407	0.00
Res Comm	1	1.0	0.64	27,878	9.29	9			44.70	45	0.00
Condominium	278	0.05	0.64	1,394	0.46	129			2.24	621	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					311,838				$1,500,000	1.00
Unimproved	9,663	6.7	0.00	0	0.00	0			0.00	0	0.00
Grand Total	48,074					311,838	$1,500,000	$4.81		$1,500,000	1.00

FIXED SFE (3,000)
(DRAFT W/Ag.)
(w/ unimp.)

Stormwater Utility Charge System for Carroll County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,909	77.0	0.10	335,412	111.80	213,434			413.23	788,853	0.53
Commercial	1,354	2.8	0.82	100,014	33.34	45,140			123.22	166,836	0.11
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	608	18.0	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	110	10.4	0.70	317,117	105.71	11,628			390.69	42,976	0.03
Apartments	88	1.7	0.64	47,393	15.80	1,390			58.39	5,138	0.00
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	21,973	0.46	na	3,000	1.00	21,973			3.70	81,212	0.05
> 1 Acre	11,202	3.14	na	4,500	1.50	16,803			5.54	62,104	0.04
Res Ag	888	11.5	na	4,500	1.50	1,332			5.54	4,923	0.00
Res Comm	1	1.0	0.64	27,878	9.29	9			34.35	34	0.00
Condominium	278	0.05	0.64	1,394	0.46	129			1.72	477	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	38,411					311,838				$1,152,555	0.77
Unimproved	9,663	6.7	0.10	29,185	9.73	94,006			35.96	347,445	0.23
Grand Total	48,074					405,843	$1,500,000	$3.70		$1,500,000	1.00

Worksheet B-6

Stormwater Revenue Estimation for Carroll County, Maryland

Property Tax ($1.5 M Rev. Requirment)
(DRAFT)

Land Use Category	Number of Parcels	Average Value/ Parcel	Average Assessed Value	Tax Base (x 100)	Revenue Required	Tax Rate Per $100 Valuation	Yearly Tax Per Average Parcel	Total Paid By Category	Percent Paid By Parcel
Agriculture	1,909	128,930	58,019	1,107,573			39.37	75,161	0.05
Commercial	1,354	355,785	160,103	2,167,798			108.65	147,109	0.10
Comm Res	0	0	0	0			0.00	0	0.00
Exempt	608	799,182	359,632	0			0.00	0	0.00
Park									
Playground									
School									
Industrial	110	1,172,636	527,686	580,455			358.09	39,390	0.03
Apartments	88	675,100	303,795	267,340			206.16	18,142	0.01
Not Perc	0	0	0	0			0.00	0	0.00
Residential									
< 1 Acre	21,973	96,452	43,403	9,537,029			29.45	647,195	0.43
> 1 Acre	11,202	130,308	58,639	6,568,696			39.79	445,760	0.30
Res Ag	888	108,881	48,996	435,088			33.25	29,526	0.02
Res Comm	1	83,100	37,395	374			25.38	25	0.00
Condominium	278	61,808	27,814	77,322			18.87	5,247	0.00
Condo Comm	0	0	0	0			0.00	0	0.00
Marshland	0	0	0	0			0.00	0	0.00
Non-standard									
Cooperative	0	0	0	0			0.00	0	0.00
Mobil/Traile	0	0	0	0			0.00	0	0.00
Group Quar	0	0	0	0			0.00	0	0.00
Motel	0	0	0	0			0.00	0	0.00
Forest Cons	0	0	0	0			0.00	0	0.00
Detached S-F									
0 - .5 Ac	0	0	0	0			0.00	0	0.00
> .5 - 1 Ac	0	0	0	0			0.00	0	0.00
> 1 Acre	0	0	0	0			0.00	0	0.00
Garden Apt.	0	0	0	0			0.00	0	0.00
High Rise	0	0	0	0			0.00	0	0.00
Other	0	0	0	0			0.00	0	0.00
Total (Dev.)	38,411			20,741,675				1,407,556	0.94
Unimproved	9,663	31,328	14,098	1,362,251			9.57	92,444	0.06
Grand Total	48,074			22,103,926	$1,500,000	0.0679		$1,500,000	1.00

Stormwater Revenue Estimation for Carroll County, Maryland

Property Tax ($20 / Res. parcel < 1 Acre)
(DRAFT)

Land Use Category	Number of Parcels	Average Value/ Parcel	Average Assessed Value	Tax Base (x 100)	Revenue Required	Tax Rate Per $100 Valuation	Yearly Tax Per Average Parcel	Total Paid By Category	Percent Paid By Parcel
Agriculture	1,909	128,930	58,019	1,107,573			26.73	51,036	0.05
Commercial	1,354	355,785	160,103	2,167,798			73.77	99,890	0.10
Comm Res	0	0	0	0			0.00	0	0.00
Exempt	608	799,182	359,632	0			0.00	0	0.00
Park									
Playground									
School									
Industrial	110	1,172,636	527,686	580,455			243.15	26,747	0.03
Apartments	88	675,100	303,795	267,340			139.99	12,319	0.01
Not Perc	0	0	0	0			0.00	0	0.00
Residential									
< 1 Acre	21,973	96,452	43,403	9,537,029			20.00	439,457	0.43
> 1 Acre	11,202	130,308	58,639	6,568,696			27.02	302,679	0.30
Res Ag	888	108,881	48,996	435,088			22.58	20,048	0.02
Res Comm	1	83,100	37,395	374			17.23	17	0.00
Condominium	278	61,808	27,814	77,322			12.82	3,563	0.00
Condo Comm	0	0	0	0			0.00	0	0.00
Marshland	0	0	0	0			0.00	0	0.00
Non-standard									
Cooperative	0	0	0	0			0.00	0	0.00
Mobil/Traile	0	0	0	0			0.00	0	0.00
Group Quar	0	0	0	0			0.00	0	0.00
Motel	0	0	0	0			0.00	0	0.00
Forest Cons	0	0	0	0			0.00	0	0.00
Detached S-F									
0 - .5 Ac	0	0	0	0			0.00	0	0.00
> .5 - 1 Ac	0	0	0	0			0.00	0	0.00
> 1 Acre	0	0	0	0			0.00	0	0.00
Garden Apt.	0	0	0	0			0.00	0	0.00
High Rise	0	0	0	0			0.00	0	0.00
Other	0	0	0	0			0.00	0	0.00
Total (Dev.)	38,411			20,741,675				955,756	0.94
Unimproved	9,663	31,328	14,098	1,362,251			6.50	62,771	0.06
Grand Total	48,074			22,103,926	$1,018,527	0.0461		$1,018,527	1.00

Appendix C

Additional Considerations In Implementing A Stormwater Utility System

Overview

Maryland Department of Environment, Sediment and Stormwater Administration has published a sample stormwater utility that could serve as a guide for the development of an ordinance for Carroll County. The MDE sample ordinance is based on a review of 20 ordinances adopted by other municipalities and counties. The sample ordinance includes 12 basic sections which are typical of the points that must be addressed when a user charge system is formed:

1. A statement of findings, intent, and authority.
2. Definitions.
3. Provisions for the creation and administration of a user charge system.
4. References to master stormwater or watershed plans.
5. Provisions for the imposition and calculation of stormwater charges.
6. Creation of a restricted fund for collection and disbursement of stormwater charges and fees.
7. Provisions for credits, exemptions, or surcharges.
8. Provisions for billing procedures.
9. Provisions for enforcement and penalties.
10. Provisions for appeals of charges.
11. A severability clause.
12. Limitations of liability in the event of floods.

The following paragraphs outline the types of charges that the County Council would have to make to the County Code.

Findings, Intent, and Authority

Findings sections of utility ordinances typically state that all people (property owners) in a community generate runoff, that stormwater management is necessary to protect the public health, safety, and welfare, that all benefit from control of stormwater, and that all should pay for control of stormwater in relation to the reasons for creating a utility. For example, one reason for a utility may be to consolidate responsibilities for different aspects of stormwater control.

While sections concerning findings and intent are general in nature, they are important in establishing the basis for a utility, and courts may look to them in the event of litigation over creation of the utility. The necessary section(s) of the County Code would have to be modified to include language specific to the rationale for creating a utility.

The County also would have to reference provisions in State law which grant authority for imposition of stormwater charges. The Stormwater Management Act (Title 4, Subtitle 2, Annotated Code of Maryland 1987) states:

> Each county or municipality may adopt a fee system to cover the cost of reviewing stormwater management plans and implementing stormwater management programs. The fee shall take effect upon enactment by the local governing body.

The County Code would have to be amended to include a reference to this provision.

Definitions

The MDE sample ordinance includes definitions for 12 terms that currently are not defined in the County Code. These and other terms would have to be added to the existing County Code if a utility were established.

Creation and Administration of the Utility

Utility ordinances usually describe how the utility will be managed. The position of the utility with the local administration is specified (e.g., within DNRP). The responsibilities of specific staff (e.g., County Executive, the Director of DNRP, The Director of Finance), including their relation to the County Council, may be described.

Specific clauses of ordinances may:

- create Stormwater Boards comprised of appointed citizens, establish terms of office, and

assign authority, duties, and responsibilities (e.g., require benefit-cost analyses for all projects);

- State responsibilities of local staff

  - authorize Department of Finance to collect charges;
  - authorize the appropriate Department to hear appeals and petitions;
  - clarify the relations of the county executive with the utility staff;

- Clarify the relation between public and private facilities;

- Specify the type of facilities that the utility will construct and maintain and the types of private facilities that the utility will accept;

- Specify the types of maintenance for which the utility will be responsible;

- Establish the procedures by which various departments will implement the utility.

Master Stormwater or Watershed Plans

Stormwater ordinances typically require that utilities operate in the context of a master stormwater plan; they may specify the minimum contents of plans. For example, ordinances may require that all capital improvements be mapped by basin and that they be budgeted according to priorities established in individual basin plans. The existence of a master plan reinforces the idea that stormwater management is a service to be financed by users like water supply and wastewater treatment. Operating within the context of a master plan or a set of watershed plans also strengthens the position of a utility in the even of a suit challenging its legitimacy.

Imposition and Calculation of Stormwater Charges

Utility ordinances typically include several sections related to the establishment and calculation of utility fees. These are coordinated with other sections of ordinances concerning fees, such as those that establish plan review or permit fees. Usually, separate section establish the fees, explain how they will be calculated, and set the levels of the charges. The rationale for all fees and the purposes of the fees are explained carefully. Items usually specified include:

- o References to authorization for imposing fees;

- o Amount to be generated by fees (e.g., charges shall cover all stormwater management costs);

- o Uses of fees (e.g., planning, design, acquisition of right-of-way, construction, routine and remedial maintenance, and reconstruction); and

- o Basis for charges (land use classification, runoff coefficients, billing algorithm, rate schedules and provisions for increasing fees).

- o The rationale for standardized residential charges.

Stormwater Fund

Utility ordinances require that a separate fund be established for all revenues collected by the utility (generally referred to as an enterprise fund). The ordinances usually specify permissible disbursements from the fund (e.g., some utilities allow payments to developers to reimburse costs of constructing facilities designed to serve areas larger than the immediate development). Ordinances also clarify the relationship between the stormwater fund and the general fund (e.g., funds may be used to pay for a proportionate share of municipal accounting expenses but funds may not be commingled).

Credits, Exemptions, or Surcharges

Some utilities provide credits, reductions, or exemptions for charges if stormwater is retained on-site or if other criteria are met. These special features usually are specified in separate sections of the ordinance. The particular section could be amended to include exemptions form utility charges and procedures for credits from charges, if any. For example, residential developments consisting of single family houses each on a lot of two acres or greater presently are exempt from permits; consideration must be given as to whether these homes would be charged by the utility.

Billing

Utility ordinances specify how frequently bills will be issued and who will be responsible for collecting them.

The model ordinance includes no references to mechanisms for charging users of systems. Sections about billing would need to be added; options in billing are discussed below.

Enforcement and Penalties

Most utility ordinances specify actions that can be taken to collect delinquent bills. Officials responsible for collection (e.g., Director of Finance) may be specified. Ordinances may provide for liens against property in the event of failure to pay. References to other sections of the local code that specify procedures for the collection of bills may be mde. Penalties for failure to comply with the ordinance may be included.

Provisions for Appeals of Charges

Ordinances typically include a separate section that establishes the procedures that people can use to appeal stormwater charges. For example, hearings could be requested with the appropriate County Department, and the Department decisions appealed to a stormwater board or to the local council.

Severability

Severability clauses specify that the entire ordinance does not become invalid if a single section is found to be invalid.

Limitations of Liability

Utility ordinances typically specify that the existence of a stormwater utility does not ensure that floods will not occur and that the local jurisdiction assumes no liability for any damages caused by flooding.

Summary

The sample ordinance available from MDE provides an overview of the basic legal requirements for establishing a utility. MDE also can make available to the County copies of ordinances adopted by approximately 20 jurisdictions. The language of an ordinance is extremely important in the event of a suit challenging the legitimacy of the utility. Support from the County's Office of Law would be required during development.

Billing Considerations

Development of a billing system can begin after local officials have selected a rate structure and specified the types of data to be used in the calculation of charges. Practical considerations in the development of a billing system are reviewed in this section. Specific factors include:

- o Methods and frequency of billing;
- o Data requirements for billing; and
- o Costs of billing.

Methods and Frequency of Billing

Options for billing in Carroll County would include:

1. Adding stormwater charges to existing bills for water and sewer service;

2. Adding stormwater charges to annual property tax bills as a line item; and

2. Creating a new, separate billing system.

Most utilities add stormwater charges to existing water and sewer bills that are mailed monthly or quarterly rather than to property tax bills that are mailed annually or semiannually. This method reportedly is favored because it reinforces the notion that the fees are user charges and not taxes. The benefit of adding the stormwater charges to existing bills is that the cost of developing and maintaining a new billing system can be significant. The most likely billing option in the County would be to add the stormwater charges to an existing billing system. This could be done very cheaply if the information in the tax assessor's files is sufficient for calculating the charges.

Data Requirements for Billing

The types of information that must be coded in a billing system are presented in table 19. Much of this information already is in the Carroll County tax files.

Table C-1

Data Needs For a Stormwater Utility Billing System

Data Needed	Data Needed
Account Number	Equivalent Runoff Units
Service Address (site)	Drainage Basin Code
Map and Parcel Number (from working maps)	Floodplain Location Code
Billing Address	Billing Cycle Code
Tax Assessor's Number	Billing History Summary
Parcel Area (estimate or measured)	Delinquency Action Code
Land Use Code	Special Charge Code
Intensity of Development Factor (rate factor)	Special Charges
	Impervious Area (if measured)
	Credits

This information must be readily accessible so that utility staff can respond to inquiries about accounts from customers.

Costs of Billing

The development of the billing system can be one of the most time consuming and costly tasks in establishing a utility, particularly if all nonresidential parcels are digitized to determine the amount of impervious area. Cyre (1986, 1987) estimates that between six and 10 months may be required to develop and implement a billing system and that the costs to develop and implement a system can range from $50,000 to $150,000 for professional services plus $3 to $10 per account. Utilities surveyed by MDE reported annual billing costs per account ranging from $1 to $8.64; for these utilities, billing costs accounted for between 1.4% to 16.3% of total revenues. If an existing billing system is used, the most significant cost the County would incur would be modification of existing databases to include information for calculating charges (e.g., runoff coefficients, percent of impervious area per parcel).

Public Relations

Opposition to proposals for stormwater management utilities (i.e., to new fees or to the magnitude of new fees) almost always emerges. Some utilities have been stalled or defeated because of opposition. Hence, most local officials with experience in the formation of utilities stress the need for carefully planned, vigorous public information programs.

Elements of public information programs include:

- news release;
- letters to business associations and community groups;
- public service announcements;
- mailing of brochures to all accounts;
- public meetings; and
- meetings with influential community leaders.

An example of a brochure used in Denver, Colorado to explain the utility concept to residents is included as Figure <<. An approach to gain public support, used successfully in Cincinnati, was to relate proposed capital improvements to complaints. Public works staff logged over 10,000 complaints about stormwater. The locations of the problems were noted on maps of 48 recognized communities or neighborhoods in Cincinnati, Ohio. Meetings then were held with the executive boards of each of the community councils to explain the need for the utility. Stitt (1986) reports that constituency development through the meetings was important to the success of the proposed utility.

Figure 4. Utility Informational Brochure, Denver, Colorado (Denver Wastewater Division, no date).

when it rains

THE NEED FOR STORM DRAINAGE

Before people settled in the front range area of Denver, the natural state of the land was rolling prairie covered by grass. When it rained, the water soaked into the land or naturally flowed to the streams and rivers.

When people did come to Denver and settle in the area, they built homes, stores, offices, churches and apartment houses. They paved the land with streets, parking lots, sidewalks and driveways. Now, when it storms, the ground cannot absorb the water as easily and many flow patterns have been changed.

As development of the land continued, it became increasingly important to control the storm water. Storm drainage facilities had to be built, operated, maintained, renewed and replaced in order to:

PROTECT PEOPLE
PROTECT PROPERTY
REDUCE INSURANCE RISKS
IMPROVE PROPERTY VALUES
ENHANCE THE ENVIRONMENT
PROVIDE FOR SAFE TRAFFIC FLOW

To control storm waters and receive the benefits of that control, there is a cost. Since everyone in the City benefits, the Denver City Council passed an ordinance which authorizes a Storm Drainage Service Charge to be collected from all improved parcels of land in the City.

The Wastewater Management Division of the Department of Public Works has been given the responsibility to manage this important function for the Citizens of Denver.

HOW WILL THE MONEY BE USED?

(1) Denver is a vital and growing City, and planning for future as well as present storm sewer needs is extremely important. A Storm Drainage Master Plan has been developed and is continuously upgraded so that information is always available to determine:

- Where and when repairs, changes and enlargement of the existing storm drainage system are needed to solve the present problems.
- Where and when future storm sewers will be needed so that new problems do not develop as Denver grows.
- What the costs will be to construct, operate and maintain the needed storm drainage system, including the best and least expensive method of paying those costs.

(2) In addition to the money needed to operate and maintain the present storm drainage system, a large portion of the storm drainage service charge will be used to:

- Renew the existing storm facilities so they operate properly for a longer period of time.
- Replace existing storm facilities that have become unusable over the years due to the natural deterioration process.

(3) Management of new land development in the City is required to provide for a proper and adequate storm drainage system. Some of the money will be used for this important function in the review of plans for new subdivisions, buildings, parking lots, driveways, etc. to insure that these requirements are met by new construction.

THE EXISTING STORM SYSTEM

The Storm Drainage System is complex. There are many parts which make up this system from underground pipelines, which gather the water as it first enters the system, to the gutches and natural waterways which control and carry the storm water away. The existing storm drainage system, presently valued at approximately $73 million consists of:

12,500 Catch Basins
950 Siphons
375 miles of underground lines and structures
40 miles of Ditches
20 miles of gutches & natural waterways

This System must be maintained on a year around basis so that when needed, it will operate to safely control and dispose of the storm waters.

QUESTIONS??? AND ANSWERS!!!

WHO WILL PAY FOR THE SYSTEM?
The owners of every improved parcel of land within the City of Denver will help share the cost of Denver's Storm Drainage System in an equitable manner!

HOW WILL THE CHARGE BE FIGURED?
The annual charge to a land owner will be determined by the overall need of the land parcel to use the Storm Sewer System. For instance, a parking lot will have more storm runoff than a grassy area of the same size. The annual charge will be based on the total amount of impervious surface on a parcel in relation to its total area.

WHAT IS IMPERVIOUS SURFACE?
Impervious surface is a manmade area that will not readily absorb rain water as it falls. Examples would be roof tops and paved areas.

CITY AND COUNTY OF DENVER

DEPARTMENT OF PUBLIC WORKS
WASTEWATER MANAGEMENT DIV

WASTEWATER MANAGEMENT DIVISION
P.O. Box 17827 Terminal Annex
Denver, Colorado 80217

PRE-SORTED
FIRST CLASS
U.S. POSTAGE
PAID
Permit No. 1056
Denver, CO

STORM DRAINAGE
SERVICE CHARGE
ADVANCE NOTIFICATION

OWNER/OCCUPANT

WHAT IS MY SHARE OF THE COST?

The probability of storm water runoff from a specific parcel of land using the storm drainage system of the City is directly related to the amount of impervious surface area on that parcel. The Storm Drainage Service Charge is based on the percentage of impervious surface area to the total parcel area. For instance, to determine the rate and annual charge for a specific parcel of land: (1) divide the impervious area by the parcel area, the answer is the ratio of impervious area to parcel area; (2) go the rate table and find the proper ratio group and rate which applies to that parcel; (3) then, multiply the rate times the impervious area and divide by 100; the answer to the above will be the annual Storm Drainage Service Charge for that parcel of land.

The information shown below is for the listed service address and will be used to determine the storm drainage service charge for the parcel. Space has been provided for you to check the accuracy of our information. In the event your figures differ from those of record, please fill in the boxes and return the section below the dotted line to this office for further checking, and if necessary, a field survey.

The date you may expect to receive a bill for the Storm Drainage Service Charge is shown on the last line of the page. Please do not send money at this time.

RATE TABLE	
Ratio Group	Rate
0 to .10	$0.27
.11 to .20	0.47
.21 to .30	0.57
.31 to .40	0.67
.41 to .50	0.77
.51 to .60	0.77
.61 to .70	0.87
.71 to .80	0.97
.81 to .90	1.07
.91 to 1.00	1.17
(Minimum $3.00/Parcel)	

IF YOU NEED MORE INFORMATION!!

Should you have any questions or want more information about the storm drainage service charge, please call the Wastewater Management Division, Customer Services at 629-1451, extension 235.

THIS IS NOT A BILL

MAILING ADDRESS: ACCOUNT NUMBER: SERVICE ADDRESS:

	PARCEL AREA	IMPERVIOUS AREA	RATIO
RECORDS INDICATE	SQ. FT.	SQ. FT.	
ENTER FROM YOUR RECORDS			

YOU WILL RECEIVE A BILL FOR THE ABOVE PARCEL ON OR ABOUT:

There is some evidence, however, that public relations programs have only a limited effect on the success of a proposal and that the most important factor is the size of the proposed charge. Proposals for utilities with fees in the range of $1 to $2 per month for single family residences seem to be accepted, while proposals for higher fees seem to have been rejected. In Tampa, Florida, for example, a proposal for a utility with monthly residential fees in excess of $4 was stopped by public opposition despite (Wallace 1986):

- 77 letters to business, civic, and professional groups
- 6 news articles;
- 9 public announcements in three newspapers;
- public meetings in each of seven districts;
- 70,000 utility bill messages; and
- responses to 75 telephone inquiries.

Cyre (1986) suggests that users seem to be willing to pay from one-third to one-half as much as they pay for water or sewer bills, whichever is lower, and that there "seems to be a psychological ceiling on stormwater charges of $3 per month for residences." The City of Bellevue, however, charges more than $4 per month to single family residences. Fees in Bellevue, however, have been increased gradually over time.

There also is evidence that the timing of a proposal may affect its success. Utilities in Austin, Texas and Tulsa, Oklahoma were established after severe floods resulted in the drowning of several people. Stitt (1986) declares flatly:

> You need a storm. Nothing was more helpful for stimulating public interest in the stormwater problem than the two 100 year storms that Cincinnati experienced in 1982.

Regardless of the effectiveness of a public information program in explaining the utility, the first bill is certain to generate inquiries that the county should be prepared for. Some communities have installed extra telephone lines and hired additional temporary help to respond to calls. Stitt (1986) reports that the Cincinnati Stormwater Division received 1,000 calls the day the bills were first issued, but that the number of calls declined to "only about 100" per day after a week.

Appendix D

While the report to which this supplement is appended includes an overview of issues that would arise in the implementation of a user charge system (e.g., the need for a public relations program), several pragmatic political issues have not been addressed with the attention that would be required in the event a decision were made to pursue a utility. These include a host of issues that may be thought of as strategic: how the County Executive ought "package" a utility proposal, how issues of equity ought be characterized publicly, the timing of implementation, or ways to adjust runoff coefficients (which are controls) to achieve other equity objective or to make administration of the system cheaper and easier. These issues are far off on the time horizon, and do not require direct attention unless a decision is made in favor of pursing a utility. Never the less, it may be important to keep these long-term matters in mind when considering the issue of utilities in general.

It may be insightful to consider the findings of the Baltimore County Stormwater Management Committee, convened by the Director of Environmental Protection and Resource Management. They have recently recommended the formation of a stormwater utility to finance stormwater controls. In doing so, they suggested that guidance from the Administration would be essential in addressing the following issues, which in view of geographic proximity may be relevant to Carroll County.

1. Justification for a Utility People will question the need for a utility. A utility is needed for two reasons: current funding for maintenance is inadequate and new programs are needed to help achieve water quality goals related to cleaning up the Chesapeake Bay and its tributaries. While documentation to support these two reasons is adequate, each has political implications. For example, the statement that current funding for maintenance is inadequate could be construed as a criticism of budgetary or allocation decisions made by elected officials. The proposition that the only way for maintenance to be funded is to establish a separate fee that is placed into a restricted account is a more direct criticism. On the other hand, this alternative approach to financing is consistent with the Administration's stated goals of looking into sources of revenue other than property tax.

2. Equity of the Rate Structure The example in Chapters 4 and 5 is illustrative of the way in which utility financing works. Although most residential users would be better off paying user chances, most nonresidential property owners, particularly owners of industrial, agricultural, and tax exempt property[12] would be better off under a property tax system. It is likely that classes of users will contest elements of the rate base. Based on expected responses to a utility proposal, official could modify the rate structure in ways to mute objections while leaving basic principles intact. For example, rather than using engineering based runoff coefficients themselves as charge rate factors, the coefficients could be grouped so that there would only be a few rate classifications (the Grouped RF (Rate Factor) Approach is an example of this concept). This would minimize the number of different rates and could reduce the disparity between types of property owners.

   Another issue pertains to credits. Most utilities offer waivers or credits, at least partial ones, to owners of nonresidential properties who control stormwater on-site. The Committee believes that it is unfair to impose charges on the owner of property who already has paid for the construction of stormwater management facilities and is responsible for maintaining them. In addition, the development and implementation of a credit system is considered essential for the success of proposals to include agricultural properties in the rate base. Agricultural land is the largest single source of non-point source pollution. Although aid is available to assist farmers in the implementation of conservation plans, the cost of implementation still is high. Although utility charges to owners of agricultural land could be significant, formation of a utility that included credits for implementation of best management practices would provide an additional incentive for farmers. Although the Committee believes that credits should be available, the Committee does not believe that charges for runoff should be waived completely for any property owner. Stormwater discharges occur even from properties that control water on-site. In general, the Committee believes that property owners who receive credits should continue to pay at the rate at which owners of undeveloped property are charged.

   While a credit system provides incentives for on-site controls and is important front eh perspective of equity, credits reduce total revenues. The impact of a credit system on potential utility revenues and on charges paid by people not eligible for credits needs to be investigated. Design of a credit system will be a major task in implementation of a utility.

3. Scope of Utility System While the costs of current stormwater programs represent a relatively small portion of the County's total budget (about 2%), the costs are significant (about $20,000,000). The costs of proposed new programs ($1.9 million) would represent an increase of almost 10% in current

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[12] Note that Carroll County does not presently envision the inclusion of tax exempt property in a utility rate base should it elect to pursue that funding option.

expenditures. If the new programs (watershed planning and maintenance) were assigned to DEPRM, DEPRM's operating budget would increase by 135%. An increase of this magnitude could be difficult to manage in the short term.

A utility could be established to fund all or only a few of the existing and proposed activities. If all stormwater activities were to be financed with at utility, current tax revenues would be freed for other activities or, theoretically, property taxes could be cut. While this may seem an unlikely scenario, several municipalities have done this when implementing utilities. Locally, the City of Baltimore recently dropped the tax rate by five cents, recognizing that the action was largely symbolic. Determining the scope of programs to be funded by a utility involves numerous political as well as technical considerations.

4. Implementation Creation of a utility typically requires a substantial period of time. Utility managers responding to a survey by MDE reported planning periods prior to Council authorization ranging from seven months to 2.5 years. The planning period reported most frequently was 1.5 to 2 years. Most (75%) of the utilities reported that utilities were implemented within six months following council authorization to proceed. In Baltimore County, the Committee has been studying the utility concept for nearly a year; pre-implementation studies have been completed. Overall, the Committee believes that the data available to them is sufficient for the Council to determine whether a utility ought be implemented in Baltimore County. Depending on when a proposal could be presented to the Council, a utility could be implemented as early as 1991.

This brief list of issues illustrates the types of problems that will be encountered in the implementation of a utility. Systematic considerations should be given to these and other issues prior to and during implementation. Consultants may need to be hired during the implementation phase.

POTENTIAL REVENUES FROM STORMWATER UTILITIES IN MARYLAND

FINAL REPORT

July 26, 1991

Jim George
Greg Lindsey

Sediment and Stormwater Administration
Maryland Department of the Environment
2500 Broening Highway
Baltimore, Maryland 21224

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EXECUTIVE SUMMARY

STUDY BACKGROUND AND OBJECTIVES

In the Water Quality Act of 1987, Congress amended the statute to address management of nonpoint source pollution. Section 319 of the Act requires that States submit assessment and management reports to the U.S. Environmental Protection Agency (USEPA) that outline strategies to control nonpoint source pollution. In response, Maryland's primary goal has been to implement the Chesapeake Bay Nutrient Reduction Plan for which quantitative goals already were in place (i.e., a 40% reduction in nutrient loadings to the Chesapeake Bay by the year 2000). This study addresses one aspect of implementing new Federal and State regulations, that is, the issue of funding Maryland programs to control nonpoint source pollution.

Stormwater management historically has been financed with general revenues from property taxes. Reliance on property taxes, however, is often inadequate. Since 1973, jurisdictions across the Country have begun implementing stormwater management utilities as an alternative source of revenue. Today over 100 stormwater management utilities are in operation nationwide.

The primary objective of this study is to estimate the potential revenue generating capacity of county-level stormwater management utilities in the State of Maryland. This study also investigates the sensitivity of these estimates to a variety of simplifying assumptions and several alternative options regarding who would be charged by a utility, that is, which standard land use categories would be included in the rate base. Finally, the distribution of charges among various types of land uses are explored for a representative set of counties.

STUDY APPROACH

The Maryland Department of Environment, Sediment and Stormwater Administration (MDE, SSA) has outlined a general approach to estimate potential revenues from stormwater utilities (Lindsey, 1988). With some modifications, the study follows this approach to estimate potential revenues from stormwater utilities for each County and Baltimore City. These estimates are summed to make a statewide revenue estimate. Land use data collected by the Maryland Office of Planning (MOP) in 1987 is used for this procedure.

The general approach involves estimating revenues as a function of parcel size and land

use. It is assumed that parcels within a land use category, such as industrial land use, share very similar runoff characteristics (in particular a similar proportion of impervious area). This assumption allows all of the parcels of a certain land use category to be grouped and treated using the average parcel size for each category. SSA has assigned a stormwater run-off coefficient or rate factor to each category, which reflects the typical amount of impervious material associated with that type of land use.

Six variations on this general approach are used to investigate the effects of alternate assumptions. The primary differences include varying the level of detail of information and using different methods to determine what amount to charge single family residential parcels relative to other land use categories. These variations among the six approaches provide one type of sensitivity analysis of the revenue estimate.

In addition, other sensitivity analyses are conducted on one of the six approaches. One analysis introduces additional land use categories into the rate base that had been excluded from the original six approaches. Agricultural parcels, tax exempt parcels, and undeveloped parcels were originally excluded for two reasons. The first reason was that, in practice, utilities often do not charge owners of these land use categories. The second motivation was to ensure that the method would not produce an overly optimistic revenue estimate.

An assumption used in all six approaches is that single family residential parcels of less than one acre would be charged $20 per year. To test the sensitivity of this assumption to changes, one of the six approaches is reevaluated assuming two alternate annual charges of $15 and $25. The primary findings of the study, and a summary of the results of these sensitivity analyses are presented in the next section.

OBSERVATIONS AND CONCLUSIONS

The estimates of total annual State revenue for all six approaches range from $60,565,500 to $72,301,400 (a 16% difference) with a median value of $67,853,200. This outcome indicates that modifications to the utility charge algorithm described within the body of this report do not greatly affect the total revenue estimate. While estimates of revenue for the entire State are relatively stable, several counties exhibit a deviation of more than 40 percent between their lowest and highest estimates depending on which of the six approaches is used.

The two sensitivity analyses described above produce significant changes in the estimate of the total annual State revenues. In particular when agricultural parcels, exempt parcels, and undeveloped parcels are introduced into the rate base for one of the six approaches, the annual revenue estimate increases from $72,301,400 to about $214,900,000.

When the annual charge of $20 for single family residential parcels is increased to $25 for a particular approach, the revenue estimate increases from $72,301,400 to $90,376,750. When the annual charge is decreased to $15 the revenue estimate decreases to $54,226,050.

Finally, several results provide insights about how charges are distributed among different land use categories for a given county. In general, the different approaches do not significantly alter the distribution of charges among the land use categories. The changes that occur do not appear to follow a pattern and must be assessed on a case by case basis for each county.

On the other hand, when making comparisons across counties, significant differences are observed in the distribution of charges among the land use categories. For example, when considering average results from all six approaches, the industrial sector of Baltimore County is estimated to bear an average of 21% of the cost, while in Montgomery County the industrial sector is estimated to bear only an average of 5% of the cost. This is attributed to differences in land development patterns.

Numerous analyses regarding cost distributions are possible. The process involves the consideration of the numbers of parcels, the parcel sizes and the relative proportions of these characteristics among the land use categories. It is possible to alter the distribution of the cost among different land use categories to some degree by altering the utility charge structure; however, the results of this study indicate that the development pattern of a county is the primary determinate.

Addendum:

Revised Estimate of the Potential Annual Revenue from Stormwater Utilities in Maryland Based on Median Parcel Sizes

Since the completion of the original report, SSA has revised the estimate of the annual revenue generating potential for Maryland counties based on median parcel sizes. The original revenue estimate, based on average parcel sizes, was about $68 Million; the revised estimate is about $42 Million (a 38% decrease).

This revised computation is based on one of the six rate structure approaches used in this report, that is, the Quantile Approach. SSA selected the Quantile Approach to make this revised estimate because it yields an estimate that falls in the middle of the range of the six approaches. The range of the original six estimates is from $54 Million to $83 Million. If we assume that using median values would result in a 38 percent decrease for each of the six estimation methods used in this report, the revised range would be from $33.5 Million to $51.5 Million.

The estimates developed in the body of this report are based on average parcel sizes for all land uses except residential land use, which was varied for each approach. The revised revenue estimate uses approximations of the median parcel sizes for commercial and industrial land uses, and mean parcel sizes for the other land uses[1].

This revised estimate is probably more reliable than the original estimate. The reason that median values tend to be more stable is because they are not skewed by a small number of anomalous large parcels.

The following tables list the data used in the revised estimation procedure. This data is presented as a comparison of average and median parcel sizes for commercial and industrial land uses, and is listed by county. Finally, note that agricultural, tax exempt, and undeveloped land uses are omitted from the original and revised estimates.

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[1] Median parcel sizes were estimated for only the Commercial and Industrial land uses as a matter expediency. This simplification is justified on the basis that these two land uses, in addition to residential land use, make up that vast majority of all land uses (accounting for the exclusion of agricultural, tax exempt, and undeveloped land from the rate base).

Potential Stormwater Utility Revenues in Maryland: A Comparison Between Estimates Based on Median and Average Parcel Sizes

Potential Revenues Using the "Quantile" Approach

Counties/City	Average Parcel Sizes	Median* Parcel Sizes
Allegany	$1,731,000	$663,400
Anne Arundel	$6,114,300	$3,751,700
Baltimore	$9,236,800	$5,931,300
Calvert	$794,900	$558,300
Caroline	$424,300	$315,200
Carroll	$1,545,900	$1,164,700
Cecil	$2,036,900	$803,900
Charles	$1,864,800	$1,378,400
Dorchester	$855,800	$435,000
Frederick	$2,605,200	$1,272,800
Garrett	$2,316,400	$416,100
Harford	$3,165,100	$1,594,000
Howard	$2,347,000	$1,571,000
Kent	$369,400	$213,600
Montgomery	$5,082,300	$3,908,600
Prince George's	$9,034,600	$5,995,600
Queen Anne's	$595,500	$410,600
Somerset	$420,500	$258,100
St. Mary's	$1,073,800	$691,100
Talbot	$814,700	$552,200
Washington	$2,058,400	$1,151,800
Wicomico	$1,129,900	$705,300
Worcester	$2,567,000	$924,400
Baltimore City	$9,959,200	$7,144,300
TOTAL	$68,143,700	$41,811,400

* Median values were computed for Commercial and Industrial parcels, which strongly influence the revenue estimate; all other land use parcel sizes are based on averages (except residential). The average values are based on 1987 data and the median values are based on 1990 data.

A Comparison of Average and Median Parcel Sizes (Acres) For Commercial and Industrial Land Uses in Maryland Counties

	Commercial Parcel Sizes		Industrial Parcel Sizes	
Counties/City	**Average**	**Median**	**Average**	**Median**
Allegany	1.6	0.25	38.7	1.80
Anne Arundel	2.7	0.80	11.9	4.50
Baltimore	2.0	0.40	12.6	2.20
Calvert	4.0	0.75	49.0	4.00
Caroline	2.2	0.35	8.8	3.25
Carroll	2.8	0.50	11.2	2.00
Cecil	5.2	0.75	39.4	7.50
Charles	3.7	0.75	9.4	1.25
Dorchester	2.7	0.30	14.2	4.00
Frederick	3.2	0.30	55.9	2.50
Garrett	20.0	0.75	51.1	25.00
Harford	2.7	0.50	87.1	4.00
Howard	3.2	1.00	9.8	4.00
Kent	2.4	0.30	0.0	0.00
Montgomery	1.0	0.25	8.9	0.75
Prince George's	1.9	0.30	8.8	0.75
Queen Anne's	3.6	0.60	6.2	5.25
Somerset	2.1	0.30	0.0	0.00
St. Mary's	4.3	0.75	21.3	0.30
Talbot	2.0	0.35	12.4	0.75
Washington	2.9	0.30	10.0	3.50
Wicomico	1.7	0.30	5.5	1.25
Worcester	2.2	0.25	5.2	1.20
Baltimore City	0.5	0.25	3.2	1.25

Notes: The median values are based on 1990 data. The average values are based on 1987 data.

1.0 INTRODUCTION

This report is an analysis of potential stormwater utility revenues in the State of Maryland. It includes estimates of potential revenues for each major jurisdiction in Maryland (23 counties and Baltimore City) under a variety of assumptions.

The report begins with several definitions and an explanation of the utility approach to financing stormwater management (Section 2). A brief overview of previous research conducted by the Maryland Department of Environment, Sediment and Stormwater Administration (MDE, SSA) is provided. General procedures for estimating utility revenues are summarized and illustrated with an example.

In Section 3, estimates of total revenues are presented. Six different approaches are used to explore the sensitivity of estimates to underlying assumptions about the amount of impervious area on typical parcels and to other factors. In addition, the sensitivity of the estimates to different definitions of the utility rate base (i.e., the land use categories that will be charged) is explored, and general limitations of the analyses are noted.

The U.S. Environmental Protection Agency provided funding for this study as part of a grant to MDE under Section 319 of the 1987 Water Quality Act. Section 319 requires that states complete assessment and management reports that document nonpoint sources of pollution and outline management programs necessary to achieve water quality objectives. In Maryland's management report, MDE identified the lack of funding for stormwater programs and projects, including water quality retrofits, as a significant barrier to control of nonpoint source pollution and achievement of nonpoint source-related water quality objectives. Hence, when funds became available under Section 319, MDE proposed that EPA fund implementation of a technical assistance program to assist local officials in establishing stable, sufficient sources of funds for stormwater management.

This report comprises the first deliverable for the utilities technical assistance project funded with Maryland's Section 319 grant. The revenue estimates included herein will be used to support feasibility studies that will be prepared for individual counties.

2.0 STORMWATER UTILITIES

Stormwater management historically has been financed with general revenues from property taxes. Since local officials often view stormwater management as a lower priority than other, more visible government programs, stormwater management typically receives limited financial resources. As a result, reliance on property taxes to finance stormwater management has proven inadequate.

Alternative sources of financing are available. The Chesapeake Bay Nutrient Reduction Plan, which outlines programs and activities necessary to achieve Bay cleanup objectives, identifies stormwater utilities as a primary alternative source of funding (Shanks and Tassone, 1988). The Sediment and Stormwater Administration has supported research of stormwater utilities (Lindsey 1988a, 1988b, 1989).

2.1 Definition and Rationale for the Utility Approach

Stormwater utilities are public utilities, much like conventional water and waste water utilities, that are established to provide the service of stormwater management. They are financed by dedicated[1] user charges, not by property taxes. User charges for an individual property are based on the contribution of the property to the total volume of stormwater runoff that must be managed.[2]

The utility approach involves a redefinition of the way in which people have thought about runoff and stormwater management (if they have thought about it at all). The revised perspective is that runoff is a man-made problem, and that owners of property are responsible for it. This is a reasonable view point if one compares the higher water retention characteristics of undeveloped land compared to land having impervious structures, driveways, and patios, which significantly increase runoff.

The rationale for the utility approach is the "user pays" or "polluter pays" principle. Individual property owners are viewed as generators, and the role of government is to control the discharges. To finance the government's activities, property owners pay user charges in amounts proportionate to their discharges. Neither property values and ability to pay, nor perceived benefits (e.g., protection from floodwaters) and willingness to pay generally are considered. Thus, with the utility approach, the benefits of stormwater management are deemphasized, and emphasis is placed on the cause of the problem.

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[1] Dedicated simply means the charges can be used only for stormwater management.

[2] In theory, factors in addition to the volume of runoff (proximity to sensitive environments, pollutant/nutrient contributions) can be incorporated into charge systems; however, the difficulty of accounting for the costs of such factors has prevented most utilities from doing so.

Three definitions follow from this discussion. First, users are people or institutions whose properties generate runoff to the surrounding area (including streams, lakes and stormwater sewer systems). Second, beneficiaries are people or properties that gain from stormwater management. Benefits include improved water quality and flood control. Finally, user charges are dedicated fees paid by users (generators of stormwater) based on the amount of runoff that leaves their property. The utility approach consists of practical application of these definitions.

Care must be taken in the formation of utilities, particularly their rate structures, because utilities are subject to controversy. Four of 19 utilities surveyed in 1987 reported legal challenges in which the rate structure was questioned (Lindsey, 1988a). Courts, however, have upheld the creation of stormwater utilities. Crye (1986) has summarized an important legal standard that has evolved:

> Charges must be fair and reasonable and bear a substantial relationship to the cost of service and facilities.

This says that local jurisdictions must have a rational basis for making estimates of runoff and determining charges, but that runoff from parcels need not be measured precisely. Equally important, the standard does not mention benefits or beneficiaries. Utility rate systems may be based on costs, not benefits.

There is a consensus among public works officials that the utility approach is the best way to finance stormwater management. The main reason for their preference is that utilities are a stable source of funds. A second important factor is that many people think that user charges based on one's contribution to the problem are more fair than property taxes. These two rationales are summarized in a statement by the American Public Works Association (APWA, 1981):

> The user charge and utility concept are the most dependable and equitable approaches available to local governments for financing stormwater management.

2.2 The Experiences of Other Stormwater Utilities

Stormwater utilities exist in more than 100 communities in the United States (Cyre, 1990). Utilities use a variety of methods to estimate runoff and determine charges. Before reviewing the specific approaches investigated for this report, several findings of surveys of existing stormwater utilities are worth noting.

In 1987, The Maryland Department of the Environment, Sediment and Stormwater Administration (SSA) sent questionnaires to 25 existing utilities; 19 responded. Survey

findings show that utilities have been established in both smaller communities and older, central cities (utility service area populations range from 20,000 to more than a million). Some are organized to serve multiple jurisdictions (e.g., a county and a city). The oldest utility responding to the survey was established in 1973. All of the utilities base the user charges on some type of estimate of the amount of runoff from parcels. Most based their estimates on the amount or percentage of impervious area of an individual's property.

Several summary measures developed from the survey data provide a sense of the revenue generating potential of stormwater utilities.

- Annual user charges for single family residential (SFR) users range from $15 to $52.80 ($1.25 to $4.40 monthly) in 1987.

- Charges to single family residential users account for between 24% to 62% of all revenues from user charges.

- Revenues per developed acre within the utility service area range from $50.45 to $122.06 annually.

- Revenues per acre (both developed and undeveloped) range from $22.75 to $79.93 annually.

- Total annual revenues range from about $263,000 to a projected $8.2 Million.

In 1990, SSA resurveyed the utilities. Annual SFR charges presently range from about $13 to almost $90, while annual utility revenues range from $75,000 to almost $10.5 million.

2.3 General Approach to Estimating Potential Revenues

Estimating potential revenues in a jurisdiction is a straightforward process of summing up the individual user charges of all of the rate payers in the utility rate base. For planning purposes this is simplified by grouping users according to similar land uses and estimating typical charges for average-sized parcels within each land use category. In this context the rate base is defined as the set of land use categories for which owners will be charged.

We begin with an overview of the general procedures for estimating revenues. Following the overview is a detailed illustration of the procedures used in this study to generate several revenue projections based on alternative underlying assumptions.

It should be stressed that the following estimates of potential revenues bear no direct

relationship to the revenues from the actual implementation of a stormwater program. These estimates are made solely to provide an indication of the amount of revenues that could be generated if the utilities are established under a certain set of assumptions and are to charge amounts comparable to amounts charged by utilities elsewhere.

2.3.1 Overview

Preliminary estimates of the revenue-generating capacity of Maryland counties (and thus the State) can be made using land use data that are delineated at the county level[3]. The following land use data are necessary:

- Land use category definitions[4]
- The number of parcels of land in each category
- The total acreage in each category
- Parcel area data (average parcel area is sufficient for initial planning studies).

In addition stormwater runoff rate factors are needed. These are coefficients from 0 to 1 that reflect the typical percentage of impervious area for a given parcel and thereby reflect the parcel's tendency to generate stormwater runoff.

The concept behind most stormwater utility charge schemes is straight forward. In general, utility charges are directly proportional to parcel size and the rate factor, i.e., they can be thought of an acreage charge weighted by the percentage of area that is impervious. This relationship is shown in the following simplified user charge equation.

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[3] Data are available from the Maryland Office of Planning. Appendix A is a sample of the land use data used in this study.

[4] Land use categories are standard descriptive classifications (e.g., industrial, commercial, residential, undeveloped, and others). As an approximation, it is assumed that stormwater runoff characteristics are the same for all parcels in a given land use category.

$$PC = PA \times F \times C/U$$

where, PC = the charge for a parcel

PA = the area of the parcel

F = the rate factor (runoff coefficient) for the parcel (typically associated with the type of land use category, $0 \leq F \leq 1$)

C/U = the charge per unit area (or other units to be described later in this report)

The rate factor (F) relates the charge to the amount of runoff, which is central to the utility concept. That is, parcels that are more intensely developed have a greater value of F, and a greater charge for a given parcel size (e.g., F = 0.80 for commercial parcels, which typically have paved parking areas and sidewalks, and generate a lot of runoff).

Using data from the Department of Assessments and Taxation, the Maryland Office of Planning has categorized every parcel of land in each county according to land use (e.g., commercial, industrial, and residential). For the purposes of this revenue estimation procedure every parcel within each land use category is assumed to have the same characteristic potential for runoff and is assigned a common rate factor. This amounts to assuming that, within a land use category, each parcel has the same proportion of impervious area (i.e., the intensity of development is assumed to be the same). While this assumption is obviously not true, it is sufficient at this level of planning, and it allows typical charges for each category to be estimated.

Within a land use category, the average parcel size is calculated and multiplied by the rate factor. This yields an estimate of the average impervious area per parcel, which can be expressed as the number of equivalent runoff units that can be attributed to the parcel. Typical charges for each parcel can be based on the number of equivalent runoff units. Lindsey (1988 b) has outlined this procedure.

By convention, most utilities have followed the practice of expressing the amount of impervious area or the number of equivalent runoff units as single family equivalent units (SFEs) (sometimes called equivalent residential units - ERUs). This approach will be followed here. The average impervious area is converted to SFEs by simply dividing through by the average impervious area of a typical single family residential parcel. An SFE is a measure of the impervious ground cover per typical single family residential parcel. It allows the amount of impervious area of a parcel in any land use category to be expressed in terms of the amount typically found on a single family residential parcel. For example, a typical commercial parcel may equate to 4.5 SFEs. Among other reasons, this approach has been adopted by utilities to emphasize the fact that charges

are fair and so that homeowners can easily understand their charges relative to charges paid by others.

A more detailed account of the general approach follows. It is based on a slight modification of the equation presented above, and reflects the use of SFEs for an average parcel in a given land use category:

$$PC = (PA \times F)/(I) \times C/U$$

where,

PC = the charge for an average parcel

PA = the area of an average parcel

F = the rate factor (runoff coefficient) for the parcel (typically associated with the type of land use category, $0 \leq F \leq 1$)

I = is the average impervious area of a typical residential parcel

C/U = charge per SFE, i.e., $20/SFE (In general this is "charge per unit", where the unit in this case is the SFE)

These modifications simply have a scaling effect by dividing through by the impervious area of a typical residential parcel. As an additional enhancement of the equation another term may be added or subtracted to reflect a credit or a surcharge. This is not shown explicitly in the equation above.

The average charge per parcel for a given land use category is determined by multiplying the number of SFEs times a dollar-amount per SFE, which is assumed to be $20/SFE for all six approaches in this study. This average charge per parcel is then multiplied by the number of parcels in the land use category. The result is an estimated total charge (i.e., revenue) for the given land use category. This process is repeated for each land use category. The subtotals for each land use category are then summed to arrive at a total county revenue estimate. This process is performed for each county and summed to arrive at an estimated state revenue figure.

2.3.2 An Illustrative County Stormwater Utility Revenue Estimation

We illustrate the method used to estimate revenues for each county. Before discussing the illustration below, it is worth placing it in context by drawing a distinction between the approach used here to estimate revenues, and the approach typically used by local officials. Local officials typically determine the amount of revenues needed and then estimate charges. For example, assume that an engineering-based estimation of the total annual revenue requirement for stormwater management is known to be $1.5 Million. The ensuing procedure would be to determine the user charges necessary to meet this revenue requirement. Since all user charges are keyed off the charge for a single family equivalent (SFE) unit, the procedure amounts to adjusting the charge per SFE until the revenue requirement is met. A typical charge for a residential parcel less than one acre in size (i.e., per SFE) might be $18.25 per year.

The second approach, which is used in this report, is the reverse of the first approach. We assume a fixed $20 annual charge per SFE. The procedure is to calculate the revenues that would be generated based on this fixed assumption.

Since the user charges in each land use category can be expressed in SFE units, the process is well suited to the use of a computer spread sheet. The SFE unit is flexible and can be altered to reflect different underlying assumptions for a particular revenue estimation. Since user charges for parcels in all of the other categories are keyed off of the SFE, the SFE can be viewed as the control mechanism of the procedure.

Two examples of how the specific definition of the SFE unit can be altered follow. First, the range of residential parcel sizes used to represent a single family equivalent may be changed. In this study, for instance, SFEs are defined with respect to either residential parcels of less than one acre, or parcels of less than one-quarter acre. Second, since the amount of impervious area associated with the SFE is only an estimate, its value can be altered to investigate the implication of different assumptions (for example, we can assume a typical residential parcel is 60% or 65% impervious).

In the case illustrated below, the single family equivalent is set somewhat arbitrarily at 3,000 square feet of impervious area for residential parcels less than or equal to 1 acre in size. In this case the impervious area has been fixed at 3,000 square feet rather than using the product of a rate factor and the average parcel size to determine the average impervious area within the interval less than one acre. The rationale for this is discussed in the description of the six alternative approaches; however, it is sufficient to say at this point that the ability simply insert a number (3,000 sq.ft.) further reflects the flexibility of the SFE unit.

Table 1 is a worksheet that illustrates the process used to estimate potential revenues from a county stormwater utility. Data used in the worksheet are from the Maryland Office of Planning (See Appendix A for a sample of this data). The components of the worksheet are described immediately below.

Table 1

Illustrative Worksheet for Estimating Revenues From Utility User Charges

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	957	107.7	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,085	6.6	0.82	235,747	78.58	85,262			1,571.64	1,705,225	0.68
Comm Res	1	9.0	0.68	266,587	88.86	89			1,777.24	1,777	0.00
Exempt	468	42.5	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	43	39.4	0.70	1,201,385	400.46	17,220			8,009.19	344,395	0.14
Apartments	17	2.0	0.64	55,757	18.59	316			371.71	6,319	0.00
Not Perc	28	1.7	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	14,133	0.38	na	3,000	1.00	14,133			20.00	282,658	0.11
> 1 Acre	4,859	4.36	na	4,500	1.50	7,289			30.00	145,769	0.06
Res Ag	189	11.7	na	4,500	1.50	284			30.00	5,670	0.00
Res Comm	1	1.0	0.64	27,878	9.29	9			185.85	186	0.00
Condominium	5	0.00	0.64	0	0.00	0			0.00	0	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Traile	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
0 - .5 Ac	0	0.0	0.40	0	0.00	0			0.00	0	0.00
> .5 - 1 Ac	0	0.0	0.23	0	0.00	0			0.00	0	0.00
> 1 Acre	0	0.0	0.16	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	21,786					124,601				$2,492,000	1.00
Unimproved	10,878	5.8	0.00	0	0.00	0			0.00	0	0.00
Grand Total	32,664					124,601	$2,492,000	$20.00		$2,492,000	1.00

na = not applicable

Column C1 is the name of the land use category. In the cases of Exempt and Residential land uses, subcategories are defined to allow finer distinctions in stormwater runoff characteristics.

Column C2 is the number of parcels in each land use category.

Column C3 is the average parcel size for each land use category expressed in acres. For the Residential land use category, weighted average parcel sizes were calculated for parcels greater than and less than one acre using the data displayed in Appendix A.

Column C4 contains the utility rate factors, which represent the typical percentage of impervious cover on a property. For example, the rate factor for industrial parcels is 0.70 implying that, on average, about 70% of each industrial parcel is covered by impervious material. These factors reflect standard hydrologic runoff coefficients[5] such as those used in the Rational Method of runoff estimation.

This column can also be used to control whether or not a land use category is included in the rate base. Table 1 illustrates a case in which zero values are inserted for agriculture, exempt, and unimproved land use categories thereby excluding them from the rate base.

Column C5 is the average impervious area per parcel for each land use category. This average impervious area is expressed in square feet. The values are calculated as the (average acres per parcel) x (proportion of impervious area) x (43,560 ft/acre). That is, (C3) x (C4 which is the rate factor) x (43,560 ft/acre).

Column C6 is the number of Single Family Equivalent (SFE) units. An SFE is defined as the ratio: (impervious area of an average parcel for a given land use) / (average impervious area of a residential parcel less than 1 acre). In the worksheet it is calculated as C5/C5* where C5* is the particular value of C5 for Residential < 1 Acre[6].

This dimensionless unit equals one for a typical single family living on a residential parcel of less than 1 acre. Since most people are familiar with residential land use, SFEs allow a comparison among land use categories based on a familiar measure. Once

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[5] In general this is a precise statement. However, in several approaches presented in this report these values are altered. Where this is the case, the alterations are noted.

[6] Most of the approaches presented in this report define the SFE with respect to the average parcel size among residential parcels less than one acre. In one approach, however, the delineation of the residential land use is much finer. In that case, the SFE is defined with respect to the average parcel size among residential parcels less than 1/4 acre. As a consistent rule, all of the approaches presented in this report define SFEs with respect to the smallest subclassification of residential land use. Furthermore, when referring to the smallest subclass the term "typical residential parcel" is used.

allow a comparison among land use categories based on a familiar measure. Once defined, SFEs also facilitate the utility charge calculations, although they are not necessary to meet these ends.

Recall that the estimations in this report all assume that the smallest residential parcels pay $20 per year. Thus, once SFEs are determined for each land use category, calculations are reduced to multiplying $20 times the number of SFEs. In the case of the average small residential parcel, the calculation is trivial: (1 SFE) x ($20 per SFE) = $20. If a land use category has five and one half times the impervious area as the typical residential parcel the calculation is: (5.5 SFEs) x ($20 per SFE) = $110.

Column C7 is the number of SFEs per land use category. This is equal to the average number SFEs per parcel multiplied by the number of parcels in the given land use category. That is, (C2) x (C6). The column is summed to a total at the bottom.

Column C8 is the Total County Revenue Generated based on the assumption that the typical residential parcel will be charged $20 per year. It is the product of $20 times the sum of column C7 (the grand total number of SFEs for the county). In terms of computations, it is plugged into the spread sheet after a hand calculation.

Column C9 is the charge per unit as depicted by (C/U) in the equation presented above. That is, it is the dollars per SFE, which in the present case is $20/SFE. It is calculated as the fraction (C8*) / (C7*) where the star indicates the values that are used are from the bottom of the column.

Column C10 is the typical annual charge for each land use category. It is the amount that would be paid by the owner of an average sized parcel in the given land use category. It is calculated as the typical number of SFEs times the charge per SFE ($20), or (C6) x (C9*) where the star indicates the value that is used is from the bottom of the column.

Column C11 is the total amount of revenue generated by a given land use category. It is the product of the average annual charge and the number of parcels for the given land use category. It is calculated as (C10) x (C2).

Column C12 is the percentage of the total revenue paid by the given land use category. It is the total revenue per category divided by the grand total revenue for the entire county. It is calculated as (C11) / (C8*) where the star indicates the value that is used is from the bottom of the column.

Table 1 also illustrates the flexibility of the worksheet-based estimation procedure. Notice that the column C4 entries for residential land use are "na" (not applicable). Rather than multiplying a rate factor (C4) times the average parcel size (C3) to arrive at the average impervious area (C5), the impervious area for residential parcels less than 1

acre has been set equal to 3,000 sq.ft.[7] An impervious area of 1.5 times this area (4,500 sq. ft.) is used for residential parcels greater than 1 acre. Note that this leads to the larger residential category paying a user charge that is 1.5 times that of the smaller category (i.e., $30).

This particular assumption was investigated as one of six approaches reviewed in this report (Approach 1). The motivation for this particular arrangement is discussed in the descriptions of the alternate approaches presented in the later in this report.

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7 This rough estimate, based on typical values found in the technical literature, is the assumption made in Approach 1 of this report. Approach 2 fixes this value at 4,000 sq. ft.

3.0 POTENTIAL REVENUES FROM STORMWATER UTILITIES IN MARYLAND

This section includes estimates of the revenue-generating capacity of the State of Maryland under a variety of utility user charge approaches. Six alternative approaches are presented; all are variations of the general approach described in the previous section. The sensitivity of these estimates to different assumptions is explored.

3.1 Alternative Utility Charge Structures

3.1.1 Common Assumptions Among the Six Approaches

It is useful to review the assumptions that are common to the six revenue estimation approaches prior to describing the approaches in detail. The limitations imposed by these assumptions will be revisited as part of the discussion of results.

It is also important to recognize that, even though the procedures are similar in form to actual user charge schemes, the revenue projections generated by this study constitute only rough planning estimates. The simplifying assumptions associated with this exercise introduce errors that are tolerable for this level of estimation, but may not be appropriate for the actual implementation of a utility (in particular the use of average parcel size for each land use category).

As the overview of the general approach in Section 2 indicates, average parcel sizes are used in each of the six revenue estimation methods. Average values of this type are susceptible to being skewed by a small number of extreme values. Where corrections have been made to account for this, they are noted.

As mentioned above, a base annual charge of $20 per SFE is used in each approach. Use of annual charge was motivated by several considerations. First, it reflects a conservative figure that falls in the range of SSA 1987 Stormwater Utility Survey findings (it is less than the median annual charge). Second, it reflects preliminary findings of current research into people's willingness-to-pay for stormwater management services in one Maryland county (Baltimore County) (Lindsey, 1991). While changes in this value drive the total revenue figure, it has no effect on the distribution of charges among different land use categories. The issue of the distribution of charges among land use categories is discussed below in the subsection on results.

As noted, the rate base is defined as the categories of users to be charged. For the six baseline estimates, several land use categories are not included in the rate base. These

are agriculture, marshlands, unimproved[8] parcels, and tax exempt parcels (e.g., churches, schools, parks, government facilities, and others). Resistance to utilities often originates from these land use categories. For instance, farmers may argue that they are already regulated by soil conservation measures. Owners of marshlands or unimproved lands may argue that as long as their land is left natural they should not be penalized simply for owning it. Finally, tax exempt establishments may perceive utility charges as a form of taxation and may contest the charges.

The decision to exclude these land use categories from the six approaches stems from uncertainty about their eventual inclusion. Excluding them also errs on the side of underestimating the potential revenues, which is conservative.

Many existing utilities, however, include some combination of these land use categories in their rate base. For example, the SSA survey of nineteen utilities reveals that thirteen utilities charge churches and hospitals that are typically exempt from property taxes. Eleven charge parks, and ten charge agricultural land use categories. Whereas streets and right-of-ways are excluded from the rate base of the six approaches presented in this report, six of the utilities surveyed include them. Three utilities also reported charging users of undeveloped land. As part of the sensitivity analysis presented in Section 3.2, these land uses are included in the rate base resulting in a three-fold increase in the potential revenues.

The land use data used in this study are aggregated at the county (i.e., they include data for incorporated municipalities). Consequently, the estimates in this report rely on the simplifying assumption that cooperative agreements among jurisdictions could be made (e.g., between cities and the surrounding county). This avoids the effort required to determine which cities would not participate with the counties in developing utilities. This assumption also avoids the need to edit the available data to remove such cities from the rate base.

Since all of the approaches are essentially based on the same data, issues of data quality affect all six of the approaches examined in this report. The data is presumed to be accurate, though the potential for misclassification of parcels and other inaccuracies may exist. Furthermore, the data printouts (See Appendix A) were generated in 1987. Since land developers are supposed to have adhered to best management practices since that time (e.g., on-site stormwater control for new developments), it is likely that such parcels would be eligible for credits under the implementation of a utility. The credits would have the effect of offsetting the error due to omitting newly developed lands.

The assumptions outlined above highlight the similarities among the six revenue estimation approaches. In contrast, the primary differences and reasons for developing

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[8] In the tax files, any property with an improvement worth more than $10 is classified as "improved."

the different approaches are summarized in the following section.

3.1.2 Rationales for and Differences Among the Six Approaches

The six revenue generation approaches are variations of the general approach described Section 2. As an introduction to the six user charge approaches reviewed in this study, three broad comparisons are presented. Table 2 summarizes the three basic similarities and differences among the approaches. These are: 1) the method of determining residential SFEs, 2) the specificity of residential land use categories, and 3) the specificity of rate factors.

Determination of Residential SFEs. The six approaches can be characterized according to how the SFEs were determined for subcategories of the residential land use category. The traditional method, described in the general approach, is to calculate the impervious area based on the average parcel size for each residential subcategory (e.g., < 1 Acre, and > 1 Acre). This is the product of the rate factor (percent impervious) and average parcel size within the given subcategory. Note that the average impervious area for the smallest residential subcategory defines the SFE. A second method of determining the SFE is to select a fixed average impervious area based on professional judgement.

There are two reasons for arbitrarily fixing the SFE. The first is an equity consideration. Direct application of rate factors produces a pronounced difference in user charges between parcels just below and just above the one acre cut-off in the user charge approaches that utilize only two residential subcategories. This is because the average acreage for the larger residential category dominates the computation of the SFE. Fixing the SFE by selecting a fixed amount of impervious area can mitigate the disparities among categories.

The second reason is that rate factors are poorly documented for residential parcels larger than two acres. For larger parcels in general, it is reasonable to assume that a significant portion of the land is undeveloped. Since undeveloped lands are excluded from the rate base of all six approaches[9], discounting the runoff contribution from the undeveloped portions of large residential parcels is a consistent extension. In the absence of accurate data, judgement must be used in fixing SFEs for larger parcels.

It happens that, for parcels less than one acre in size, values ranging from 2,500 to 3,000 square feet of impervious area commonly are found in the engineering literature. Thus, an estimate of 3,000 square feet serves as a reasonable choice for fixed value of the SFE; this value is used in two of the six cases. For reasons of equity, larger parcels have been assigned the value of 1.5 SFEs. This corresponds to a value of 4,500 square feet of impervious area. This ratio of 1 to 1.5 is used in the two of the six approaches. These

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[9] As a sensitivity analysis of one of the six approaches (Approach 1), undeveloped lands are included in the rate base and the results are provided.

two approaches are cases having two residential subcategories, i.e., less than and greater than one acre.

In the user charge approaches which use detailed residential subcategories, the transition from small to large rates is distributed gradually over more categories. As a consequence, the stark inequity does not arise as it does when only two subcategories are used. Thus for the approaches tabulated above having detailed residential categories, the traditional rate factor approach produces a reasonably equitable outcome.

One of the six approaches is a hybrid. It uses both the traditional application of rate factors and the method of fixing the SFE based on professional judgement. This particular case has only two residential subcategories (residential parcels less than and those greater than one acre). The impervious area for the small subcategory is computed using rate factors, and the larger subcategory is fixed at 1.5 SFEs, i.e., 1.5 times the impervious area of the small subcategory.

This discussion shows that the six approaches can be grouped according to how the residential SFEs were determined. That is, by traditional use of the rate factors (i.e., calculated), use of professional judgement to choose reasonable SFE values (i.e., fixed), or by a combination of the two (a hybrid). Table 2 indicates how SFEs are determined for each approach.

Specificity of Residential Acreage Categories. In practice, utility charge systems must be adequately detailed without being overly cumbersome. In the general approach described Section 2, a simple procedure is applied repeatedly for each land use category under the assumption that the physical characteristics of parcels within a category are similar enough to be aggregated. The aggregation arises explicitly in the form of using the same runoff coefficient (rate factor) for all of the parcels within a category. Alternatively, parcels within any land use category can be grouped into subcategories according to different acreage intervals, and assigned slightly different rate factors. This increased detail is intended to better represent the variations within the overall land use category. When considering actual implementation of a charge system, such increases in detail are usually gained at the expense of increased administrative burden.

For the residential land use category, two variations were considered in this study. In the first case, two subcategories were defined. Residential parcels were classified as being either less than or equal to one acre (Res. < 1), or being greater than one acre (Res. > 1). In the second case, detailed parcel size intervals were used beginning with quarter acre increments for the range of 0 to 0.5 acres, then half acre increments up until 2 acres, then one acre increments up until 5 acres, then five acre increments through 20 acres and so on (see Appendix A). The approaches which used these two variations are summarized in Table 2.

Table 2

Similarities and Differences Among the Six Revenue Estimation Approaches

Three Differentiating Characteristics	Six Approaches					
	Fixed SFE (3,000)	Fixed SFE (4,000)	Quantile	Detailed	Simplified	Grouped RF
Residential SFEs (Method of Determining the SFEs)	Fixed	Fixed	Calculated	Calculated	Hybrid	Calculated
Residential Categories (Number of Residential Subcategories)	Two	Two	Two	Detailed	Two	Detailed
Rate Factors (The Number of Different Rate Factors Used)	Six	Six	Nine	Many	Three	Four

Specificity of the Runoff Rate Factors. A third way to differentiate the six approaches is according to the level of specificity of the rate factors. Again, a trade off between precision and the associated administrative burden motivates the discussion. Recall a similar trade off motivated the consideration of approaches which utilized detailed residential subcategories versus categories that were collapsed down to two (less than or greater than 1 acre).

In the case of rate factors, several existing utilities assign rate factors on the basis of making measurements of impervious area via surveys or by digitizing aerial photos. In this case, the different values of rate factors constitute a continuum. In other cases, a discrete number of rate factors are associated with land use categories. In the latter case, the number of different rate factors used in the charge scheme may be reduced further through aggregation.

Two approaches are used herein. One involves aggregation or grouping of rate factors; the other involves use of different rate factor for each land use category (i.e., desegregated rate factors). This study considers two approaches that group rate factors into 2 or 4 different categories, while the remaining four approaches desegregate rate factors into either roughly 8 categories or a continuum of values. The specific approaches are summarized above in Table 2.

As mentioned previously, when considering implementation of an actual user charge system, aggregating information, such as the number of rate factors, reduces administrative burden. In the context of implementation, a second motivation exists for aggregating rate factors, a reduction in contested charges. If from the beginning the utility concedes that the approach is not precise, disputes over details, such as the accuracy of survey work, and statistical representations of land use categories become moot.

3.1.3 Descriptions of Six Alternative User Charge Approaches

The six different approaches are identified by simple names in addition to being numbered. The six approaches summarized below are: Fixed SFE (3,000), Fixed SFE (4,000), Quantile, Detailed, Simplified, Grouped RF (rate factors). A more detailed description of the six approaches is provided in Appendix C.

Approach 1 "Fixed SFE (3,000)": The name of this approach is drawn from the fact that the residential SFEs were fixed by professional judgment to 3,000 square feet for residential parcels less than one acre in area.

The residential category is divided into two groups: parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

3,000 sq. ft. impervious for parcels < 1 acre (This defines the unit SFE)
4,500 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

The degree of specificity of rate factors is mid-ranged with approximately six different rate factors being used for different land use categories.

Approach 2 "Fixed SFE (4,000)": Like Approach 1, the residential category is divided into two groups: parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

4,000 sq. ft. impervious for parcels < 1 acre (This defines the unit SFE)
6,000 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

The degree of specificity of rate factors is mid-ranged with approximately six different rate factors being used for different land use categories.

At first glance, it may seem counter intuitive that using a higher impervious area for residential parcels would produce a lower revenue estimate. To see how this works, consider the following example in which a comparison is made between SFEs defined to be 4,000 sq.ft./SFE versus 3,000 sq.ft./SFE.

A commercial parcel of 12,000 sq.ft. of impervious area under the Fixed SFE (4,000) approach pays $20/SFE or (12,000/4,000) x $20 /sq.ft. = $60. Under the Fixed SFE (3,000) approach, the same commercial parcel is assessed (12,000/3,000) x $20 /sq.ft. = $80. In both approaches, the same amount of revenue is generated by the residential parcels because their rates are fixed by definition at $20 and $30 per parcel for the two residential subcategories. Consequently, the residential land use category does not contribute to differences in the projected revenue.

Approach 3 "Quantile": Again, the residential category is divided into two groups: Res. < 1 acre, and Res. > 1 acre. Rate factors are used to determine SFEs for the residential land use category.

This approach corrects for sharp differences in user charges between smaller and larger parcels that arise when the residential land use category is broken into two categories and mean acreage values are used to represent typical parcel size. An alternative to use of mean acreage values, which are often skewed by infrequent extreme values, is to use the median (50th percentile) parcel size (for parcels less than one acre) and the 90th percentile size as the typical value for parcels greater than one acre[10].

The level of specificity of rate factors is slightly increased above that of Approaches 1 and 2 with approximately eight different rate factors being used for different land use categories.

Approach 4 "Detailed": For this approach, the residential category is divided into about 20 acreage intervals according to the data available (See Appendix A, page A-2). In addition to the high level of specificity of the residential category, the rate factors are highly detailed since a different rate factor is assigned to each of the 20 residential acreage categories. The SFEs for residential parcels are all computed using rate factors as opposed to being fixed.

This approach represents the most detailed revenue estimation approach of the study, although it is quite simplified in comparison to actual implementation methods.

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[10] It is the parcel size below which 90 percent of the parcels are smaller, or stated another way, is the parcel size for which only 10 percent of the parcels are larger.

Approach 5 "Simplified": This approach was motivated by a key aspect of the approach used in Austin, Texas, which classifies each land use category into one of three rate factor groups 0.10, 0.40, or 0.80.

This approach uses rate factors to determine the SFE for the residential parcels < 1 acre, but fixes the SFE for parcels > 1 acre at 1.5 SFEs. Consequently, the value of the unit SFE can rise and fall for different estimates between counties, while the SFE for parcels > 1 acre follows that rise and fall. This combined use of rate factors to compute the unit SFE and fixed SFEs for the parcels > 1 acre is referred to above in Table 2 as a hybrid treatment of residential SFEs.

This approach derives its name from the fact that it is characterized by having two simplified features; the collapsed rate factors and only two residential categories.

Approach 6 "Grouped RF": This approach is based loosely on the Ft. Collins, Texas approach, which attempts to minimize administrative burdens and contested charges by aggregating users into relatively broad rate factor categories.

Like the Detailed Approach, the level of specificity of the residential category is highly detailed, and the SFEs for residential parcels are all computed using rate factors. Unlike the Detailed Approach, however, the level of specificity of the rate factors is simplified by grouping (hence the name Grouped RF).

The SFE was calculated as (0.60) x (mean acreage) using the smallest residential acreage interval (0 - 0.25 acres), where 0.60 is the rate factor.

3.2 Revenue Estimation Results

The presentation of results begins with an overview of the State total revenue-generating figures and some broad observations. An in depth look at results for five counties representing varying degrees of development is then presented. This is intended to illustrate some of the relationships between the different approaches and how they perform for counties with different development patterns. In addition, several variations on the Fixed SFE (3,000) approach were investigated to explore the sensitivity of the base approach. Finally, the limitations of the study are discussed.

3.2.1 Summary Results

Table 3 includes estimates of total utility revenues for each county and Baltimore City for each of the six approaches. These are summed to provide an estimate of total state wide revenues. A glance at the total revenue figures in Table 3 reveals little difference among the six approaches. The median revenue estimate is $67,853,200 with a difference in minimum and maximum estimates of about $11 Million. Fixed SFE (3,000), and Grouped RF tend to produce the largest estimates, while Fixed SFE (4,000) and the

Simplified Approach usually produce the smallest estimates.

The revenue estimates for each county respond differently to the different approaches; some increase when going from one approach to another while others decrease or remain essentially unchanged. The most common reason for this observation results from differences in development patterns among counties. Less developed counties tend to have larger residential parcels, fewer industrial and commercial parcels and more land in agricultural use which was not included in the rate base for the six approaches. Several particular examples of these occurrences are discussed in the subsection on sensitivity analyses.

Table 4 presents the minimum and maximum estimates for each county and indicates the approach that produced the extreme. From Table 4, the difference between maximum and minimum revenue estimates for a given county are found to range from $250,100 (Kent County, Simplified Approach) to $10,129,400 (Baltimore Co., Fixed SFE (3,000) Approach). This excludes the maximum estimate for Baltimore City of $15,160,000 (Simplified Approach).

Table 5 summarizes the approaches that most often produced the high and low estimates. These findings are presented as a percentage of the counties for which an approach resulted in a particular outcome of the revenue estimate. For example, the Simplified Approach yielded the lowest estimate for 83% of the counties, and in 54% of the counties, the Fixed SFE (4,000) Approach yielded the second lowest estimate.

Several observations are noteworthy. The Simplified Approach most often generates the lowest county-level estimates, and the Fixed SFE (4,000) Approach consistently yields the second lowest estimate. The picture is less clear for approaches that generate high estimates. The Fixed SFE (3,000) and Grouped RF approaches nearly share equally in generating high revenue estimates.

It is also interesting to note that the projection for the Detailed Approach falls in the middle of the other projections. Recall that the Detailed Approach is an attempt to build a revenue estimation scheme that more accurately reflects physical runoff conditions for residential users. The Detailed Approach is also intended to mimic the greater amount of detail (and administrative burden) that is associated with the actual implementation of a utility charge system.

The estimates for Baltimore City also display a large variance ($7.9 - $15.2 Million). Furthermore, the approach that produced the maximum revenue estimate for Baltimore City is the Simplified Approach, which is more typically associated with producing minimum estimates for the other counties. The reason for this deviation is discussed below.

The reason most of the estimates for most counties are small for the Simplified Approach is related to both the method of determining the SFEs and the specificity of the residential land use category. The SFEs for Res. < 1 acre are determined using rate factors and average acreage. In most cases, this produces a large estimated impervious area (typical SFE > 6,000 sq. ft. as compared with 3,000 and 4,000 for Approaches 1 and 2) which in turn lowers the number of SFEs for nonresidential categories. In Baltimore City, however, the average acreage is very small (0.07 versus a typical 0.38). This sharply decreased the estimated impervious area for Res. < 1 acre (i.e., the SFE) and consequently increased the number of SFEs in the nonresidential sectors. Specific observations, like the Baltimore City case are difficult to discern from the summary-level results. To address the micro-level observations, it is helpful to consider several case studies. This has been done below for five counties that represent a variety of development patterns.

Table 3

Potential Stormwater Utility Revenues for Maryland Counties and Baltimore City for Five Alternative Charge Approaches

Counties/City	Fixed SFE 3,000 (Approach 1)	Fixed SFE 4,000 (Approach 2)	Quantile (Approach 3)	Detailed (Approach 4)	Simplified* (Approach 5)	Grouped RF** (Approach 6)
Allegany	$1,979,700	$1,616,600	$1,731,000	$1,878,800	$1,591,200	$2,222,100
Anne Arundel	$5,585,900	$4,744,800	$6,114,300	$4,574,000	$4,478,500	$4,686,900
Baltimore	$10,129,400	$8,592,800	$9,236,800	$9,803,000	$10,068,300	$9,904,200
Calvert	$969,100	$812,300	$794,900	$1,017,400	$690,200	$1,234,200
Caroline	$515,800	$427,300	$424,300	$463,300	$365,000	$575,400
Carroll	$1,705,900	$1,456,200	$1,545,900	$1,871,300	$1,247,700	$2,138,600
Cecil	$2,492,000	$1,977,500	$2,036,900	$2,393,200	$1,434,900	$2,582,500
Charles	$1,383,700	$1,169,600	$1,864,800	$1,447,200	$1,088,800	$1,902,800
Dorchester	$914,000	$741,700	$855,800	$878,000	$604,600	$954,100
Frederick	$2,850,800	$2,339,400	$2,605,200	$3,136,800	$1,931,900	$3,315,400
Garrett	$4,646,500	$3,540,200	$2,316,400	$2,901,000	$1,788,200	$3,214,600
Harford	$3,374,300	$2,741,000	$3,165,100	$3,231,100	$2,294,900	$3,432,800
Howard	$2,769,000	$2,286,700	$2,347,000	$3,183,800	$2,075,600	$3,269,800
Kent	$384,200	$320,500	$369,400	$345,100	$250,100	$369,000
Montgomery	$6,582,200	$5,768,900	$5,082,300	$4,975,600	$5,463,800	$5,038,700
Prince George's	$8,324,000	$6,936,400	$9,034,600	$6,518,800	$7,592,300	$6,520,500
Queen Anne's	$714,700	$592,000	$595,500	$631,300	$450,700	$643,800
Somerset	$578,400	$472,900	$420,500	$492,100	$349,500	$506,300
St. Mary's	$1,459,700	$1,194,600	$1,073,800	$1,254,400	$835,600	$1,458,100
Talbot	$667,700	$554,700	$814,700	$610,100	$482,000	$611,100
Washington	$2,138,600	$1,765,300	$2,058,400	$1,930,600	$1,538,700	$2,150,600
Wicomico	$1,239,000	$1,042,000	$1,129,900	$1,149,100	$914,400	$1,324,500
Worcester	$2,061,300	$1,501,200	$2,567,000	$1,671,000	$1,394,800	$1,885,900
Baltimore City	$8,671,900	$7,961,900	$9,959,200	$11,205,700	$15,160,000	$11,320,500
TOTAL	$72,301,400	$60,556,500	$68,143,700	$67,562,700	$64,152,800	$71,262,400

* Estimates cited here are based on a variation of the Austin, TX approach
** Estimates cited here are based on a variation of the Ft. Collins, TX approach

Notes: All estimations assume that $20 is assessed for typical residential parcels (i.e., parcels less than one acre or less than one quarter acre depending on the approach).

Estimates are based on 1987 land use data.

Table 4

Minimum and Maximum Revenue Projections Selected from the Six Alternative Approaches

Counties/City	Minimum	Maximum
Allegany	$1,590,700[5]	$2,222,100[6]
Anne Arundel	$4,478,500[5]	$6,114,300[3]
Baltimore	$8,592,800[3]	$10,129,400[1]
Calvert	$690,200[5]	$1,234,200[6]
Caroline	$365,000[5]	$575,400[6]
Carroll	$1,247,700[5]	$2,138,600[6]
Cecil	$1,434,900[5]	$2,582,500[6]
Charles	$1,088,800[5]	$1,902,800[6]
Dorchester	$604,800[5]	$954,100[6]
Frederick	$1,931,900[5]	$3,315,400[6]
Garrett	$1,788,200[5]	$4,646,500[1]
Harford	$2,294,900[5]	$3,432,800[6]
Howard	$2,075,600[5]	$3,269,800[6]
Kent	$250,100[5]	$384,200[1]
Montgomery	$4,975,600[4]	$6,582,200[1]
Prince George's	$6,518,800[4]	$9,034,600[3]
Queen Anne's	$450,700[5]	$714,700[1]
Somerset	$349,500[5]	$506,300[6]
St. Mary's	$835,700[5]	$1,459,700[1]
Talbot	$482,000[5]	$814,700[3]
Washington	$1,538,700[5]	$2,150,600[6]
Wicomico	$914,400[5]	$1,324,500[6]
Worcester	$1,394,800[5]	$2,567,000[3]
Baltimore City	$7,961,900[2]	$15,160,000[5]
TOTAL	$53,856,200	$83,216,400

Note: Superscripts correspond to the revenue estimation approach that produced the given maximum or minimum:

1 FIXED SFE (3,000)
2 FIXED SFE (4,000)
3 QUANTILE
4 DETAILED
5 SIMPLIFIED
6 GROUPED RF

Table 5

Approaches Most often Responsible for Large and Small Revenue Estimates

Size of Revenue Estimate	Approach Most Often Responsible	Percentage of Counties
Highest	Grouped RF Approach	50 %
2nd Highest	Fixed SFE (3,000) Approach	46 %
Mid Range	Quantile or Detailed Approaches	60 %
2nd Lowest	Fixed SFE (4,000) Approach	54 %
Lowest	Simplified Approach	83 %

3.2.2 A Closer Look at Results From Five Counties

The counties considered in this subsection are Baltimore, Carroll, Cecil, Harford, and Montgomery. The counties represent a variety of land development patterns. Baltimore and Montgomery counties are urban, while Carroll and Harford are developing. Cecil is mostly rural. They also represent cases in which development of estimates required special treatment of land use categories including the residential category. This was the case with both Baltimore County and Montgomery County (as well as Baltimore City). Appendix B presents worksheets for Montgomery County and Cecil County that illustrate this difference. Cecil County is representative of the way land use categories were typically reported by the Office of Planning.

Table 6 shows the projected revenue figures generated by the six approaches for the five selected counties. It also shows the distribution of the total charge among the following five land use categories as a percentage: Residential (below and above 1 acre), Commercial, Industrial, and the grouping of All Other land use categories.

For these five counties Montgomery County displays the smallest difference between its highest and lowest projection, while Cecil County show the largest difference. For Montgomery County, the highest projection is just 25% greater than the lowest projection, while the corresponding ratio is 44% for Cecil County. In most cases, the two highest and two lowest projections are practically the same.

Table 6

Percentage of Payment By Land Use Categories

Counties	Revenues	Residential < 1 acre	Residential > 1 acre	Commercial	Industrial	All Others
Baltimore						
1) Fixed SFE (3,000)	$10,129,400	31%	5%	25%	24%	15%
2) Fixed SFE (4,000)	$8,592,800	37%	6%	22%	21%	14%
3) Quantile	$9,236,800	34%	6%	22%	22%	16%
4) Detailed	$9,803,000	33%	9%	21%	20%	17%
5) Simplified	$10,069,300	31%	6%	20%	23%	20%
6) Grouped RF	$9,904,200	32%	10%	22%	19%	17%
Carroll						
1) Fixed SFE (3,000)	$1,705,900	24%	16%	44%	13%	3%
2) Fixed SFE (4,000)	$1,456,200	28%	19%	39%	11%	3%
3) Quantile	$1,545,900	26%	36%	22%	7%	9%
4) Detailed	$1,871,300	27%	25%	28%	8%	12%
5) Simplified	$1,247,700	33%	29%	21%	7%	10%
6) Grouped RF	$2,138,600	18%	21%	26%	7%	28%
Cecil						
1) Fixed SFE (3,000)	$2,492,000	11%	6%	68%	14%	1%
2) Fixed SFE (4,000)	$1,977,500	14%	7%	65%	13%	1%
3) Quantile	$2,036,900	14%	14%	58%	12%	2%
4) Detailed	$2,393,200	15%	12%	58%	12%	3%
5) Simplified	$1,434,900	20%	14%	52%	12%	2%
6) Grouped RF	$2,582,500	12%	16%	57%	10%	5%
Harford						
1) Fixed SFE (3,000)	$3,734,300	18%	8%	32%	38%	4%
2) Fixed SFE (4,000)	$2,741,000	22%	10%	30%	35%	3%
3) Quantile	$3,165,100	19%	18%	26%	30%	7%
4) Detailed	$3,231,100	21%	15%	25%	30%	9%
5) Simplified	$2,294,900	26%	16%	22%	30%	6%
6) Grouped RF	$3,432,800	18%	16%	25%	26%	15%
Montgomery						
1) Fixed SFE (3,000)	$6,582,200	48%	5%	34%	6%	7%
2) Fixed SFE (4,000)	$5,768,900	54%	5%	29%	5%	7%
3) Quantile	$5,082,300	57%	5%	26%	4%	8%
4) Detailed	$4,975,600	50%	8%	26%	4%	12%
5) Simplified	$5,463,800	51%	8%	25%	5%	11%
6) Grouped RF	$5,038,700	46%	7%	27%	4%	16%

The distribution of charges among the land use categories is apparently determined primarily by the specific characteristics of each county rather than the different approaches. That is to say, within a given county, the proportion of the total revenue generated by each land use category generally remains about the same from approach to approach.

Having said this, however, Table 6 reveals several cases in which the distribution of charges do vary between approaches within a given county. For example, residential parcels greater than one acre bear an increased proportion of the cost for Approach 3 (Quantile) for all five counties. Other less pronounced variations in the residential category are also apparent. Another redistribution is evident between Approaches 1 and 5 for the Commercial sector in Carroll County. In Approach 1 (Fixed SFE (3,000)), the Commercial sector bears 44% of the cost, while in Approach 5 (Simplified), it bears only 21%. Note also the general trend in the "All Others" column for Carroll County; the cost burden ranges from 3% for Approach 1 (Fixed SFE (3,000)) to 28% for Approach 6 (Grouped RF).

As stated above, the most pronounced differences in the distribution of revenues arise due to differences among counties rather than among approaches within a county. For instance, Montgomery County has a large residential sector reflected strongly in Table 6; the residential sector bears between 53% to 62% of the charge depending on the revenue estimation approach used. This compares to Baltimore County (another developed county) in which the residential sector bears between 37% to 54%, and Cecil County (a rural county) in which the residential sector bears between 17% to 34% of the cost.

Notice that, while Cecil County is relatively small, the proportion of the cost borne by its commercial sector is large compared to other counties. This is a result of two factors. First, the average size of a commercial parcel in Cecil County is 6.6 acres while in Harford County it is 2.2 acres and in Baltimore County it is 2.0 acres. Second, the proportion of commercial parcels to other parcels for Cecil County is larger than for other counties. For example, the ratio of commercial parcels to residential parcels in Cecil County is about 6%. This compares with Harford County at 4% and to Baltimore County at 3%.

Another dynamic of the utility charge systems becomes apparent when analyzing what underlies the similar proportions of revenue generated by the commercial and industrial sectors of Harford County. The similar proportions could suggest that the number of industrial and commercial parcels are equal. In actuality, however, Harford County has 1,632 commercial parcels and only 72 industrial parcels.

The reason for this even share of the revenue base is that the commercial sector is composed of a large number of small parcels, and the industrial sector has a small number of large parcels. Consequently, the estimated average annual charge for the industrial sector in Harford County is roughly 27 times higher than that of the commercial sector (e.g, $13,182/year per industrial parcel and $496/year per commercial parcel using the Fixed SFE (3,000) Approach).

Clearly, comparisons of the type presented above are numerous. However, the factors to consider when assessing how the revenues will be distributed among land use categories in a particular county are the same. These considerations are parcel sizes, the numbers of parcels, and the proportional distribution of these two measures between the different land use categories. When designing a utility charge system for a particular jurisdiction, more detailed analyses of this type must be conducted in order to fully understand the efficiency and equity of the system.

3.2.3 Sensitivity Analyses

The principal result of the study, stated previously in the summary results, is that the total revenue estimates are quite similar for all six approaches. Recall that the median of the six total revenue estimates was presented earlier as $67,853,200 with a difference between minimum and maximum estimates of about $11 Million.

The sensitivity of the total revenue estimate can be explored by considering the following hypothetical situation. That is, suppose that each county were independently to select the approach that yielded the lowest revenue estimate and these county revenue estimates were summed to arrive at a total revenue projection for the State. Alternatively, suppose that each county were to select the highest estimate and these were summed in a similar fashion. Such State revenue estimates provide an indication of potential lower and upper bounds on the total State revenue estimate that range from $53,856,200 to $83,216,400.

Another simple sensitivity analysis consists of determining the new estimates when the annual charge is changed to $15 or $25 per SFE for the Detailed Approach which lies in the middle of the range of six estimates. When an annual charge of $15/SFE is assessed, the total state revenue estimate drops to $54,226,050. When an annual charge of $25/SFE is assessed, the total state revenue estimate rises to $90,376,750. These new bounds are exactly 25 percent below and above the original figure of $72,301,400 just as $15 and $25 are 25 percent below and above the original $20 annual charge.

To test the sensitivity of the approaches to changes in the underlying simplifying assumptions, the Fixed SFE (3,000) approach has been used as the test case. It is assumed that the other approaches would respond similarly to the same sensitivity analyses. The analyses included the following:

1) Assumptions about which land use categories would be included in the rate base. That is, inclusion or exclusion of Agricultural, Exempt, and Unimproved land use categories.

2) Fixed SFE (3,000) with the rate factor for the residential agriculture land use category set at 0.1 versus fixing the impervious area at 4,500 sq. ft. (Note that this analysis is unique to the Fixed SFE (3,000) Approach).

An Illustrative Sensitivity Analysis: Removal of Elkton Parcels From Rate Base

The issue of nonparticipation by local municipalities in county stormwater programs was mentioned earlier in this report. If a city has its own stormwater management program and does not participate in the county program, the county revenue base will be smaller. As an illustration of the potential impact of a nonparticipating city, we considered a specific case for Cecil County, Maryland.

The City of Elkton (Cecil County) has an independent stormwater control system, and thus Elkton is not likely to participate in a county-wide utility. We assessed the impact of removing Elkton from the rate base by reevaluating four of the six utility charge approaches. This entailed subtracting the appropriate number of parcels for each land use category based on information in property tax assessment tables, and adjusting the average parcel size. In general, the average parcel size of the remaining parcels increased slightly. This seems consistent with the general tendency for lot sizes to be smaller within city limits.

The analysis was based on the assumption that residential parcels less than one acre in size would be assessed a fixed annual charge of $20. This results in each of the alternative approaches generating different revenue totals rather than being fixed to meet a $1.5 Million revenue target. Depending on the charge approach, the percentage decrease in revenues resulting from the removal of Elkton from the rate base ranged from 3.9% to 5.4%. Since the different charge structures generated varying total revenues prior to the removal of Elkton parcels, the decrease in the dollar amounts are not directly comparable. The analysis results are presented in Table 7.

Table 7

Sensitivity Analysis: Removal of Elkton Parcels From User Charge Rate Base

Charge Approach	Revenues Generated (Elkton Included)	Revenues Generated (Elkton Excluded)	Revenue Decrease	Percent Decrease
Fixed SFE 3000	$2,268,600	$2,180,600	$88,000	3.9%
Fixed SFE 4000	$1,823,560	$1,745,340	$78,220	4.3%
Quantile	$4,009,720	$3,821,040	$188,680	4.7%
Simplified	$1,333,940	$1,262,520	$71,420	5.4%

Rate Base Considerations. Table 8, column C summarizes the results of including Agricultural, Exempt, and Unimproved land use categories in the Fixed SFE (3,000) Approach; the original estimate is given in column A. This revised estimate shows a

dramatic increase from $72,360,700 to $213,795,200.

A rate factor of 0.1 was used for the Agricultural, Undeveloped, and Exempt land use categories. The rate factor of 0.1 was selected as an arbitrary low value. This category includes both intensely developed lands such as schools, and government building, as well as undeveloped park lands. Given that relatively small rate factors were used in this revised estimate, the huge increase in the state revenue estimate reflects the large land area that has been introduced by including the new land use categories.

It is worth noting that intermediate analyses, which are constituted by introducing subsets of the three additional land use categories, would produce intermediate estimates below $213,795,200. Thus, the consideration of these three land use categories provides a fair sense of the true upper bound on the original Fixed SFE (3,000) approach.

Sensitivity of the Residential Agricultural Category. Several examples have been presented that represent alternative ways the estimated impervious area of residential parcels may be treated. The two methods used in this study were: 1) multiplying a rate factor by the average parcel size, and 2) selecting a value based on professional judgement. All else being equal, estimates using the Fixed SFE (3,000) Approach were generated in which the estimated impervious area for the Residential Agricultural Category was altered.

This analysis is intended to be indicative of the outcome of a minor change in any of the approaches. It differs from the other changes to the residential category discussed previously because those changes dictated the value of the SFE which in turn affected outcomes of the other land use categories.

Comparison of columns A and B in Table 8 summarizes the results of this analysis. The original Fixed SFE (3,000) Approach (Column A) fixes the impervious area of the Residential Agricultural category at 4,500 sq. ft. The modification (Column B) uses a small rate factor of 0.1 to calculate the impervious area. The increase in the estimated total revenue from $72,301,400 to $75,565,700 indicates that the use of the rate factor results in a smaller estimated impervious area.

Table 8

Variations on the Fixed SFE (3,000) Revenue Estimation Approach

Counties/City	(A) Fixed SFE 3,000 (Res. Ag. Imp. Acreage Fixed at 4,500 sq. ft. per Parcel)	(B) Fixed SFE 3,000 (Res. Ag. Imp. Acreage based on 0.1 Rate Factor)	(C) Fixed SFE 3,000 (Inclusion of Agri., Exempt and Unimproved in Rate Base)
Allegany	$1,979,700	$1,985,000	$9,183,900
Anne Arundel	$5,585,900	$5,708,000	$11,700,000
Baltimore	$10,129,400	$10,489,600	$19,278,900
Calvert	$969,100	$1,058,700	$3,807,700
Caroline	$515,800	$613,000	$5,957,400
Carroll	$1,705,900	$2,109,300	$8,821,700
Cecil	$2,492,000	$2,550,600	$7,879,800
Charles	$1,383,700	$1,547,500	$8,424,800
Dorchester	$914,000	$961,500	$10,728,700
Frederick	$2,850,800	$2,884,000	$13,563,600
Garrett	$4,646,500	$4,661,000	$17,689,000
Harford	$3,374,300	$3,568,700	$9,142,000
Howard	$2,769,000	$2,795,500	$5,897,000
Kent	$384,200	$395,000	$4,820,500
Montgomery	$6,582,200	$6,582,200	$12,604,500
Prince George's	$8,324,000	$8,342,000	$5,009,800
Queen Anne's	$714,700	$776,700	$7,166,000
Somerset	$578,400	$648,200	$6,133,000
St. Mary's	$1,459,700	$1,450,000	$7,264,900
Talbot	$667,700	$701,400	$5,078,300
Washington	$2,138,600	$2,210,500	$9,547,300
Wicomico	$1,239,000	$1,388,000	$4,435,000
Worcester	$2,061,300	$2,171,200	$10,442,500
Baltimore City	$8,671,900	$9,968,100	$9,218,900
TOTAL	$72,301,400	$75,565,700	$213,795,200

3.2.4 Limitations

The scope of this study is limited to providing a rough planning estimation of the revenue generating capacity of a stormwater management utility in Maryland. The effects of the simplifying assumptions used in this study and their potential effects are discussed below. In addition, another level of analysis considers the limitations of the utility concept itself.

Limitations on interpreting the Study Results. The reader may notice a close relationship between the discussion of limitations and that of sensitivity analysis. In short, where a simple sensitivity analysis of the effects of an assumption is not possible, the simplifying assumptions are discussed here as limitations.

As mentioned earlier in this report, average parcel area estimates are vulnerable to being skewed upward by a small number of large parcels. This is corrected for, to some degree, (and possibly over corrected) in the Fixed SFE (3,000) and Fixed SFE (4,000) approaches for the residential categories, but is not addressed for any of the other categories. A probable example of this, although it has not been confirmed by accessing the original data, arises in Garrett County. In this case the average acre per parcel for the commercial category is 30 acres. Other typical average parcel sizes for this category are about 3 acres and at most 6 acres.

Not accounting for the effects of credits for on-site stormwater best management practices (BMPs) contributes to overestimation of revenues. In most existing utilities, credits are awarded to property owners and groups of owners who establish and maintain stormwater management mechanisms to handel their runoff. For example, large industrial sites may construct retention ponds and, consequently, reduce their utility charge. Similarly, newly developed town houses may share stormwater management ponds making the home owners eligible for a credit.

Several simplifying assumptions are worth noting. It is unclear if accounting for these would increase or decrease the revenue estimation. These include the aggregation of all sites within a land use category, which does not properly reflect the variability among parcels. Again, because averages are used, it is possible that the aggregation of industrial parcels, for example, over estimates the revenue potential. However, it is also possible that for other reasons the aggregation yields an under estimation.

In the sensitivity analysis above that assessed the inclusion of the Exempt land use category, a value of 0.1 was used for the rate factor. It is not clear whether this value is accurate because the exempt category includes such a wide variety of land uses (e.g., parks, hospitals, churches, airports). Although accuracy is in question, the value is most likely an underestimate and thus does not exaggerate the potential revenues from this sector.

Limits of the Utility Concept The utility concept as typically applied has several inherent limitations. One is that the runoff coefficients used to represent runoff volumes are not precise. Even if the impervious area per parcel is known, other factors including surface slope, soil type, and antecedent soil moisture that are known to affect runoff volumes are not considered. Incorporating the detailed data necessary to address these additional variables usually is not considered cost effective.

A significant underlying concern with excess stormwater is that it carries nutrients into the Chesapeake Bay resulting in reduced water quality. Most utility charge structures do not attempt to assess additional charges for users who introduce higher concentrations of nutrients. The same issue applies to other types of pollutants as well, including grease, industrial chemicals, and pesticides. Credits for on-site stormwater management address this issue to some degree, but only in an indirect manner.

Several trade-offs occur with regard to equity issues when using a utility approach. For instance, an individual's ability to pay is not considered in the utility charge structure as it is in the case of property tax assessments. In the later case, the assumption[11] is that someone owning an expensive piece of property has higher financial means, and thereby, can pay proportionately more of the share.

The utility approach also does not necessarily reflect the benefits received by those who pay the most. Other user charges often have increased benefits associated with increased charges. This is the case for highway tolls, and entry charges for use of public parks, or boat launches.

In the case of the stormwater utility charge, the underlying philosophy is that the more the user pollutes or places a burden on the sewer system, the more the user pays. Thus, more runoff from a property owner's parcel results in a higher charge. If the user is in a rural area and the water from his land traverses its way to the bay via natural channels rather than through the municipal sewer system, it could be argued that the user charge is not equitable since he is not using the publicly maintained system. Issues of this type require resolution on a case by case basis and may be addressed by use of a modified charge structure.

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[11] This assumption is increasingly difficult to make in view of the number of people who have seen property values increase dramatically, while their modest financial means have not kept pace.

GEOGRAPHY: CECIL COUNTY-SUMMARY REDISTRIBUTED

TAPE DATE APR 87

LAND USE	IMPROVED					UNIMPROVED					TOTAL	
	NO. OF PARCELS ACRES SPEC.	ACRES	AVERAGE ACRES	NO. OF PARCELS ACRES NOT SPEC	TOTAL ACRES	NO. OF PARCELS ACRES SPEC.	ACRES	AVERAGE ACRES	NO. OF PARCELS ACRES NOT SPEC	TOTAL ACRES	PARCELS	ACRES
AGRICULTURAL	957	103115	107.7	0	103115	402	25554	63.6	0	25554	1359	128669
COMMERCIAL	1085	7193	6.6	0	7193	620	7379	11.9	0	7379	1705	14572
COMM RES	1	9	9.0	0	9	1	15	15.0	0	15	2	24
EXEMPT	468	19911	42.5	0	19911	426	5190	12.2	0	5190	894	25101
INDUSTRIAL	43	1694	39.4	0	1694	41	448	10.9	0	448	84	2142
APARTMENTS	17	34	2.0	0	34	0	0	.0	0	0	17	34
NOT PERC	28	48	1.7	0	48	306	749	2.4	0	749	334	797
RESIDENTIAL	18992	27409	1.4	0	27409	8850	21502	2.4	0	21502	27842	48911
RES AGR	189	2214	11.7	0	2214	229	1719	7.5	0	1719	418	3933
RES COMM	1	1	1.0	0	1	1	0	.0	0	0	2	1
CONDOMINIUM	5	0	.0	0	0	1	0	.0	0	0	6	0
CONDO COMM	0	0	.0	0	0	0	0	.0	0	0	0	0
MARSHLAND	0	0	.0	0	0	1	16	16.0	0	16	1	16
DISTRICT TOTAL	21786	161628		0	161628	10878	62572		0	62572	32664	224200

GEOGRAPHY: CECIL COUNTY-SUMMARY REDISTRIBUTED
LAND USE CODE: RESIDENTIAL

TAPE DATE A. K 87

IMPROVED PARCELS(ACRES SPECIFIED)

ACREAGE INTERVALS	NUMBER OF PARCELS	PERCENT OF TOTAL PARCELS	CUMULATIVE NUMBER OF PARCELS	CUMULATIVE % OF TOTAL PARCELS	ACREAGE: NUMBER OF ACRES	ACREAGE: PERCENT OF TOTAL ACRES	ACREAGE: CUMULATIVE NUMBER OF ACRES	ACREAGE: CUMULATIVE % OF TOTAL ACRES	ACREAGE: AVERAGE ACREAGE	ACREAGE: CUMULATIVE AVERAGE ACREAGE
0 - .25	6181	32.55	6181	32.55	823	3.00	823	3.00	.13	.13
>.25 - .5	3743	19.71	9924	52.25	1498	5.47	2322	8.47	.40	.23
>.5 - 1.0	4209	22.16	14133	74.42	3127	11.41	5449	19.88	.74	.39
>1.0 - 1.5	1538	8.10	15671	82.51	1869	6.82	7318	26.70	1.22	.47
>1.5 - 2.0	785	4.13	16456	86.65	1400	5.11	8718	31.81	1.78	.53
>2.0 - 3.0	821	4.32	17277	90.97	2059	7.51	10778	39.32	2.51	.62
>3.0 - 5.0	767	4.04	18044	95.01	3068	11.19	13845	50.51	4.00	.77
>5.0 - 10.0	590	3.11	18634	98.11	4121	15.04	17966	65.55	6.98	.96
>10.0 - 15.0	160	.84	18794	98.96	1941	7.08	19907	72.63	12.13	1.06
>15.0 - 20.0	66	.35	18860	99.30	1134	4.14	21041	76.77	17.18	1.12
>20.0 - 30.0	61	.32	18921	99.63	1521	5.55	22562	82.32	24.93	1.19
>30.0 - 40.0	26	.14	18947	99.76	889	3.24	23451	85.56	34.19	1.24
>40.0 - 50.0	8	.04	18955	99.81	368	1.34	23819	86.90	46.00	1.26
>50.0 - 75.0	21	.11	18976	99.92	1325	4.83	25144	91.74	63.10	1.33
>75.0 - 100.0	5	.03	18981	99.94	430	1.57	25574	93.31	86.00	1.35
>100.0 - 150.0	4	.02	18985	99.96	540	1.97	26114	95.28	135.00	1.38
>150.0 - 200.0	6	.03	18991	99.99	1068	3.90	27182	99.17	178.00	1.43
>200.0 - 300.0	1	.01	18992	100.00	227	.83	27409	100.00	227.00	1.44
>300.0 - 500.0	0	.00	18992	100.00	0	.00	27409	100.00	.00	1.44
>500.0 - 750.0	0	.00	18992	100.00	0	.00	27409	100.00	.00	1.44
>750.0 - 1000.0	0	.00	18992	100.00	0	.00	27409	100.00	.00	1.44
>1000.0 - 10,000	0	.00	18992	100.00	0	.00	27409	100.00	.00	1.44
>10,000	0	.00	18992	100.00	0	.00	27409	100.00	.00	1.44

UNIMPROVED PARCELS (ACRES SPECIFIED)

ACREAGE INTERVALS	NUMBER OF PARCELS	PERCENT OF TOTAL PARCELS	CUMULATIVE NUMBER OF PARCELS	CUMULATIVE % OF TOTAL PARCELS	ACREAGE: NUMBER OF ACRES	ACREAGE: PERCENT OF TOTAL ACRES	ACREAGE: CUMULATIVE NUMBER OF ACRES	ACREAGE: CUMULATIVE % OF TOTAL ACRES	ACREAGE: AVERAGE ACREAGE	ACREAGE: CUMULATIVE AVERAGE ACREAGE
0 - .25	3393	38.34	3393	38.34	358	1.67	358	1.67	.11	.11
>.25 - .5	1515	17.12	4908	55.46	607	2.82	965	4.49	.40	.20
>.5 - 1.0	1562	17.65	6470	73.11	1142	5.31	2107	9.80	.73	.33
>1.0 - 1.5	611	6.90	7081	80.01	743	3.46	2850	13.26	1.22	.40
>1.5 - 2.0	326	3.68	7407	83.69	578	2.69	3428	15.94	1.77	.46
>2.0 - 3.0	358	4.05	7765	87.74	888	4.13	4317	20.08	2.48	.56
>3.0 - 5.0	371	4.19	8136	91.93	1491	6.93	5807	27.01	4.02	.71
>5.0 - 10.0	319	3.60	8455	95.54	2231	10.38	8038	37.39	6.99	.95
>10.0 - 15.0	129	1.46	8584	96.99	1613	7.50	9651	44.89	12.50	1.12
>15.0 - 20.0	65	.73	8649	97.73	1108	5.15	10759	50.04	17.05	1.24
>20.0 - 30.0	81	.92	8730	98.64	2003	9.32	12762	59.36	24.73	1.46
>30.0 - 40.0	37	.42	8767	99.06	1242	5.78	14004	65.13	33.57	1.60
>40.0 - 50.0	22	.25	8789	99.31	981	4.56	14985	69.70	44.59	1.71
>50.0 - 75.0	29	.33	8818	99.64	1825	8.49	16810	78.18	62.93	1.91
>75.0 - 100.0	14	.16	8832	99.80	1248	5.80	18058	83.99	89.14	2.04
>100.0 - 150.0	6	.07	8838	99.86	651	3.03	18709	87.01	108.50	2.12
>150.0 - 200.0	5	.06	8843	99.92	859	4.00	19568	91.01	171.80	2.21
>200.0 - 300.0	5	.06	8848	99.98	1190	5.53	20758	96.54	238.00	2.35
>300.0 - 500.0	2	.02	8850	100.00	743	3.46	21501	100.00	371.50	2.43
>500.0 - 750.0	0	.00	8850	100.00	0	.00	21501	100.00	.00	2.43
>750.0 - 1000.0	0	.00	8850	100.00	0	.00	21501	100.00	.00	2.43
>1000.0 - 10,000	0	.00	8850	100.00	0	.00	21501	100.00	.00	2.43
>10,000	0	.00	8850	100.00	0	.00	21501	100.00	.00	2.43

NO. OF IMP. PARCELS, ACREAGE SPECIFIED 18992 (100.0)
NO. OF IMP. PARCELS, ACREAGE NOT SPEC. 0 (.0)
TOTAL 18992

NO. OF UNIMPROVED PARCELS, ACREAGE SPECIFIED 8850 (100.0)
NO. OF UNIMPROVED PARCELS, ACREAGE NOT SPEC. 0 (.0)
TOTAL 8850

FIXED SFE (3,000)

Baseline Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	957	107.7	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,085	6.6	0.82	235,747	78.58	85,262			1,571.64	1,705,225	0.68
Comm Res	1	9.0	0.68	266,587	88.86	89			1,777.24	1,777	0.00
Exempt	468	42.5	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	43	39.4	0.70	1,201,385	400.46	17,220			8,009.19	344,395	0.14
Apartments	17	2.0	0.64	55,757	18.59	316			371.71	6,319	0.00
Not Perc	28	1.7	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	14,133	0.38	na	3,000	1.00	14,133			20.00	282,658	0.11
> 1 Acre	4,859	4.36	na	4,500	1.50	7,289			30.00	145,769	0.06
Res Ag	189	11.7	na	4,500	1.50	284			30.00	5,670	0.00
Res Comm	1	1.0	0.64	27,878	9.29	9			185.85	186	0.00
Condominium	5	0.00	0.64	0	0.00	0			0.00	0	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Trailer	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	21,786					124,601				$2,492,000	1.00
Unimproved	10,878	5.8	0.00	0	0.00	0			0.00	0	0.00
Grand Total	32,664					124,601	$2,492,000	$20.00		$2,492,000	1.00

FIXED SFE (3,000)

Baseline Stormwater Utility Charge System for Montgomery County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,152	67.2	0.00	0	0.00	0			0.00	0	0.00
Commercial	9,273	1.0	0.82	35,719	11.91	110,408			238.13	2,208,146	0.33
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	1,577	12.3	0.00	0	0.00	0			0.00	0	0.00
Industrial	205	8.9	0.70	271,379	90.46	18,544			1,809.18	370,882	0.06
Apartments	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Res Ag	0	0.0	na	0	0.00	0			0.00	0	0.00
Res Comm	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Condominium	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	1	5.0	0.64	139,392	46.46	46			929.27	929	0.00
Mobil/Trailer	10	3.1	0.64	86,423	28.81	288			576.15	5,761	0.00
Group Quar	116	2.3	0.64	64,120	21.37	2,479			427.47	49,586	0.01
Motel	33	3.1	0.82	110,730	36.91	1,218			738.19	24,360	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
< 1 Acre	132,208	0.00	na	3,000	1.00	132,208			20.00	2,644,142	0.40
> 1 Acre	10,271	4.01	na	4,500	1.50	15,407			30.00	308,128	0.05
Attached S-F											
< 1 Acre	38,171	0.00	na	2,000	0.67	25,447			13.33	508,943	0.08
> 1 Acre	40	5.52	na	3,000	1.00	40			20.00	800	0.00
Garden Apt.	14,484	0.2	0.40	3,485	1.16	16,825			23.23	336,490	0.05
High Rise	8,233	0.1	0.64	2,788	0.93	7,651			18.59	153,014	0.02
Other	261	0.8	0.50	17,424	5.81	1,516			116.16	30,318	0.00
Total (Dev.)	216,035					332,077				$6,641,500	1.00
Unimproved	35,909	3.1	0.00	0	0.00	0			0.00	0	0.00
Grand Total	251,944					332,077	$6,641,500	$20.00		$6,641,500	1.00

FIXED SFE (3,000)

Baseline Stormwater Utility Charge System for Cecil County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	957	107.7	0.00	0	0.00	0			0.00	0	0.00
Commercial	1,085	6.6	0.82	235,747	78.58	85,262			1,571.64	1,705,225	0.68
Comm Res	1	9.0	0.68	266,587	88.86	89			1,777.24	1,777	0.00
Exempt	468	42.5	0.00	0	0.00	0			0.00	0	0.00
Park			0.11	0	0.00	0			0.00	0	0.00
Playground			0.17	0	0.00	0			0.00	0	0.00
School			0.50	0	0.00	0			0.00	0	0.00
Industrial	43	39.4	0.70	1,201,385	400.46	17,220			8,009.19	344,395	0.14
Apartments	17	2.0	0.64	55,757	18.59	316			371.71	6,319	0.00
Not Perc	28	1.7	0.00	0	0.00	0			0.00	0	0.00
Residential											
< 1 Acre	14,133	0.38	na	3,000	1.00	14,133			20.00	282,658	0.11
> 1 Acre	4,859	4.36	na	4,500	1.50	7,289			30.00	145,769	0.06
Res Ag	189	11.7	na	4,500	1.50	284			30.00	5,670	0.00
Res Comm	1	1.0	0.64	27,878	9.29	9			185.85	186	0.00
Condominium	5	0.00	0.64	0	0.00	0			0.00	0	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Mobil/Trailer	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Group Quar	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Motel	0	0.0	0.82	0	0.00	0			0.00	0	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Garden Apt.	0	0.0	0.40	0	0.00	0			0.00	0	0.00
High Rise	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Other	0	0.0	0.50	0	0.00	0			0.00	0	0.00
Total (Dev.)	21,786					124,601				$2,492,000	1.00
Unimproved	10,878	5.8	0.00	0	0.00	0			0.00	0	0.00
Grand Total	32,664					[illegible],601	$2,492,000	$20.00		$2,492,000	1.00

FIXED SFE (3,000)

Baseline Stormwater Utility Charge System for Montgomery County, MD

Land Use	Number of Parcels	Average Acre/ Parcel	Rate Factor (Imp)	Average Sq. Ft. Impervious per Parcel	Typical Number of SFEs	SFEs per Land Use Category	Revenue Requirement ($)	Dollars/ SFE	Typical Annual Charge	Total $ by Category	% Paid by Category
Agriculture	1,152	67.2	0.00	0	0.00	0			0.00	0	0.00
Commercial	9,273	1.0	0.82	35,719	11.91	110,408			238.13	2,208,146	0.33
Comm Res	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Exempt	1,577	12.3	0.00	0	0.00	0			0.00	0	0.00
Industrial	205	8.9	0.70	271,379	90.46	18,544			1,809.18	370,882	0.06
Apartments	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Not Perc	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Res Ag	0	0.0	na	0	0.00	0			0.00	0	0.00
Res Comm	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Condominium	0	0.0	0.64	0	0.00	0			0.00	0	0.00
Condo Comm	0	0.0	0.68	0	0.00	0			0.00	0	0.00
Marshland	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Non-standard											
Cooperative	1	5.0	0.64	139,392	46.46	46			929.27	929	0.00
Mobil/Trailer	10	3.1	0.64	86,423	28.81	288			576.15	5,761	0.00
Group Quar	116	2.3	0.64	64,120	21.37	2,479			427.47	49,586	0.01
Motel	33	3.1	0.82	110,730	36.91	1,218			738.19	24,360	0.00
Forest Cons	0	0.0	0.00	0	0.00	0			0.00	0	0.00
Detached S-F											
< 1 Acre	132,208	0.00	na	3,000	1.00	132,208			20.00	2,644,142	0.40
> 1 Acre	10,271	4.01	na	4,500	1.50	15,407			30.00	308,128	0.05
Attached S-F											
< 1 Acre	38,171	0.00	na	2,000	0.67	25,447			13.33	508,943	0.08
> 1 Acre	40	5.52	na	3,000	1.00	40			20.00	800	0.00
Garden Apt.	14,484	0.2	0.40	3,485	1.16	16,825			23.23	336,490	0.05
High Rise	8,233	0.1	0.64	2,788	0.93	7,651			18.59	153,014	0.02
Other	261	0.8	0.50	17,424	5.81	1,516			116.16	30,318	0.00
Total (Dev.)	216,035					332,077				$6,641,500	1.00
Unimproved	35,909	3.1	0.00	0	0.00	0			0.00	0	0.00
Grand Total	251,944					332,077	$6,641,500	$20.00		$6,641,500	1.00

Appendix B (Continued)

Appendix C

Six Alternative User Charge Structures for Estimating Stormwater Utility Revenues

Approach 1 "Fixed SFE (3,000)": This approach serves as the base case against which primary comparisons are made. The name of this approach implies that the residential SFEs were fixed by professional judgment. The choice of 3,000 square feet of impervious area was based on general agreement with published figures and is somewhat arbitrary. The number "3,000" refers to the assumed average square footage of impervious area per residential parcel less than one acre.

The residential category is divided into parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

3,000 sq. ft. impervious for parcels < 1 acre (1 SFE)
4,500 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

The impervious area for residential agricultural use is also fixed at 4,500 sq. ft.. As an intended consequence, Residential parcels > 1 acre are assessed a fixed annual charge of $30 (1.5 times the utility rate for parcels < 1 acre).

The degree of specificity of rate factors is moderate using approximately six different rate factors for the different land use categories.

Approach 2 "Fixed SFE (4,000)": This approach is a slight modification of the Fixed SFE (3,000) approach. It differs only in the estimated impervious area that is assumed when computing residential SFEs.

The residential category is divided into parcels < 1 acre, and parcels > 1 acre. The following average estimated impervious areas are assumed for each residential category:

4,000 sq. ft. impervious for parcels < 1 acre (1 SFE)
6,000 sq. ft. impervious for parcels > 1 acre (1.5 SFE)

The impervious area for residential agricultural use is also fixed at 6,000 sq. ft.. As an intended consequence, Residential parcels > 1 acre are assessed a fixed annual charge of $30 (1.5 times the utility rate for parcels < 1 acre).

The degree of specificity of rate factors is moderate with approximately six different rate factors being used for different land use categories.

Recall that the choice in Approach 1 of 3,000 square feet of impervious area was based on agreement with published figures. The selection of 4,000 sq.ft. is motivated by two factors. First, this estimate is consistent with results from generally accepted guidance described in the Soil Conservation Service Technical Release No. 55. Second, this value yields more conservative (lower) revenue estimates than the 3,000 sq.ft. value.

Approach 3 "Quantile": This approach is again very similar to Approach 1, Fixed SFE (3,000). Like Fixed SFE (3,000), the residential category is divided into Res. < 1 acre, and Res. > 1 acre. It differs only in the manner in which the SFEs are determined for the residential land use category. It is designed to use rate factors to determine the SFE, while at the same time correcting for the pronounced difference in user charges between smaller and larger parcels.

Recall that the traditional approach is to multiply the mean parcel size times the rate factor. The mean, however, has a tendency to be skewed by extreme values and can result in a small number of large parcels pulling up the average parcel size when most parcels are actually quite small.

As an alternative, the median parcel size may be considered. The median parcel size is the point at which 50 percent of the parcels are larger and 50 percent are smaller. It is more generally referred to as the 50th percentile measure, and is not influenced by extreme sized parcels.

Another measure is the 90th percentile. It is the parcel size below which 90 percent of the parcels are smaller, or stated another way, is the parcel size for which only 10 percent of the parcels are larger.

Rather than using the average parcel size within the category Res. < 1 acre, the median value of all residential parcels is used. Similarly, rather than using the average parcel size within the category Res. > 1 acre, the 90th percentile is used.

The median and 90th percentile were estimated rather than computed exactly. The percentiles were easily read from the cumulative percent of total parcels tabulated as part of the available data (See Appendix A). An estimated value was determined as the average parcel size associated with the interval in which the percentile fell. For example, on page A-2 of Appendix A, the 50th percentile falls within the acreage interval > 0.25 - 0.5 acres. Reading across to the right, the average acreage within this interval is 0.40 acres. Given this acreage, a rate factor value can be read from an engineering table (Soil Conservation Service, TR55).

The mean parcel size for the interval less than 1 acre and the estimated median parcel size of all residential parcels are roughly the same. This is because the 50th percentile (the median) invariably falls in the range below one acre (the majority of residential parcels are less than one acre in every county in Maryland), and the range of the interval is narrow,

thus allowing little variability in the parcel size. As an outcome of this, SFE estimates for the interval of parcels below one acre do not differ significantly from estimates in the other approaches.

This was not the case for the 90th percentile value, which is typically significantly different than the mean value of residential parcels in the interval greater than 1 acre. A typical comparison of values is a MEAN = 3.57 acres and a 90th percentile = 1.77 acres (Howard County). In more developed counties with many small parcels, the 90th percentile can fall the range below one acre. In this case, the average parcel size associated with first acreage interval which falls above one acre was used.

The level of specificity of rate factors is slightly increased above that of Approaches 1 and 2 with approximately eight different rate factors being used for different land use categories. The reason for this is that the rate factors for the two residential subcategories in the quantile approach are typically distinctive from the others.

Approach 4 "Detailed": This approach differs from Fixed SFE (3,000) in two of the three of the characteristics described in the last section, and differs slightly on the third point (See Table 2 above). That is, the level of specificity of the residential category is highly detailed, and the SFEs for residential parcels are all computed using rate factors, both of which are different to the Fixed SFE (3,000) approach. The level of specificity of the rate factors are highly detailed for the Detailed Approach, whereas, the level is of intermediate specificity for the Fixed SFE (3,000) approach.

The residential category is divided into about 20 acreage intervals according to the data available (See Appendix A, page A-2). Average parcel sizes were used for each interval, and impervious area estimates were determined using engineering tables for parcels of less than 2 acres. For parcels greater than 2 acres the percent impervious was estimated assuming a reasonable constant amount of impervious area (14,000 sq.ft.) for parcels above two acres until the value 0.1 percent impervious was reached (at the 200 - 300 acre interval) above which 0.1 percent was used for all parcels.

This approach represents the most detailed revenue estimation approach of the study, although it is quite simplified in comparison to actual implementation methods. Since this is the most detailed case, it should approximate reality better than the other cases, and in this regard, serves as a baseline by which to compare the other approaches.

Approach 5 "Simplified": This approach applied a key aspect of the Austin Texas to Approach 1, Fixed SFE (3,000), described above. The primary modification to Fixed SFE (3,000) is a reduced level of specificity of the rate factors across all land use categories.

In addition, this approach uses rate factors to determine the SFE (impervious area for Res. < 1 acre), and fixes the SFE for Res. > 1 acre at 1.5 SFEs. Consequently, the SFE is able to rise or fall between county estimates, and the SFE of the larger residential land use subcategory follows that rise or fall. The use of rate factors and fixed SFEs is referred to above in Table 2 as a hybrid treatment of residential SFEs since both are used.

The Simplified approach derives its name from the fact that it is characterized by having two streamlined, or coarse, features. These are the rate factors and the residential categories. The Simplified approach uses the values 0.80, 0.40, and 0.10 as rate factors, whereas all of the other approaches use a more refined set. Additionally, as in Fixed SFE (3,000), the residential category is divided into parcels < 1 acre, and parcels > 1 acre.

Approach 6 "Grouped RF": This approach is similar to the Detailed Approach in that it differs from Fixed SFE (3,000) in the same way for two of the three of the characteristics described in the last section. It differs to a lesser degree on the third point (specificity of rate factors), and does so in the opposite sense of the Detailed Approach (i.e., the rate factors are aggregated or grouped rather than detailed).

Like the Detailed Approach, the level of specificity of the residential category is highly detailed, and the SFEs for residential parcels are all computed using rate factors. These are both different than the Fixed SFE (3,000) approach. Unlike the Detailed Approach, however, the level of specificity of the rate factors is coarse for the Grouped RF Approach, whereas, the level is of intermediate specificity for Fixed SFE (3,000).

The Grouped RF approach is based loosely on the Ft. Collins, Texas utility charge structure, which attempts to minimize administrative burden and contested charges by aggregating users into relatively broad rate factor categories.

The Grouped RF approach assigns rate factors according to the following table:

Grouped RF Rate Factor Assignments

Degree of Development	Runoff Coefficient	Rate Factor
Very Light	0 - 0.30	0.25
Light	0.31 - 0.50	0.40
Moderate	0.51 - 0.70	0.60
Heavy	0.71 - 0.90	0.80
Very Heavy	0.91 - 1.0	0.95

The SFE was calculated as (0.60) x (mean acreage) using the smallest residential acreage interval (0 - 0.25 acres), where 0.60 is the rate factor. For residential parcels greater than 0.25 acre, the following algorithm was used to calculate the impervious area:

(0.25 acre) x (rate factor) + (remaining acreage) x (1/4) x (rate factor). In words that is the first quarter acre times the rate factor, plus the remaining acreage over 0.25 acre times 1/4 times the rate factor. A rate factor of 0.25 was used for residential parcels greater that 0.25 acres.

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SAMPLE STORMWATER UTILITY ORDINANCE

MAY, 1988

WATER MANAGEMENT ADMINISTRATION
MARYLAND DEPARTMENT OF THE ENVIRONMENT
2500 BROENING HIGHWAY
BALTIMORE, MARYLAND 21224

SAMPLE STORMWATER UTILITY ORDINANCE

This sample stormwater utility ordinance is designed to provide guidance to local officials in establishing stormwater utilities. It is based on a review of 20 stormwater ordinances used in other communities. While some of the sections can be incorporated into an actual ordinance essentially as written, most will have to be modified and adapted to local circumstances. Several sections (e.g., those concerning requirements for watershed planning and exemptions from stormwater charges) are optional; local officials must determine whether these ought be included. The ordinance has been written for officials who are interested in forming a utility to serve a single jurisdiction. Officials interested in forming a utility to serve multiple jurisdictions should contact the Stormwater Management Administration for additional information.

1.0 FINDINGS, INTENT, AND AUTHORITY

1.1 Findings

The (local unit board/council) finds that:

* the (local unit) maintains a system of storm and surface water management facilities, including but not limited to inlets, conduits, manholes, channels, ditches, drainage easements, retention and detention basins, infiltration facilities, and other components as well as all natural waterways;

* the stormwater system has received inadequate maintenance and is in a state of disrepair;

* water quality is degrading due to erosion and the discharge of nutrients, metals, oil, grease, toxic materials, and other substances into and through the stormwater system;

* the public health, safety, and welfare is adversely affected by poor ambient water quality and flooding that results from inadequate management of both the quality and quantity of stormwater;

* the (local unit) is exposed to the possibility of costly litigation due to the state of disrepair of the existing system and the potential for floods that can damage property, injure individuals, and impede movement of emergency vehicles.

The (local unit board/council) further finds that:

* every parcel of real property, both public and private, either uses or benefits from the maintenance of the stormwater system;

* current and anticipated growth in (local unit) will contribute to and increase the need for improvement and maintenance of the stormwater system;

* the extent of use of the stormwater system by each property is dependent on factors that influence runoff, including land use and intensity of development, amount of impervious surface on the property and the geographic location of property in a given watershed or basin;

* owners of properties should finance stormwater management to the extent that they contribute to the need for it;

* responsibility for stormwater management has not been clearly defined, that planning for stormwater management should be improved, and that the necessary and true costs of stormwater management have not reflected in past expenditures by the (local unit);

* management of the stormwater system to protect the public health, safety and welfare will require increased revenues;

* it is in the interest of the public to consolidate responsibility for management of the stormwater system within a single agency, to initiate long range master planning, to undertake water quality management and stormwater system maintenance activities, and to finance stormwater management adequately with a user charge system that is reasonable and equitable so that each user of the system pays to the extent to which he contributes to the need for it.

1.2 Intent

Therefore, with the passage of this ordinance, it is the intent of (local unit board/council) to promote the public health, safety, and welfare by:

* creating a stormwater management utility to manage the stormwater system;

* consolidating responsibility for all stormwater management activities in (local unit agency);

* preparing long range master plans for stormwater management for each water basin in (local unit);

* undertaking regular maintenance and requiring annual inspections of all stormwater management facilities, both public and private;

* financing stormwater management adequately through the imposition of user charges for each piece of real property that uses the stormwater system;

* setting charges such that the fees paid by each user reflect the extent to which the user creates need for the system and such that the charges bear a substantial relationship to the cost of service;

* creating a rate structure based on intensity of development, land use, and the amount of impervious area on each property that is fair and equitable, is simple and can be administered easily, and generate sufficient revenues.

1.3 Authority

Authority for the creation of this stormwater utility and the imposition of charges to finance stormwater management is conferred in $4-201 Environment Article, Annotated Code of Maryland, 1983, which states:

> Each county or municipality may adopt a fee system to cover the cost of reviewing stormwater management and implementing stormwater management programs. The fee shall take effect upon enactment by the local governing body.

The provisions of this Ordinance are adopted under the authority of the (local unit) Code and shall apply to all real properties within the (unincorporated, incorporated) area of (local unit). The application of this Ordinance and the provisions expressed herein shall not be deemed a limitation or a repeal of any other powers granted by State statute.

2.0 DEFINITIONS

(1) "Board" means the Stormwater Management Board created under Sections 3.2 and 3.3 of this Ordinance to provide advice to the (local unit board/council) concerning all matters of Utility operation.

(2) "Charges" are fees levied on owners or occupants of parcels or pieces of real property based on the contribution of the property to runoff.

(3) "Credits" are reductions in the amount of stormwater charges that are levied against a property.

(4) "Equivalent runoff units" are units used to determine stormwater charges that are calculated by multiplying the area of a parcel times a rate factor that is based on the percentage of impervious surface.

(4) "Impervious surface" means surfaces on or in a lot or parcel of real property that eliminate infiltration of stormwater into the earth.

(5) "Intensity of development" refers to the percentage of a parcel that is covered with impervious surface.

(6) "Plan" means a master stormwater plan prepared under the authority of this Ordinance that identifies the existing stormwater system and recommends a program and specific projects for continued development and improvement of the system for the purposes of flood control and water quality management.

(7) "Owner or occupant" is the person who pays, or is legally responsible for the payment of utility or other charges on city metering, made against a lot or lots, parcel of land, building, office or premises within the _____, or who should be legally responsible for such payment in case metering is not available.

(8) "Single family equivalents" are units used to express equivalent runoff units (ERUs) for non single family residential parcels in terms of the average number of ERUs for a single family residential parcel.

(9) "Stormwater system" means the system or network of storm and surface water management facilities, including but not limited to inlets, conduits, manholes, channels, ditches, drainage easements, retention and detention basins, infiltration facilities, and other components as well as all natural waterways;

(10) "Undeveloped land" is a parcel or piece of land that is without any building, structure, or improvement.

(11) "Users" are owners or occupants of a piece of real property within the boundaries of the Utility that contributes runoff to the stormwater system.

(12) "Utility" means the administrative organization of the (local unit) that has been established exclusively for the purposes of stormwater management and flood control and is authorized to impose and collect charges for these same purposes.

3.0 CREATION AND ADMINISTRATION OF UTILITY

3.1 Establishment of Stormwater Management Utility

In accordance with all applicable laws of the State of Maryland, the (local unit council/board) hereby establishes a Stormwater Management Utility with the authority for determining and levying charges for stormwater management. The Utility will be in the (local agency, e.g., Dept. of Public Works) under the control of the (local agency administrator, e.g., County Administrator).

3.2 Boundaries and Jurisdiction

The boundaries of the Utility shall be (boundaries of local jurisdiction(s)) or (such watersheds within the boundaries of the local jurisdiction as identified by the local agency administrator) and approved by the local unit council/board).

3.3 Creation of Stormwater Management Board (optional)

To assist with management of the Utility, the (local unit council/board) hereby establishes a Stormwater Management Board to provide advice to the (local unit council/board) concerning all aspects of the program of the Utility. The Board shall consist of from five to seven members as determined from time to time by the (local unit council/board). The (local unit council/board) shall appoint all members. Terms of members shall be four years, except that initial appointment shall be made in such a way that terms overlap. The (local unit council/board) shall appoint persons to fill vacancies that may exist on the Board from time to time.

3.4 Duties of the Board (optional)

The Board shall provide advice and recommendations on all aspects of the management and operation of the Utility including:

- identification of stormwater management problems;

- development of a long range master plan for stormwater management, including priorities for implementation of capital improvements;

- determination of Utility charges;

- any petitions or appeals by users of the system who contest levels of charges or request waivers or exemptions from charges.

3.5 Utility Administration

The (local agency administrator) shall have responsibility for implementing all aspects of the Utility including long range planning, plan implementation, capital improvements, maintenance of stormwater facilities, determination of stormwater charges, billing, enforcement of applicable stormwater management ordinances, and hearing of appeals and petitions. The (local agency administrator) also will have responsibility for providing staff support to the (local unit council/board) and the Board. Such responsibility will be delegated to those agencies and staff within the (local unit) administration best equipped to undertake the particular task. In the event that an agency or department other than the one in which the Utility is located is best equipped to undertake a particular task, the (local agency administrator) shall ensure that appropriate interagency charges are determined such that all costs of stormwater management are reflected in the Utility budget and that Utility charges finance all aspects of stormwater management.

3.6 Scope of Utility Responsibility

The (local unit council/board) hereby transfers all components of the stormwater system presently maintained by other agencies within (local unit) to the Utility. The Utility shall have full responsibility for planning, development, and maintenance of the stormwater system. The Utility will be responsible for all additions to the stormwater system constructed with public funds.

With respect to new stormwater management facilities constructed by private entities, the (local agency administrator) shall develop criteria for use in determining whether these will be maintained by the Utility or by the private entity which has constructed them. Such criteria may include whether the facility has been designed primarily to serve residential users and whether it has been designed primarily for purposes of stormwater management. In general, preferences shall be given to public maintenance of new facilities, particularly for those facilities designed to provide water quality benefits. In situations in which it is determined that public maintenance is not preferable, standards shall be developed to ensure that inspection of facilities occurs annually and that facilities are maintained as needed.

4.0 MASTER STORMWATER PLAN (OPTIONAL)

The (local unit council/board) hereby requires the (local agency administrator) to prepare a Master Stormwater Management Plan (hereafter referred to as the Plan) for each water basin in (local unit). The Plan shall establish goals for stormwater management and shall be the basis for determining all future activities, including capital improvements and maintenance activities, which are undertaken by the Utility. The Utility shall not undertake any activities that are not recommended in the plan.

In general, the plan shall include an inventory of all existing stormwater facilities and identify alternative actions that the Utility can undertake to achieve water quality goals and the costs of such alternatives. The plan shall include such maps as necessary to show the location of facilities and alternatives by basin. Projects or facilities that are proposed should clearly be linked to projected improvements in water quality or flooding situations and shall reflect State requirements and preferences for on-site controls of stormwater runoff. The plan shall include benefit-cost analyses and cost-effectiveness criteria which can be used to compare alternatives. Where they exist, existing planning documents for individual basins may be consolidated as part of the master plan.

The plan shall be submitted to the (local unit board/council) for approval not more than one year following establishment of the Utility. From time to time, as required by the (local unit board/council), the (local agency administrator) shall update the plan.

5.0 STORMWATER USER CHARGES

5.1 Creation and Purpose of Stormwater Charges

The (local unit board/council) hereby establishes stormwater user charges to finance all Utility activities. Necessary activities generally are those identified in the master plan and at minimum shall be identified as administrative, operations and maintenance, and capital improvements. Such charges shall be paid by each user of the stormwater system and will reflect the extent to which the user creates need for the system. The charges will bear a substantial

relationship to the cost of service for the property.[1,2] The rate structure shall be fair and equitable, simple and easy to administer, and generate sufficient revenues to fund necessary Utility activities.

Use of charges is limited to those purposes for which the Utility has been established, including but not limited to: planning; acquisition of interests in land and real property, including easements; design and construction of facilities, including debt service and related financing expenses; maintenance of the stormwater system; billing and administration; and water quality management, including monitoring, surveillance, private maintenance inspection, construction inspection, and other activities which are reasonably required. If the (local agency administrator) determines that capital charges shall differ among basins, it shall be required that capital expenditures from the fund relate to the particular basin from which the fees for such purposed were collected. It shall not be required, however, that expenditures for administration and operations and maintenance relate to the particular basin from which the fees for these purposes were collected.

Such charges may be increased periodically, if in the judgement in the (local unit board/council) increases are needed to achieve stormwater management goals. Updates of the master plan shall include estimates of the magnitude of increases in charges that would result from implementation of the plan.

5.2 Calculation of Fees in General

The (local agency administrator) shall establish a method of calculating charges and a rate structure based on intensity of development, land use, and the amount of impervious surface on each property. Prior to implementation of the Utility, the (local agency administrator) shall submit the proposed rate structure to the (local unit board/council) for approval. Because intensity of development and the amount of impervious area per parcel generally correlate with type of land use, user categories generally shall be identified as land use categories. To the extent practicable, the classes of users shall correspond to standardized land use categories used by the Maryland Department of State Planning.

[1] If the number and size of capital improvements to be undertaken in each basin differ significantly, local officials may decide to vary capital charges among basins. If capital charges are calculated separately for different basins, however, administrative and operations and maintenance expenses shall not differ among basins.

In general, the fees shall be calculated using the following formula:

Charge per parcel =

(area * rate factor * charge per ERU) ± credit or surcharge

where:

area = the total area of the property;

rate factor = a coefficient used to reflect the amount of impervious area and the percentage of rainfall that leaves a property as runoff (Table 1);

ERU = equivalent runoff unit;

charge/ERU = a charge per quantity runoff established such that each user of the system pays an equal amount for the per unit volume of runoff and the total revenue requirements of the Utility are met; and

credits or surcharges are determined as in Section 7.0.

Rate factors similar to those included in Table 1 are to be used in determining charges. If the (local agency administrator) determines that scaling of all rate factors or charges for non single family residential parcels so that they are in units of single family equivalents would be more convenient and easy to administer, such a rate structure may be developed. Total revenue requirements of the utility shall be considered those necessary to achieve stormwater management goals and shall include but not be limited to costs identified in the Plan.

Initially, all charges shall be based on rate factors that correspond to general land use. For individual properties other than single family residential, the (local agency administrator) shall survey existing sources of information for data concerning the amount and percent of impervious area on the properties. Once the utility is established, the (local agency administrator) shall commence a program to verify the amount of impervious area on all properties. Information to be used may include data from on-site measurements, site development plans, tax assessors records, data from aerial photographs, or any other available data. Eventually, all charges for nonresidential properties shall be based on the amount of impervious area on the properties as verified by the (local agency administrator).

Table 1. Representative Rate Factors for Utility Charges.

Land Use Category	Average Percent Impervious	Rate Factor
Agriculture	-	.10
Commercial	.85	.82
Commercial Residential	.70	.68
Exempt		.26
Parks	.07	.11
Playgrounds	.13	.17
Schools	.50	.50
Industrial	.72	.70
Apartments	.65	.64
Not Perc	-	.00
Residential		
Acreage < 1/8 (town houses)	.65	.40
1/8 < A ≤ 1/4	.38	(.40 is average for
1/4 < A ≤ 1/3	.30	Acreage < 1/2)
1/3 < A ≤ 1/2	.25	
1/2 < A ≤ 1	.20	.23
1 < Acreage	.12	.16
Res Agr	-	.16
Res Comm	-	.64
Condominium	-	.64
Condo Comm	-	.68
Marshland	-	.00
Other Nonstandard Categories		
Cooperative	-	.64
Mobile	-	.64
Group Quar	-	.64
Motel	-	.82
Other	-	.50

Estimates of the average percentage of impervious area are from SCS TR-55 or the Rational Method. The estimate of .65 for apartments was taken from the TR-55 estimate for town houses. A "-" in the average impervious column means that no estimate corresponded directly with the land use category. The rate factors were determined by selecting figures for a comparable use (e.g., Res Agr was assigned the same rate factor as Residential [1 < Acreage]. The equation used to convert average impervious area to a rate factor is:

$$C = .95(\% \text{ imp.}) + .05(1 - \% \text{ imp.})$$

where:

C = the runoff coefficient or rate factor for a parcel;
% imp. = the percentage of impervious surface on a parcel.

5.3 Standardized Residential Charges

The (local unit board/council) finds that most parcels of real property are classified as single family residential, that the intensity of development of these parcels is similar, and that it would be excessively and unnecessarily expensive to determine precisely the percentage of impervious area on each parcel. Therefore, the (local unit board/council) directs the (local agency administrator) to standardize charges for all single family residential users. Based on a representative sample of single family residential parcels, the (local agency administrator) shall determine the average amount of impervious surface per parcel, and the number of ERUs per parcel. The standard residential charge shall be a flat fee equal to the average number of ERUs times the charge per ERU. The (local agency administrator) may establish classes of single family residential users based on total parcel area if doing so would better reflect contribution to runoff and would result in more equitable charges.

5.4 Charges in the Event of Multiple Owners

In the case where there are multiple owners or occupants of properties such as condominiums or shopping centers, and each occupant or owner receives utility service from his own meter, in general the mathematical average of the number of owners/occupants and the size of the parcel of land will be used to calculate each owner's/occupant's charge. If there are significant differences in the total area of property owned or occupied by any owner or occupant, the (local agency administrator) shall also consider the relative contributions to runoff in determining the allocation of the total charge to the owners/occupants.

5.5 Charges for Public Properties

The (local unit board/council) finds that all real property owned and maintained by various local, state, and federal governmental units contributes to runoff and the stormwater management problem. Public properties, including streets and rights-of-way and properties owned by other local units such as school districts, are to be charged as if they were private properties. In the case of properties owned by (the local unit), such charges will be paid from the general fund and deposited into the Stormwater Utility Fund. In the case of properties owned by other local governments, or state or federal governments, intergovernmental charges shall be levied.

5.6 Watershed Management Areas

If in the Plan significant differences in capital requirements are found to exist in different water basins, and the (local agency administrator) determines that different capital fees shall be established for each basin, he shall designate such basins as Watershed Management Areas and conduct public hearings to inform basin residents of the designation and of the intent to impose differential charges.

6.0 STORMWATER FUND

6.1 New Stormwater Fund

The (local unit board/council) hereby directs the (local agency administrator) to establish a separate enterprise fund called the Stormwater Utility Fund to be used exclusively for purposes of the Utility. All revenues received by the Utility shall be deposited into the fund. All disbursements from the fund will be for expenditures for stormwater management authorized by (local agency administrator) in accordance with all applicable laws, regulations, and policies.

6.2 Interagency Charges

As is necessary, the (local agency administrator) shall development a procedure for implementing and accounting for interagency charges such that all expenditures for the purposes of stormwater management are paid for by revenues from stormwater charges. Examples of the types of expenditures that should be accounted for by interagency charges, and paid for with Utility revenues, include legal fees, billing expenses, and other general administrative and accounting expenses. In addition, the procedure shall include provisions to insure that charges to the general fund for runoff from public properties are credited to the Utility Fund.

7.0 CREDITS, EXEMPTIONS AND SURCHARGES

7.1 Credits for On-site Management

The (local agency administrator) shall develop and implement procedures whereby users of the stormwater system can receive credit for on-site retention of stormwater runoff. Such credit will consist of partial exemption from user charges. Precise determination of the magnitude of credit will depend in part on calculations made by the (local agency administrator) on the extent of control provided by the user. The (local agency administrator) shall consider the degree of control of both the quantity and quality of stormwater when

determining credits. In addition, the (local agency administrator) shall consider future responsibility for maintenance when determining credits (see Section 3.6). In no case shall the user charge be reduced to an amount less than the standard single family residential charge.

Such credits shall remain in effect so long as the owner of such systems has obtained the proper permits and constructed the facilities according to plans approved by (local agency), the owner remains responsible for all costs of operation and maintenance of the system, and the (local agency administrator) has access for inspection of the system to determine if it is in compliance with design and maintenance standards and functioning properly.

7.2 Exemptions from Charges (OPTIONAL)

Notwithstanding any local Ordinances which exempt certain parcels from responsibility for implementing stormwater controls, all properties except those listed here will be liable for payment of stormwater charges. Properties exempted from payment of stormwater charges include:

- wetlands, ponds, and other natural watercourses that serve as components of the stormwater management system;

- public parks that have not been developed and include no impervious area and are predominantly in their natural state;

- agricultural land (Note: Table 1 includes runoff coefficients for agricultural land in the event it is charged;

- undeveloped land.

7.3 Surcharges for Parcels in Floodplains (OPTIONAL)

Properties of land lying within the historical 100 year floodplain may be flooded despite activities undertaken by the Utility. Costs to serve and protect such properties generally will exceed costs to serve and protect other properties. Because costs to protect these parcels will be greater, a surcharge shall be levied on them. The (local agency administrator) shall undertake studies to determine the increase in costs necessary to serve and protect these properties and shall recommend to the (local unit board/council) a surcharge stated in terms of a percentage of the general Utility charge for a similar parcel not in the 100 year floodplain.

8.0 BILLING

The (local agency administrator) shall modify existing utility billing systems to incorporate bills for stormwater charges. For properties not served with water or sewer by (the local unit), the (local agency administrator) shall develop a new billing system that can be added to the existing system. Information included in the billing system shall include, but not be limited to, the owner of each property and land use information required to calculate the charges.

9.0 ENFORCEMENT AND PENALTIES

9.1 Enforcement

The (local agency administrator) is authorized to use to the full powers of the (local unit) to enforce provisions of this ordinance. In the event that any user fails to pay the charges specified herein, the (local agency administrator) shall take whatever legal steps necessary to collect such charges. Unpaid charges shall constitute a lien against the property affected. Charges which have remained unpaid for a period of six months prior to (date before issuance of property taxes) of any year may, after notice to the owner, by resolution of the (local unit board/council) be certified to the (local unit assessor), who shall place the charges on the next tax role. Alternatively, the (local unit board/council) may direct the (local unit attorney) to file suit and to collect unpaid charges.

9.2 Penalties (duplicated from Maryland Model Stormwater Management Ordinance) (OPTIONAL)

Any person convicted of violating the provisions of this ordinance shall be guilty of a misdemeanor, and upon conviction thereof, shall be subject to a fine of (specify amount) or imprisonment not exceeding (specify period), or both. In addition, the (governing authority) may institute injunctive relief, mandamus or other appropriate action or proceedings at law or equity for the enforcement of this Ordinance or to correct violations of this Ordinance, and any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent, injunctions, or mandamus or other appropriate forms of remedy or relief.

10.0 APPEALS

Any person aggrieved by an action of the (local agency administrator) charged with enforcement of this ordinance, who believes that stormwater charges have been imposed without ba-

sis or have been determined incorrectly, shall have the right of appeal and may petition the (local hearing examiner) for a hearing to contest such charges. The appeal shall be filed in writing within (time frame) of the date of official notification or transmittal of the contested determination by the (local agency administrator). The petitioner shall state clearly the grounds on which the appeal is based. The appeal shall be processed in the manner prescribed for hearing administrative appeals under (local or state code provision).

11.0 SEVERABILITY

If any section, subsection, sentence, clause, phrase, or portion of this ordinance is for any reason held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed a separate, distinct, and independent provisions and such holding shall not affect the validity of the remaining portion of this Ordinance, it being the intent of the (local unit board/council) that this Ordinance shall stand, notwithstanding the invalidity of any section, subsection, sentence, clause, phrase, or portion hereof.

12.0 FLOODS AND LIABILITY

Floods from stormwater runoff may occasionally occur which exceed the capacity of the stormwater system maintained and financed with Utility charges. This Ordinance does not imply that properties subject to charges shall always be free from flooding or flood damage, or that all flood control projects to control runoff can be constructed cost-effectively. Nothing whatsoever in this Ordinance shall deem the (local unit, local unit board/council, (local agency administrator, or local agency staff) liable for any damages incurred in a flood or from adverse water quality. Nothing in this Ordinance purports to reduce the need or necessity for flood insurance.

A SURVEY OF STORMWATER UTILITIES

STORMWATER MANAGEMENT ADMINISTRATION

MARYLAND DEPARTMENT OF THE ENVIRONMENT

March, 1988

Prepared by:

Greg Lindsey

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SUMMARY

The Stormwater Management Administration, Maryland Department of the Environment, surveyed 25 existing stormwater utilities in September, 1987 for information about their operations. The survey was motivated because of concern that the State will not achieve water quality goals unless local governments maintain stormwater facilities designed to provide water quality benefits. Nineteen utilities (76%) returned surveys.

Utilities have been established both in smaller communities (e.g., population 20,000) and older, central cities (e.g., Cincinnati). Several serve multiple jurisdictions (e.g., a county and a city); a few are organized on the basis of watersheds. Most utilities are administered by departments of utilities; many are within departments of public works. All have responsibility for operations and maintenance of stormwater systems; only 12 of the 19 report having responsibility for water quality management. The oldest utility was formed in 1973; 11 of the 19 have been formed since 1983. The reported costs of forming the utilities vary significantly; many of the initial costs related to creation of the billing system. In most cases, 1.5 to two years of planning were required before local councils voted to establish utilities.

Most utilities base user charges on the total amount or percentage of impervious area on individual properties and calculate charges in terms of single family equivalents, which are units that equate runoff from all parcels to the average amount from a single family residential parcel. The majority of utilities bill users monthly. Reported monthly user charges for single family residential parcels range from $1.25 to $4.40. Total revenues from charges range from more than $425,000 to a projected $8.2 Million. Most utilities finance capital revenues primarily with current revenues.

While all utilities undertake maintenance of public facilities, private facilities usually are maintained by the owner of the property on which the facility is located. Although 15 utilities are responsible for regulation and enforcement, only two are required by regulation to inspect private facilities regularly. Most utilities inspect private facilities only in response to complaints.

From the Administration's perspective, utilities appear to be an excellent approach to providing a stable base of funding for stormwater management. However, with respect to the Administration's concerns about water quality management and the needs for regular inspection and maintenance of private facilities, few of the utilities appear to have fully integrated these activities into otherwise comprehensive approaches.

A SURVEY OF STORMWATER UTILITIES

1.0 INTRODUCTION

The State of Maryland is one of the few states that has taken aggressive action to control urban stormwater (Kaiser and Burby (1987)). The state requires local governments to adopt stormwater management programs, and runoff from new developments must be maintained at pre-development levels. Three recent surveys have found, however, that stormwater management facilities mandated by state and local programs are not functioning as designed (Geis and Tassone (1983); Maryland Division of Sediment and Stormwater (1986), Pensyl and Clement (1987)). All three surveys cite the lack of maintenance as the main reason for failure.

A primary reason for the lack of maintenance is a lack of funding. Recognizing this, the Sediment and Stormwater Administration has begun to investigate alternative methods of financing stormwater management. Many writers recently have recommended the utility approach as the best method of financing stormwater management.[1] As part of this investigation, therefore, the Administration surveyed stormwater utilities in the United States for detailed information about their formation, organization, financing, operations, and maintenance practices.

This report is a summary of the information collected in the survey. The information is presented in tabular form so that readers can easily compare and contrast various aspects of the utilities. While similarities among the utilities are apparent, the data show that there is no single model for a stormwater utility. The utilities that exist were formed for different reasons at different times, they perform different activities, and they use a variety of mechanisms to fund these activities. It seems clear that a wide variety of approaches can be successful, and, in particular, that the utility approach holds promise for the State of Maryland. This report does not, however, include recommendations for the implementation of stormwater utilities in Maryland. For planning guidelines for the formation of utilities, see the companion Administration report, <u>A Planning Guide to Stormwater Management Utilities</u> (Lindsey (1988)).

[1] See Priede [Camp Dresser & McKee (1986), Cyre (1982, 1983, 1986, 1987), Engemoen (1985), Honchell (1986), Poertner (1981), Warren (1986), Godfrey (1985), Stitt (1986), and Ferrari (1987).

Survey Methodology

The survey was designed in the late summer of 1986 and mailed in September 1986. The basic approach was after that recommended by Dillman (1978), although because the number of known utilities was so small, the survey was not pretested by mailing to representatives of utilities. Instead, the survey went through several iterations based on correspondence and conversations with utility officials and comments from Administration staff. Follow-up mailings were done at one, three, and seven week intervals.

Utilities to be surveyed were identified in an ad hoc process that included a variety of sources such as articles in journals, conversations with utility managers, presentations at conferences, and numerous reports. Although perhaps 50 or more utilities exist (ASCE (1985)), only 37 were identified, and the questionnaire was mailed to each of them. During the course of the survey, it was learned the 12 of these were only in the planning stages and had not been implemented. Nineteen of the existing utilities (76%) and five of the 12 proposed utilities (42%) returned the questionnaires. The response rate is considered good given the detail of the questionnaire (Appendix A).

Only the data from the existing utilities are included in the tables presented in the following sections. Data from the proposed utilities, which were not as complete, are not presented here but are available from the Administration. With one or two exceptions, the data that are presented are based solely on the respondents' answers to the questions in the questionnaire. As with any mail survey, some error or bias resulting from misinterpretations either by the respondent or the researcher is inevitable. Whatever error exists in this case is believed to be small and inconsequential given the basic purpose of the report, which is to present a broad overview of the ways in which stormwater utilities are organized, financed, and operated.

Although the sample size is small, it is believed that the survey presents a good overview of the variety of approaches that can be grouped together in the general category of the utility approach. The conclusions that follow are based simply on general observations of trends in the raw data. Frequently, only ranges of data are reported. No statistical analyses were undertaken due to the small sample size and the potential for error in some of the data. It is emphasized that the specification of a range of values for a particular parameter does not mean that values will always or should fall within the range.

2.0 SURVEY RESULTS

Data from the survey have been organized into sixteen tables, each concerned with a specific topic such as details of implementation, billing system, or revenues and expenditures. The discussion that follows is focused on the information in the tables.[1]

Stormwater Utilities: Location, Service Area, and Population Served

Basic information about the location and service area of the utilities is presented in Table 1. Utilities from nine different states responded to the survey. Seven of the respondents were from the state of Washington, three from Oregon, two each from Colorado and Ohio, and one from Kentucky, Michigan, Minnesota, Montana, and Texas.[2] Based on these results, the majority of utilities appear to be in Western states.

There is evidence, however, the geographical distribution is widening. The Florida Department of Environmental Regulation reports that, in addition to the existing utility in Tallahassee, at least nine more are being implemented, and that planning has begun for an additional 15 to 20.[3] The five proposed utilities that returned surveys all are in Florida. Honchell reports that several more utilities have been formed in the Minneapolis-St. Paul area following the successful Roseville experience.

Fifteen of the nineteen utilities serve individual municipalities. Four serve multiple jurisdictions: three in Washington (Everett, Seattle/King County, and Vancouver/Clark County) and one in Kentucky (Louisville/Jefferson County). In these, in addition to a city, the utilities serve urbanized portions of counties. In at least one (the Vancouver utility) the portion of the County served is a particular basin that has water quality problems.

The size of the populations served by stormwater utilities varies widely. The smallest utility serves a population of 20,000 (Wooster, Ohio), while the largest that responded, the Louisville/Jefferson County utility, serves a population of more than 684,000. The Seattle/King County utility, which

[1] In each of the Tables, a "1" indicates an affirmative response (i.e., the utility replied "yes" to a question whether a particular parameter was applicable).

[2] Of the six existing utilities that did not respond, two each are in Colorado and Washington, one from Florida, and one from Oklahoma.

[3] Personal correspondence, Mr. Eric Livingston, Florida Department of Environmental Regulation, September 1986).

Table 1. Stormwater Utilities: Location, Service Area, and Population Served.

Utility	State	Jurisdiction	Population of Service Area
Ann Arbor	MI	City of Ann Arbor	108,000
Auburn	WA	City of Auburn	30,000
Austin	TX	City of Austin	450,000
Billings	MT	City of Billings	85,000
Boulder	CO	City of Boulder	90,000
Cincinnati	OH	City of Cincinnati	385,000
Corvallis	OR	City of Corvallis	42,000
Everett	WA	Most heavily developed watersheds in the County	150,000
Ft. Collins	CO	City of Ft. Collins	80,000
Kent	WA	City of Kent	31,000
Louisville	KY	City of Louisville and Jefferson County	684,565
Medford	OR	City of Medford	45,000
Portland	OR	City of Portland	400,000
Renton	WA	City of Renton	34,460
Roseville	MN	City of Roseville	36,000
Seattle	WA	Western one-third of King County (most urban area)	NR(1)
Tacoma	WA	City of Tacoma	160,000
Vancouver	WA	City of Vancouver and one basin in Clark County	52,000
Wooster	OH	City of Wooster	20,000

Total number of utilities: 19

Number of different states represented in survey: 9

Smallest population served by utility: 20,000 (Wooster OH)

Largest population served by utility: 684,565 (Louisville and Jefferson County KY; the Seattle/King County service area probably is larger).

(1) NR = no response in survey

Other utilities known to exist that did not resond to survey:

Aurora CO
Bellevue WA
Denver CO
Steilacoom WA
Tallahassee FL
Tulsa OK

did not report population served, probably is larger, as is the Denver utility, which did not respond. Seven of the 19 utilities serve populations greater than 100,000.

Stormwater Utilities: Administration and Functions

Data concerning the administrative organization and the various functions performed by the utilities are presented in Table 2. The administrative agency in which stormwater utilities are located most commonly is a department of utilities. Eleven utilities are administered by such departments. Of these 11, seven of the utility administrators report to directors of public works, which implies indirect management by the public works departments. Administrators of three of the 11 report directly to city managers.

Two utilities are administered directly by departments of public works. Another two are administered by separate stormwater utility agencies. Of these two, one administrator reports to the director of public works; the other to the city manager. Two also are within bureaus of environmental services. Another agency with responsibility for administration of a stormwater utility is a department of transportation and public services.

The only utility that is a special district is the one in Louisville/Jefferson County. The administrator of this utility reports directly to the board of the special district.

The categories of functions performed by the utilities are quite similar, although there are two exceptions. All perform operations and maintenance of stormwater systems, 18 perform administrative activities related to stormwater management, 17 have responsibility for design and engineering, and 16 have responsibility for undertaking capital improvements. Fifteen utilities each undertake planning, and regulation and enforcement. The major exceptions to the uniformity in functions among utilities lies in the areas of master planning and water quality management. Only nine of the 19 utilities are required by ordinance to operate in the context of a master drainage plan. Only twelve of them perform activities specifically identified as water quality management.

In communities without utilities, responsibility for stormwater management frequently is fragmented among departments of public works and departments and planning and zoning. That most utilities (79% of the sample) have responsibility for regulation and enforcement as well as operations and maintenance indicates that most communities with utilities take a more comprehensive approach to stormwater management. Apparently, most communities that have

Table 2. Stormwater Utility Administration, Functions, and Operations (1).

Utility	Administrative Agency	Supervisor of Utility Director	Master Plan Requ'd	Admin.	Plan.	Design & Engr.	O&M	Reg. & Enforc.	Capital Improv.	Water Quality Manage.	Other
Ann Arbor	Dept. of Utilities	City Manager	N	1			1	1			
Auburn	Dept. of Public Works	Dir. of Public Works	Y	1	1	1	1	1	1	1	
Austin	Bureau of Environmental Services	City Manager	N	1	1	1	1	1		1	Flood Insurance Program
Billings	Dept. of Utilities	City Manager	Y	1	1	1	1	1	1		
Boulder	Dept. of Utilities	Dir. of Public Works	Y	1		1	1	1	1		
Cincinnati	City Storm Water Utility	Dir. of Public Works	Y	1	1	1	1	1	1	1	
Corvallis	Dept. of Transportation & Public Serv.	City Manager	N	1	1	1	1	1	1	1	
Everett	Dept. of Utilities	Manager of Prog. Dev.	N	1	1	1	1		1	1	Citizen Participation
Ft. Collins	Dept. of Public Works	Dir. of Natural Res.	Y	1	1	1	1	1	1	1	Floodplain Management
Kent	Dept. of Utilities	Dir. of Public Works	Y				1				
Louisville	Separate Stormwater/ Sanitary Dist.	Board of Special District	Y	1	1	1	1	1	1	1	
Medford	City Storm Water Utility	City Manager	Y	1	1	1	1	1	1		
Portland	Bureau of Environmental Services	Commissioner of Utilities	N	1	1	1	1	1	1	1	
Renton	Dept. of Utilities	Dir. of Public Works	Y	1		1	1	1	1	1	
Roseville	Dept. of Utilities	City Manager	N	1	1	1	1	1	1	1	
Seattle	Dept. of Utilities	Dir. of Public Works	NR	1	1	1	1	1	1		
Tacoma	Dept. of Utilities	Asst. Dir. Public Works	N	1	1	1	1	1	1	1	
Vancouver	Dept. of Utilities	Dir. of Public Works	N	1	1	1	1		1	1	
Wooster	Dept. of Utilities	Dir. of Public Works	N	1	1	1	1		1		
Total Utilities Performing Function			9	18	15	17	19	15	16	12	

(1) A "1" indicates an affirmative response (i.e., the utility performs the function.

established utilities have sought to centralize traditional drainage and flood control activities within them.

Land Use in Utility Service Areas

Data concerning the amounts of different types of development in the service areas of six utilities (Austin, Boulder, Cincinnati, Louisville, Roseville, and Tacoma) are presented in Table 3. The other respondents did not report this information. These data are important because land use categories may be regarded generally as different classes of utility customers or users. The amount of impervious area per parcel, which generally is correlated with land use, usually is considered the key factor in estimating runoff and forms the basis for most utility charges (see Table 8). In some communities, land use is used as the sole basis for charges.

The responses indicate wide variability in the size and density of utility service areas, although within ranges, the relative amounts of different types development (e.g., residential, commercial) are similar. For example, the Louisville/Jefferson County utility serves 242,079 acres. The service area for the Austin utility, which is the next largest, is roughly a third smaller, approximately 160,000 acres. The utility with the smallest service area is Roseville, which serves only 8724 acres.

The utilities do not vary as much with respect to density. Austin, with a population of 450,000 and 88,000 acres of developed land, has a density of 5.1 persons per developed acre, while Cincinnati (population: 385,000; developed area: 35,450 acres) has a density per developed acre of 10.7 persons. This implies significant differences in the types of drainage problems that must be managed by the utilities. The other four communities have densities within the range bounded by these two values.

For utilities that serve municipalities, the percent of service area that is developed ranges from 55% (Austin) to 71% (Cincinnati). Only about 40% of the Louisville/Jefferson County service area is developed. The Louisville utility, much of which is in Jefferson County outside Louisville, is 51% greater than the service area of Austin, the next largest utility for which these data are available. As might be expected, the percentage of service area that is developed is greater for the five utilities that serve only a single jurisdiction than for the lone utility that serves multiple jurisdictions.

Among all developed uses, the percentage of land occupied by single family residential ranges from 51% (Cincinnati) to 68%

Table 3. Land Uses in Utility Service Areas.

Note: all land use areas are in acres.

Land Use Category	Austin (1)	Share Total Dev.	Share Total All	Boulder	Share Total Dev.	Share Total All	Cincinnati(2)	Share Total Dev.	Share Total All	Louisville(3)	Share Total Dev.	Share Total All	Roseville(4)	Share Total Dev.	Share Total All	Tacoma	Share Total Dev.	Share Total All
Developed																		
Single Family Residential	59,840	68%	37%	6,128	54%	37%	17,907	51%	36%	53,110	55%	22%	2,926	53%	34%	9,010	60%	38%
Multi-family Residential				1,656	15%	10%	3,590	10%	7%	3,774	4%	2%	259	5%	3%	2,413	16%	10%
Commercial	7,040	8%	4%	825	7%	5%	1,952	6%	4%	12,932	13%	5%	398	7%	5%	2,000	13%	8%
Industrial	4,960	6%	3%	1,581	14%	9%	3,098	9%	6%	15,576	16%	6%	895	16%	10%	1,498	10%	6%
Institutional	10,080	11%	6%				2,566	7%	5%				510	9%	6%			
Public	6,080	7%	4%	1,211	11%	7%	6,336	18%	13%	11,952	12%	5%	552	10%	6%			
Dev. Total	88,000	100%	55%	11,401	100%	68%	35,450	100%	71%	97,344	100%	40%	5,540	100%	64%	14,921	100%	63%
Undeveloped																		
Agriculture							339		1%							75		
Park/ Open Space				2,740		16%	1,894		4%				935		11%			
Undeveloped all other	72,000		45%	2,621		16%	12,237		25%	144,735		60%	2,249		26%	8,637		
Undev. Total	72,000		45%	5,361		32%	14,470		29%	144,735		60%	3,184		36%	8,712		37%
Total All	160,000		100%	16,762		100%	49,920		100%	242,079		100%	8,724		100%	23,633		100%

(1) In Austin, commercial acreage includes multifamily residential acreage.
(2) In Cincinnati totals, the institutional category includes public buildings; public right-of-way and roads are in the public category.
(3) In the Louisville/Jefferson County service area, five small communities and one sparsely populated area with Jefferson County are excluded from the utility's jurisdiction.
(4) In Roseville, the undeveloped total includes public right-of-way.

(Austin). Excluding Austin, the range is smaller: from 51% to 60% (Tacoma). The ranges for the percentage of developed land occupied by commercial and industrial uses are smaller: 7% to 13% and 6% to 16%, respectively. The percentage of developed land occupied by multifamily residential ranges from 4% to 16%. The amounts of land devoted to public and institutional uses in the service areas are difficult to compare because the utilities categorize these data differently. For example, in Cincinnati, rights-of-way are in the public category, while in Roseville, they are categorized as undeveloped.

Stormwater Utilities: Details of Implementation

Details concerning the formation, cost, and implementation of the utilities are presented in Table 4. The Boulder utility, which was formed in 1973, is the oldest utility that responded. Two (Everett and Medford) formed during 1987. The data indicate an increasing rate of formation: five were formed during the 1970s, six more between 1980 and 1984, and seven between 1985 and 1987. The assumption of a trend towards formation of utilities is supported by the reports (noted earlier) of the large number of them currently being planned.

The time required for planning prior to votes by local councils to authorize the utilities varied considerably, although following authorization, most utilities were implemented fairly quickly. For the 17 utilities that reported this information, the planning period prior to authorization was less than two years for 12 of the utilities and more than two years for the remaining five. The planning period reported most frequently was 1.5 to 2.0 years. Four of the utilities reported planning periods of less than one year.

Data on implementation time are available for 16 utilities. Twelve of the utilities were implemented within six months after authorization. Three required between seven and 12 months to implement, while one required between two and two and one half years.

Eleven respondents reported that consultants were retained to assist in the development of the utility. There does not seem to be any correlation between size of community and use of consultants. Five of the eight utilities with populations greater than 100,000 reported using consultants; six of the 10 cities with populations less than 100,000 used consultants.[1]

[1] One city with a population less than 100,000 did not report whether consultants were retained.

Table 4. Stormwater Utilities: Details of Implementation.

Utility	Date Author. (mo/yr)	Plan. Period Before Author. (months)	Plan. Period After Author. (months)	Consultants Retained	Type of Consultants Engr.	Manage.	Acct./ Finan.	Total (1) Cost to Implement Utility ($)	Cost per (2) Capita ($)
Ann Arbor	03/84	>30	NR	Y					
Auburn	12/86	13 - 18	0 - 6	Y	X	X	X	200,000	6.67
Austin	09/82	13 - 18	0 - 6	N				100,000	0.22
Billings	NR	NR	NR	NR					
Boulder	08/73	7 - 12	0 - 6	N					
Cincinnati	08/84	19 - 24	7 - 12	Y	X			785,000	2.04
Corvallis	06/78	7 - 12	0 - 6	Y	X			50 - 70,000	1.19 - 1.67
Everett	07/87	25 - 30	7 - 12	Y				> 500,000	3.33
Ft. Collins	11/81	19 - 24	0 - 6	Y	X				
Kent	04/85	NR	NR	Y					
Louisville	01/87	19 - 24	0 - 6	Y	X	X			
Medford	08/83	25 - 30	0 - 6	Y	X		X	200,000	4.44
Portland	06/77	7 - 12	0 - 6	N				100,000	0.25
Renton	12/86	> 30	0 - 6	N				15,000	0.44
Roseville(3)	01/84	7 - 12	0 - 6	N				500	0.01
Seattle	04/86	> 30	0 - 6	Y					
Tacoma	04/79	19 - 24	0 - 6	N				200,000	1.25
Vancouver	09/78	13 - 18	25 - 30	Y					
Wooster	03/85	19 - 24	7 - 12	N					
Total using consultants				11	6	2	2		

Modal planning time prior to vote to authorize utility: 1.5 - 2.0 years

(1) Reported costs are assumed to be in dollars for the years when the utilities were created.
(2) Cost per capita is based on the total cost divided by current population because population estimates for when the utilities were created are not available. Costs were not indexed.
(3) Costs for staff time (400 hours) required to establish the Roseville were not reported.

Only six of the utilities reported the types of consultants that were retained. All six retained engineering firms; three reported use of management or accounting/financial consultants. Specific information on the reasons why consultants were used is not available; responses indicate that in most cases consultants performed tasks such as the development of billing systems and the preparation of master plans.

Implementation costs were reported by ten utilities. Very crude estimates of the cost per capita to implement the utilities have been computed from these reported costs. Because the data are in some cases almost a decade old, and because there were no controls over what was included as a cost of establishing the utility, the data are useful only for rough, ball park estimates of the ranges of costs to implement a utility.

The case of Roseville helps to illustrate this. The utility was established by city employees and evidently did not require many changes in existing city operations. Direct costs incurred by the City were reported as only $500; implementation required 400 hours of staff time, for which no cost in dollars was given. It appears that the cost in Roseville was far lower than in any other community. However, if Roseville had calculated costs for staff, it is likely that its costs would have been comparable to those reported by other utilities.

Another limitation that makes it difficult to compare costs is the reported costs are not all for the same year. Although the costs could be indexed, there is no way to do this accurately. In every case, costs were incurred over a multi-year period, and there is no way to assign costs to a specific year. In addition, population estimates for the utility service areas for the time when the utilities were established are not available. Thus, the per capita implementation cost estimates are based on current population.

With these qualifications, several very general comments can be made. The reported costs range from negligible (Roseville, 1984) to $15,000 (Renton, 1986) to $785,000 (Cincinnati, 1984). The costs per capita (excluding Roseville) range from very low, $0.22 in Austin (1982), to substantial, $6.67 in Auburn (1986). Although all reasons for variations in costs are not known, there is good evidence that a major cost element is development of the billing system, especially when parcels are mapped or digitized to determine impervious area. This is discussed in greater detail in the following subsection.

Utility Billing Systems

Tables 5 and 6 include information about the development of utility billing systems and various attributes of them. The size of the billing systems (i.e., the number of accounts) reflect the size and population of the service area, but not linearly. Data in Table 5 show that Wooster, the utility with the smallest population in its service area (20,000 [see Table 1]) also has the smallest number of accounts (7500). The Austin utility, which serves the second largest population of those reported (450,000), has the largest number of accounts (218,261).[1] Louisville/Jefferson County, which has the largest population in its service area, has the second greatest number of accounts.

For the 17 utilities for which data are available, the ratios of accounts to population ranges from 21.6% to 48.5% (Table 6). Although this range is broad, these ratios at least provide bounds for estimating the number of accounts from population, provided no better data (i.e., the number of parcels in the service area) are available. Nine of the utilities fall within the range, 21.6% to 30%, and six are within the range 30% to 38.5%. The Austin utility, unusual among respondents, has nearly half as many accounts as total population (48.5%).

In this small sample, the reported costs to establish billing systems varied greatly (Table 5). The quality of the cost data is poor; comparisons among utilities must be approached cautiously because of inconsistencies in accounting practices and for the reasons cited above. The data show, however, that the cost of developing a billing system is not simply a function of the total number of accounts in the service area. Significant economies of scale would not necessarily be expected since a given amount of work must be done to create each account, but constant costs or slightly decreasing costs could be expected. These are not shown. For example, Cincinnati, which has the fifth greatest number of accounts, had the highest reported cost per account.

The responses indicate that the costs of developing the billing system can represent a significant percentage of the cost of implementing the utility, particularly when extensive mapping or digitizing is undertaken. For example, in Auburn, $85,000, or 43% of total implementation costs, were for mapping alone. Another $20,000 was for management and financial consultants, which indicates the share of implementation costs attributable to the billing system may have been even

[1] It is likely that the population in the Austin utility's service area is third largest, ranking behind Seattle/King County's as well. The Austin utility has more accounts, however, than does Seattle's.

Table 5. Development of Utility Billing Systems (1).

Utility	Number of Accounts	Cost of Billing System ($; [2])	Cost per Account to Develop ($, [3])	Created New System	Modified Existing System	Added New Component to Existing System	Used Water/ Sewer Accounts	Used Tax Assessor's Files or Maps	Digitized Aerial Photos(4)	Parcel(4) Site Evaluation
Ann Arbor	23,354				1		1	1		
Auburn	8,000					1	1	1	1	
Austin	218,261	$25,000 (1982)	0.11		1			1		
Billings	25,000			1		1	1	1		
Boulder	16,698 (1974)	$23,923 (1974)	1.43		1		1			1
Cincinnati	97,950	$766,000 (1984)	7.82	1				1	1	
Corvallis	11,000					1				
Everett	50,000	$200,000 (1987)	4.00			1		1		
Ft. Collins	25,000	$50,000 (1981)	2.00		1		1			1
Kent					1		1	1	1	
Louisville	180,000					1	1	1	1	
Medford	14,600					1	1	1	1	
Portland	110,000				1		1	1		1
Renton										
Roseville	9,300	$500 (1984)	0.05			1	1			
Seattle	161,000			1				1	1	
Tacoma	59,800	$30,000 (1979)	0.50			1	1	1	1	
Vancouver	20,020	$61,000 (1978)	3.05	1				1		
Wooster	7,500					1	1			
Total				4	6	9	12	13	7	3

(1) A "1" indicates an affirmative response.
(1) Assumed to be value in dollars of year utility was formed.
(2) Computed by: cost of billing system / number of accounts; note: some communities did not provide the number of accounts in the year the utility was formed; therefore the calculation is based on the current number of accounts.
(3) Includes utilities in which tax assessor's maps were digitized.
(4) Site evaluation done by field inspection and measurement or by review of plans and reports.

Table 6. Utility Billing Systems.

Utility	Number of Accounts	Ratio of Accounts/ Population	Billing Frequency Residential	Commercial/ Industrial	Public/ Other	Annual Billing Costs Per (1) Account	Total	Annual Billing as % of Total Charges	Percent Delinquent Accounts
Ann Arbor	23,354	21.6%	Quarterly	Quarterly	Quarterly				
Auburn	8,000	26.7%	Bimonthly	Bimonthly	Bimonthly				
Austin	218,261	48.5%	Monthly	Monthly					
Billings	25,000	29.4%	Annually	Annually	Annually				
Boulder	19,504	21.7%	Monthly	Monthly	Monthly	$4.72	$92,058	9.5%	< 1%
Cincinnati	97,950	25.4%	Annually	Quarterly	Quarterly	$1.80	$492,000	12.3%	10%
Corvallis	11,000	26.2%	Bimonthly	Monthly	Monthly				
Everett	50,000	33.0%	Annually	Annually	Annually	$1.00	$50,000	4.5%	
Ft. Collins	25,000	31.3%	Monthly	Monthly	Monthly	$1.00	$25,000	2.3%	1%
Kent			Monthly	Monthly	Monthly				
Louisville	180,000	26.3%	Bimonthly	Monthly/ Bimonthly	Bimonthly	$1.67	$300,000	3.6%	
Medford	14,600	32.4%	Monthly	Monthly	Monthly	$3.60	$52,600	6.2%	4.7%
Portland	110,000	27.5%	Monthly/ Quarterly	Monthly/ Quarterly(2)	Monthly/ Quarterly	$8.64	$950,000	16.3%	0.2%
Renton			Monthly	Monthly	Monthly				
Roseville	9,300	25.8%	Quarterly	Quarterly	Quarterly	$3.32	$7,200	1.4%	3%
Seattle	161,000		Semiannually	Semiannually	Semiannually	$2.48	$400,000	5.4%	5%
Tacoma	59,800	37.3%	Monthly/ Bimonthly	Monthly/ Bimonthly	Monthly/ Bimonthly	$2.08	$124,619	6.8%	0.5%
Vancouver	20,020	38.5%	Annually	Annually	Annually	$2.25	$45,000	10.6%	5%
Wooster	7,500	37.5%	Monthly	Monthly	Monthly				3%

(1) Annual unit cost for residential accounts if billing frequency varies by category.
Cost = (reported unit cost * frequency of billing) or (total annual cost/number of accounts).
(2) Industrial accounts in Portland are billed only monthly.

higher. In Cincinnati, tax assessor's maps were digitized to establish the billing system. The reported cost of the billing system ($766,000) was approximately 98% of the cost of implementation ($785,000). In Everett, tax assessor's files were used to create the billing system, which accounted for 40% of the $500,000 cost of implementation.

Conversely, in Austin, where rate factors were assigned on the basis of land use, no significant mapping or digitizing costs were incurred. Setting up the billing system accounted for only 25% of the costs of implementation. Similarly, in Portland (per capita implementation cost of $0.25), the cost of setting up the billing system was not significant.[1] The stormwater charge initially was billed simply as a surcharge on the regular wastewater bill. Since the utility was formed, however, officials have been revising the billing system. Crews since have measured impervious area on industrial parcels to make bills more accurate, but it is doubtful that these costs have been considered or reported as a cost of implementation.

Four utilities (Billings, Cincinnati, Seattle, and Tacoma) created entirely new billing systems (Table 5). Six utilities simply modified existing billing systems, while nine had to modify existing billing systems, plus add new components to account for users who were not on any existing accounting system. There are too few data to correlate the creation of a new billing systems with highest reported costs.

Thirteen of the utilities used tax assessor's files or maps for development of the billing systems, 12 used information from water and sanitary sewer accounts, and eight used both. Seven reported digitizing aerial photographs or tax assessor's maps to obtain estimates of parcel impervious area for computation of charges. Three undertook some type of site evaluation such as field inspection or review of plans, reports, and permit files.

Current billing frequency for all 19 utilities is reported in Table 6. Typically, all user classes (grouped here as residential, commercial/industrial, and public/other) are billed with the same frequency. The most common billing frequency is monthly. For residential users, seven utilities bill only monthly, and two more bill at least some users monthly. Three bill bimonthly, two quarterly, one semiannually, and four annually. Some utilities bill residential users less frequently: Cincinnati bills residential users

[1] Portland did not report the costs of establishing the billing system (see Table 5). Additional information about original billing provided by Mr. Jack Quimby, personal communication.

annually and all others quarterly; Corvallis bills residential users bimonthly and other users monthly. Some utilities have options for users within a given class or bill subgroups within a certain classes differently (Portland, Tacoma).

Estimates of the annual billing costs per account are available for eleven utilities. While these data generally are considered accurate and of higher quality than the data for the costs of developing the billing systems, there is no consistency among utilities in accounting practices and the types of costs attributed to billing. For example, the cost in Portland may be high because the reported cost may include the cost for the wastewater bills as well, although this was not specified in Portland's response. The stormwater charges initially were, however, simply added to sanitary sewer bills.

Recognizing this limitation, the data seem to indicate a general correlation between lower costs and less frequent billing. The reported annual billing costs per account range from $1.00 (Everett) to $8.64 (Portland; Table 6). A notable exceptions is Ft. Collins, which bills all users monthly and reports a cost of only $1.00 per account per year. Four utilities report annual billing costs per account of less than $2.00. Three report costs between $2.00 and $3.00, and four report costs above $3.00.

Total annual billing costs range from $7,200 (Roseville) to $950,000 (Portland). An interesting statistic is the cost of billing as a percentage of total revenues from charges. The data show that the cost of billing can account for anywhere from 1.4% (Roseville) to 16.3% (Portland) of charges. The cost of billing apparently accounts for more than 5% of total revenues in seven of the 11 utilities for which these data are available.

Estimates of the percentage of delinquent accounts range from approximately 0.2% (Portland) to 10% (Cincinnati). Nine of the ten utilities reporting this information have delinquency rates of less than 5%.

Utility Rate Structures

A variety of information on utility rate structures is presented in Tables 7 and 8. The data show that the basic information used for estimating user charges is the same for most utilities, although the units used to assess charges and specific aspects of rate structures vary.

Stormwater utility charges typically are determined as a function of parcel size and a rate factor, which is a

Table 7. Utility Rate Structures: Basis and Units for Charges.

	Basis for Rate Factors(1)			Units for Assessing Charges				
Utility	Actual Measurement of Impervious Area	Runoff Coeff. Based on Land Use	Both Meas. & Runoff Coeff.	Equivalent Runoff Units (ERUs)	Single Family Equivalent (SFEs)	Special User Fees	Hydraulic Acreage	Percent Impervious(2)
Ann Arbor			1				1	
Auburn	1				1			
Austin (3)			1	1				
Billings			1					
Boulder			1		1			
Cincinnati		1		1				
Corvallis			1		1			
Everett			1					1
Ft. Collins			1	1				
Kent			1		1			
Louisville			1		1			
Medford			1			1		
Portland			1					1
Renton			1					1
Roseville		1			1			
Seattle			1					1
Tacoma (4)		1	1	1				
Vancouver			1		1			
Wooster			1		1			
Total	1	3	16	4	8	1	1	4

(1) Rate factors are coefficients used to relate estimated amounts of runoff per parcel to parcel charges.
(2) Includes utilities in which parcels are assigned to billing classes on the amount of impervious area.
(3) Austin was assigned to ERU category since charges are based on a rate factor times acreage.
(4) The Tacoma utility will reevaluate (i.e., measure) commercial/industrial parcels to reflect correct contributions to drainage.

Table 8. Features of Utility Rate Structures (1).

Utility	Separate Capital & O&M Charges	Onsite Manage. Credits	Flood-Plain Surcharge	Direct Drain Exempt.	Parcels Exempt From Property Tax	Land Zoned Ag.	Streets & ROW	Undev. Land	Parks	Local Gov't Parcels	State Gov't Parcels	Federal Gov't Parcels	Appeal Process	Other
	Charges for:													
Ann Arbor		1		1		1		1		1	1	1		1
Auburn		1		1		1			1	1	1	1	1	
Austin		1											1	
Billings	1			1		1		1	1		1	1	1	
Boulder		1	1	1						1	1	1		
Cincinnati		1		1	1	1			1	1	1	1	1	
Corvallis		1		1	1	1					1	1	1	
Everett		1		1	1	1	1		1	1	1	1	1	1
Ft. Collins	1	1			1	1			1	1	1	1	1	1
Kent	1	1			1		1		1	1	1	1	1	
Louisville		1			1					1	1	1	1	
Medford	1	1		1					1	1	1	1	1	
Portland	1			1	1				1	1	1	1	1	
Renton				1	1		1			1	1	1	1	
Roseville		1			1		1		1	1	1	1	1	1
Seattle		1			1	1	1		1	1	1		1	1
Tacoma		1		1	1	1		1	1	1	1	1	1	
Vancouver		1			1		1			1	1	1	1	1
Wooster		1			1	1				1	1	1	1	
Total	5	16	1	11	13	10	6	3	11	16	18	17	17	6

(1) A "1" indicates an affirmative response (i.e., that the rate structure of the utility includes the feature).

coefficient used to relate estimated amounts of runoff per parcel to parcel charges. This can be done in either of two basic ways: (1) rate factors can be derived from runoff coefficients, such as the Rational method coefficients, that are considered representative of the amount of impervious area on a parcel and are assigned on the basis of land use, or (2) rate factors can be based on parcel measurements, which can be obtained in the field or through some digitizing process.

The data in Table 7 show that 16 of the 19 utilities use a combination of the two methods (i.e., for some parcels, rate factors are assigned according to land use, while for others, charges are based on measurements of impervious area). Commercial, industrial and other nonresidential parcels typically are measured because the percentage of impervious area on individual parcels varies greatly. Residential parcels, however, usually are not measured because there is little variability in the amount of impervious area, at least among parcels under a certain size. Hence, charges for residential properties usually are standardized. Some utilities have measured statistically-determined samples of residential parcels to determine the mean impervious area with a high (95%) degree of confidence. Two utilities, Cincinnati and Roseville, apparently base charges solely on land use, while one, Auburn, apparently measures all parcels.

Although all utilities base their charges on estimates of the amount of runoff from parcels, they use a variety of units to assess or describe charges (Table 7). These are: equivalent runoff units (ERUs), single family equivalents (SFEs), special user fees, hydraulic acreage (defined below), and percent impervious. ERUs are the product of a rate factor, which has been determined from a runoff coefficient or from measurements, and parcel acreage. An ERU therefore is a measure of the amount or percentage of impervious area per parcel. An SFE is a measure of the impervious ground cover per typical single family residential (SFR) parcel. Utilities that use SFEs simply express the amount of impervious area for all parcels in terms of the amount typically found on a single family residential parcel.

Eight of the 19 utilities report using SFEs to assess charges. Some of these, however, use slightly different names (e.g., Louisville uses the term "equivalent service unit"). Four communities use ERUs. Four base charges solely on the percent of impervious area per parcel. Ann Arbor's "hydraulic acreage" is an area that is the weighted sum of runoff factors applied to the amounts of pervious and

impervious area on parcels.[1] One utility (Portland) refers to the charges as special user fees.

Features of rate structures are described in Table 8. The greatest similarity among the utilities is that almost all charge other government parcels which normally are exempt from property taxes, thus tapping new sources of revenue. Eighteen (all but Austin) impose charges of parcels owned by the respective state governments, and 17 (all but Austin and Seattle) charge federal properties. Sixteen also charge other local governments.

Almost all of the utilities have established appeal processes for users who want to contest charges; Ann Arbor and Boulder apparently are the only two exceptions. Sixteen of the 19 provide credits (i.e., reductions in fees) for properties that manage stormwater on-site. Those that did not report provisions for on-site credits are Billings, Portland, and Renton. Thirteen of the utilities report charging churches, hospitals, and other parcels typically exempt from user charges. Parcels that drain directly to receiving waters and do not make use of drainage systems are exempted from charges by eleven utilities. Eleven charge parks, and ten charge parcels zoned agricultural.

Several other features are more rare. Six charge for streets and rights-of-way, and five determine separate charges for capital improvements and operations and maintenance. Three report charging undeveloped land, while one (Boulder) surcharges properties located within floodplains. Other interesting features includes rebates or reduced rates for senior citizens, reduced rates for the portions of single family residential parcels over a certain size, special rates for large institutional users such as schools or universities, exemptions for wetlands, and exemptions for parcels providing direct benefits to the utility.

Utility Charges, Revenues and Expenditures, Debt

Utilities were asked to provide a variety of data concerning utility charges and revenues, revenues and expenditures, interagency charges, and capital outlays and debt. The financial data presented in the following tables and discussed in this subsection are for each utility's most recent fiscal year, which typically was 1986 or 1986-87.

Charges for single family residential parcels typically are

[1] In Ann Arbor, the hydrologic response factors are 0.20 for undeveloped property, 0.95 for impervious area with no retention, and 0.30 for impervious area with adequate retention.

standardized. Reported SFR charges range from $1.25 to $3.63 per month, or from $15.00 to $43.56 annually (Table 9). The lowest reported SFR charge is in Vancouver/Clark County; the higher is in Ann Arbor. Camp Dresser McKee (1986) reports, however, that charges to SFR parcels levied by the utility in Bellevue, Washington are $4.40 per month, or $52.80 annually.

Typical charges for nonresidential parcels are difficult to report because charges typically vary with intensity of development (i.e., amount of impervious area) and because data concerning typical sizes of parcels for the utilities are not available. For example, in Ann Arbor, charges for nonresidential parcels are $38.88 per hydraulic acre per quarter, where a hydraulic acre equals a hydrologic factor (see footnote 1, page 11) times parcel size. Three utilities charge nonresidential parcels by the amount (not percentage) of impervious area per parcel:

Utility	Non-Single Family Residential Monthly Charge
Louisville	$1.75 per 2500 sq. ft. of impervious area
Medford	$2.95 per 3000 sq. ft. of impervious area
Portland	$1.255 per 1000 sq. ft. of impervious area

These three charges can be equated simply by adjusting the charges in Louisville and Portland so that both are per 3000 square feet of impervious area. With this calculation, it is shown that Louisville has the lowest charge, $2.10, while Portland has the highest, $3.76.

Others determine charges for nonresidential parcels based on the intensity of development, which is calculated as the percentage of a parcel that is covered by impervious surface. Some establish classes of users based on intensity of development. With this type of billing system, the charge is determined by simply by the parcel size times the rate for each class of users. This rate schedule is used in Seattle:

Class	Impervious Surface Percentage	Rate
Residential	NA	$26.07/parcel/year
Very Light	0 - 10%	$26.07/parcel/year
Light	10 - 20%	$60.83/acre/year
Moderate	20 - 45%	$126.01/acre/year
Moderately Heavy	45 - 65%	$243.33/acre/year
Heavy	65 - 85%	$308.51/acre/year
Very Heavy	85 - 100%	$404.10/acre/year
County Roads	NA	$90.44/acre/year
State Highways	NA	$66.85/acre/year

Table 9. Utility Charges and Revenues.

Utility	Typical Monthly SFR Charge (1987)	Total Revenues from Charges (all categories)	SFR Charges as % of all Charges	Total (2) Utility Revenues	Share of all Revenue from Charges	Number of Rate Increases	Level of Increase(s) (%)
Ann Arbor	$3.63					1	44%
Auburn		$818,000		$818,000	100%	0	
Austin	$1.30	$4,440,000	62%	$4,440,000	100%	4	15%, 22%, 5%, 24%
Billings		$804,831		$854,471	94%	2	5%, 4%
Boulder	$1.67	$859,453	37%	$971,361	88%	2	40%, 20%
Cincinnati	$1.38	$3,990,000	32%	$4,174,000	96%	0	
Corvallis	$2.15		40%	$546,000		2	22%, 10%
Everett	$1.83	$1,100,000		$1,300,000	85%	0	
Ft. Collins	$2.20	$1,078,219		$1,389,345	78%	5	NR
Kent						0	
Louisville	$1.75	$8,200,000 (1)		$8,200,000	100%	0	
Medford	$2.95	$850,000		$975,000	87%	0	
Portland	$1.88		24%	$5,840,000		8	13.9%, 15.6%, 21.6%, 21.1% 3.5%, 6.2%, 11.5%, 10.3%
Renton	$2.50					0	
Roseville	$1.43	$530,000		$590,000	90%	0	
Seattle	$2.49	$7,424,926	51%	$7,635,382	97%	0	
Tacoma	$1.97	$1,821,287	40%	$1,845,923	99%	1	33%
Vancouver	$1.25	$425,111	62%	$466,576	91%	0	
Wooster	$2.90		32%	$263,288		0	

(1) Estimated by doubling reported revenues for six month period.
(2) All estimates of revenues are exclusive of debt.

Cincinnati's rate structure is similar, except that it has fewer categories for intensity of development and users (i.e., properties) are grouped into "area range" categories. The area range number times the intensity of development factor provides the number of equivalent runoff units (ERUs). There is a flat rate per equivalent runoff unit (ERU). The charge algorithm is:

area range number * intensity of development factor * rate per ERU = charge (current rate per ERU is $1.28)

Utilities that have measured the percentage of impervious area on non-single family residential parcels substitute actual impervious area in place of an intensity of development factor in an equation similar to the one above. Additional information on utility charges for nonresidential properties, including the rate schedules, is available from the Administration.

The amount of revenues generated annually from user charges by each utility is substantial, ranging from $263,288 in Wooster to a projected $8,200,000 Louisville/Jefferson County (Table 9).[1] Revenues from residential user charges account for anywhere from 24% (Portland) to 62% (Austin and Vancouver) of total revenues from charges. It was noted earlier, for the six utilities for which data are available, that developed SFR parcels accounted for between 51% and 68% of total developed acreage (Table 3). For each of these utilities, the percentage of total revenues paid by single family residential users is less than the percentage of total developed area accounted for by single family residential uses. This reflects the fact that residential parcels typically are less intensively developed that other nonresidential parcels (e.g., commercial, industrial).

Total annual revenues from all sources also are presented in Table 9 for 16 utilities. Wooster reports total revenues of $263,288, while projected revenues for the utility in Louisville/Jefferson County are $8,200,000. User fees account for most revenues for all utilities; three (Auburn, Austin, and Louisville) rely exclusively on revenues from charges. The utility with the lowest percentage of total revenues from user charges (78%) is Fort Collins.

Eight of the 19 utilities report having increased rates sometime during their existence. In many cases, the magnitude of the rate increases has been sizable, at least in relative terms. Of the 20 increases for which data are available, 15

[1] The Wooster utility did not provide a breakdown of its sources of revenues. This statement assumes all revenues in Wooster are from charges.

were greater than 10%, and seven were greater than 20%. Portland has raised rates eight times in 10 years; six of the increases have been for more than 10%. Portland's SFR rates still are less than $2.00, however, which indicates rates were very low initially. Austin has increased rates four times.

Total revenues and expenditures were reported for 17 of the 19 utilities. Breakdowns of the sources of revenue are available for 15 utilities; disaggregated expenditures are available for 12 utilities (Table 10). These data provide a "snapshot" of utility finances. They are useful because they provide a basis for crude generalizations about the sources of revenues and the functional expenditures for the utilities, and because, frankly, no better data exist. Detailed comparisons among utilities are not possible, however, because there is no consistency in accounting practices among utilities. Adjustment of reported figures to standard categories is beyond the scope of this review. Simply because accounting for revenues is easier than for costs, the data on sources and amounts of revenues is considered of higher quality.

As noted, user or service charges are the primary source of revenues for all utilities; the percentage of total revenues from user charges ranges from 78% in Ft. Collins to 100% in Auburn, Austin, and Louisville/Jefferson County. Nine utilities report earning interest on investments, making interest the second most important category of revenues overall. Five utilities report that interest is the second largest source of income; for the remaining four utilities with interest income, it is the third largest source of revenues.

Only three utilities collect regulatory fees, two collect development fees, and two receive some support from interfund transfers. One each receives revenues from special benefit assessments, state grants, and federal grants.

Utilities were asked to categorize expenditures according to eight functions (Table 10). The most striking aspect of the responses is the great variability in categorical expenditures among utilities. For example, reported administrative expenditures range from zero (Boulder, Medford) to 43% (Seattle). Similarly, reported expenditures on operations and maintenance range from 19% of total expenditures (Seattle) to 83% (Louisville).

The information in Table 11 provides a good illustration of why it is so difficult to compare administrative costs among utilities. Thirteen of the 19 utilities report reimbursing general funds for various expenditures. Boulder, which reports the zero administrative costs (Table 10), reports that

Table 10. Utility Revenues and Expenditures (for most recent fiscal year).

Operating Revenues	Ann Arbor	% of Total	Auburn(2)	% of Total	Austin(3)	% of Total	Billings	% of Total	Boulder	% of Total	Cincinnati	(4)% of Total	Corvallis(5)	% of Total	Everett	% of Total	Ft. Collins	(6)% of Total
User Charges			$818,000	100%	$4,440,000	100%	$804,831	94%	$859,453	88%	$3,990,000	96%	$421,200		$1,100,000	0.85	$1,078,219	78%
Regulatory Fees									$4,600				$7,800					
Special Benefit Assessments																		
Development Fees																	$221,638	16%
Interfund Transfers													$78,000					
Interest							$49,640	6%	$92,136	9%	$184,000	4%	$39,000				$89,488	6%
State Grants															$200,000	0.15		
Federal Grants																		
Other(1)	$656,476	100%							$15,172	2%								
Total All Sources	$656,476	100%	$818,000	100%	$4,440,000	100%	$854,471	100%	$971,361	100%	$4,174,000	100%	$546,000		$1,300,000	1.00	$1,389,345	100%

Operating Expenses	Ann Arbor	% of Total	Auburn	% of Total	Austin	% of Total	Billings	% of Total	Boulder	% of Total	Cincinnati	% of Total	Corvallis	% of Total	Everett	% of Total	Ft. Collins	% of Total
Administration			$196,320	28%	$128,000	4%	$3,500	1%			$341,600	16%						
Billing							$14,300	6%	$25,501	5%	$406,650	19%						
Planning			$163,600	23%	$160,000	5%												
Design & Engineering					$256,000	8%	$14,000	6%	$182,560	36%							$370,350	60%
O&M			$327,200	46%	$1,888,000	59%	$195,970	82%	$302,544	59%	$1,024,800	48%					$219,045	35%
Regulation & Enforcement																		
Water Quality					$96,000	3%												
Management			$24,540	3%	$640,000	20%											$30,000	5%
Other	$563,251	100%			$32,000	1%	$10,000	4%			$362,950	17%	$440,000					
Total All Functions	$563,251	100%	$711,660	100%	$3,200,000	100%	$237,770	100%	$510,605	100%	$2,136,000	100%	$440,000		NR		$619,395	100%
Capital Improvements			$106,340		$10,000,000		$456,000		$389,970		$1,235,000		$234,000				$996,220	

(1) Includes utilities (e.g., Ann Arbor) where only totals revenues (i.e., no breakdown by source) were reported.
(2) Expenditures assumed to be equal to revenues if total expenditures not reported.
(3) The $10 million capital improvement is financed by the City through the General Fund, not through the utility per se.
(4) Other expenditures include those for planning, design and engineering, regulation and enforcement, water quality management, and flood control (dam operations).
(5) Corvallis reported $234,000 in revenue from the sale of bonds which is not reported as revenue. The amount of debt was considered to be equivalent to amount of capital improvement.
(6) The design and engineering expenses for Ft. Collins may include some capital improvements.

Table 10. Utility Revenues and Expenditures (for most recent fiscal year; continued).

Operating Revenues	Kent	% of Total	Louisville	% of Total	Medford	% of Total	Portland	% of Total	Renton	% of Total	Roseville	% of Total	Seattle	% of Total	Tacoma	% of Total	Vancouver	% of Total	Wooster	% of Total
User Charges			$8,200,000	100%	$850,000	87%	$5,800,000	99%			$530,000	90%	$7,424,926	97%	$1,821,287	99%	$425,111	91%		
Regulatory Fees							$40,000	1%												
Special Benefit Assessments					$60,000	6%														
Development Fees																	$34,754	7%		
Interfund Transfers													$210,456	3%						
Interest					$65,000	7%					$20,000	3%			$24,636	1%	$6,722	1%		
State Grants																				
Federal Grants											$40,000	7%								
Other																			$263,288	100%
Total All Sources	NR		$8,200,000	100%	$975,000	100%	$5,840,000	100%			$590,000	100%	$7,635,382	100%	$1,845,923	100%	$466,587	100%	$263,288	100%

Operating Expenses	Kent	% of Total	Louisville	% of Total	Medford(1)	% of Total	Portland	% of Total	Renton	% of Total	Roseville	% of Total	Seattle	% of Total	Tacoma	% of Total	Vancouver	% of Total	Wooster	% of Total
Administration											$24,500	7%	$2,940,420	43%	$191,222	11%	$44,263	17%		
Billing					$50,000	13%					$7,000	2%	$651,889	10%	$124,619	7%	$39,850	15%		
Planning											$106,200	28%	$1,370,147	20%						
Design & Engineering			$892,000	17%	$150,000	38%					$17,700	5%	$159,195	2%	$100,213	6%	$36,982	14%		
O&M			$4,308,000	83%	$200,000	50%					$207,200	55%	$1,279,694	19%	$731,167	41%	$79,842	31%		
Regulation & Enforcement													$397,998	6%	$75,000	4%				
Water Quality Management											$11,800	3%			$100,000	6%	$51,666	20%		
Other															$472,182	26%	$8,188	3%	$117,066	100%
Total All Functions	NR		$5,200,000	100%	$400,000	100%	NR		NR		$374,400	100%	$6,799,343	100%	$1,794,403	100%	$259,791	100%	$117,066	100%
Capital Improvements			$892,000		$500,000		$2,000,000				$215,600		$1,879,900		$224,434		$181,469			

(1) Medford expenses for O&M ($200,000) include administrative expenses.

Table 11. Interagency Charges.

Utility	Utility Reimburses General Fund	Explanation of Interagency Charges
Ann Arbor		
Auburn	Y	billing & other departmental charges
Austin	N	
Billings	Y	administration, billing, engineering, maintenance
Boulder	N	
Cincinnati	Y	annual General Fund overhead charge ($25,000)
Corvallis	Y	administrative expenses
Everett		
Ft. Collins	Y	transfer for Finance, City Attorney
Kent	Y	
Louisville	Y	direct costs plus allotted indirect costs
Medford	Y	wages, overhead, money management
Portland	Y	
Renton	Y	
Roseville	Y	
Seattle	N	
Tacoma	N	
Vancouver	Y	general overhead
Wooster	Y	engineering, finance, legal

Thirteen of the 19 utilities report reimbursing the General Fund for direct and indirect expenses.

it simply is not charged for them. The most common types of interagency charges are those for billing, legal assistance, and miscellaneous overhead expenses. Two utilities report reimbursing the general fund for engineering. The use of these charges creates the potential for overstating or understating actual utility charges. Without detailed analysis of individual programs, it is impossible to describe these and their impacts on total utility expenditures precisely. The only reasonable conclusion is that major differences in the percentages of total revenues spent on particular functions may reflect differences in accounting practices, not differences in the ways that the utilities function.

Eight utilities reported costs of billing (Table 10). Billing costs as a percentage of total expenditures (excluding capital expenditures) range from 2% (Roseville) to 19% (Cincinnati). These percentages differ from the cost of billing as a percentage of total revenues (see Table 6) because expenditures and revenues typically are not equal.

Six utilities reported expenditures for water quality management programs ranging from 3% (Auburn, Roseville) to 20% (Austin, Vancouver/Clark County). Because water quality management activities (e.g., stream monitoring) can be separated more easily than activities such as design and engineering (which sometimes are included with capital expenditures), these estimates might be more comparable. Twenty percent seems likely to be a maximum that any utility spends on water quality programs.

For every utility for which data are available, operating revenues are greater than operating expenses. The excess of revenues over operating expenses typically is used for capital improvements, which in many cases are significant. Data on total expenditures for capital improvements are available for 14 utilities, although no data are available concerning the number or type of capital projects undertaken. Costs range from $106,000 (Auburn) to $10,000,000 (Austin). Because capital costs can vary dramatically from year-to-year, these figures should be regarded only as indicative of the magnitudes of utility capital improvement programs.

Table 12 includes additional information on capital outlays and debt. Eight of the utilities (42%) report borrowing to finance capital improvements. Total utility debt ranges from $58,883 (Boulder) to $4,935,000 (Tacoma).[1] The utilities use a variety of sources of funds or debt instruments to finance

[1] The City of Austin, not the Austin stormwater utility per se, has issued $10,000,000 of general obligation bonds to finance drainage improvements and stormwater controls for each of the past five years.

Table 12. Capital Outlays and Utility Debt.

Utility	Year Funds Last Borrowed	Source of Funds or Debt Instrument	Interest Rate	Present Total Utility Debt	Sources of Funds for Capital Outlay (Numbers reported are for the utility's most recent fiscal year. Borrowing	Grants	Previous Year's Surplus	Pay as You go	Other
Ann Arbor									
Auburn									$106,340
Austin(1)					$10,000,000				
Billings	NR	SID Bonds	10%				$455,000		
Boulder				$58,883				$395,000	
Cincinnati								$1,235,000	
Corvallis	1986	General Obligation Bonds	9%		$234,000				
Everett									
Ft. Collins							$298,354	$690,614	
Kent	NR	Revenue Bonds	NR						
Louisville								$892,000	
Medford								$500,000	
Portland(2)	1985	Revenue Bonds	8.7%	$2,000,000					
Renton									
Roseville								$216,500	
Seattle	1987	Trust Fund	1%	$1,500,000				$1,879,900	
Tacoma	1979	Revenue Bonds	6.1%	$4,935,000				$224,434	
Vancouver	1985	General Fund						$117,469	
Wooster	1980	Special Assessment	6.9%	$117,066					

(1) The City of Austin, not the utility per se, issues GO bonds.
(2) The outstanding present debt ($2 million) is the approximate share of the total debt of the utility which also is responsible for sanitary sewers.

improvements. Three utilities used revenue bonds, and one each used the following sources: general obligation bonds, system improvement/development bonds, special assessments, the general fund, and a trust fund. Interest rates paid range from 1% on money borrowed from a special trust fund in Seattle to 10% for SID bonds in Billings.

The most common method of financing capital improvements appears to be pay-as-you-go. Nine of the utilities report financing capital improvements in this way. Three of these utilities, however, also report some debt, which shows that they have borrowed in the past. One utility reported previous year's surplus as the only source of revenues for capital improvements.

Utility Inspection and Maintenance Practices

Utilities were asked a number of questions concerning inspection and maintenance of stormwater management facilities. The data collected includes responsibility for maintenance, frequency of inspection of private facilities, methods of projecting maintenance costs, and contracting practices for various maintenance activities.

The American Public Works Association (APWA (1981) has concluded that "there appears to be a preference for and a trend towards public ownership" of facilities and that "unless basins are maintained by public agencies, long term adequate maintenance cannot be assured." Though the data for utilities are limited and there is no information on trends among the utilities, the data are not necessarily consistent with these conclusions. In 13 of the 19 utilities, responsibility for maintenance of new stormwater management facilities is shared among the private and public sectors (Table 13). Four utilities (Billings, Cincinnati, Corvallis, Kent) reported that public agencies are responsible for maintaining new facilities, while two (Ann Arbor, Renton) reported that new facilities are maintained in the private sector.[1]

For nine utilities, the criterion for determining whether new facilities will be maintained in the public sector or private sector is simple and straightforward: facilities on public property are maintained by public entities; facilities on private property are maintained by private entities. For three utilities (Austin, Everett, Seattle), responsibility for maintenance is determined by the land use served by the facility: facilities that serve residential properties are

[1] It is not clear whether the utility in Cincinnati maintains all new facilities; it was reported that the utility maintains them, but that the criterion for maintenance is only facilities on public property.

Table 13. Inspection and Maintenance of Stormwater Facilities.

Utility	New Facilities: Public Main.	New Facilities: Private Main.	Criteria for Public/Private Maintenance (1)	Regulations Specify Inspection Frequency (private fac.)	Actual Frequency of Inspection of Private Facilities: Once/ Year	Once/ Year if Time	Only if Complaints	Not Inspected by Utility
Ann Arbor		Y		N			1	
Auburn	Y	Y	A	N				
Austin	Y	Y	B,C,D	Y (yearly)		1		
Billings	Y							
Boulder	Y	Y	A	N		1		
Cincinnati	Y		A	N			1	
Corvallis	Y			N			1	
Everett	Y	Y	B	N			1	
Ft. Collins	Y	Y		N				
Kent	Y							
Louisville	Y	Y		N		1		
Medford	Y	Y	A	N			1	
Portland	Y	Y	A	N			1	
Renton		Y		N			1	
Roseville	Y	Y	A	N			1	
Seattle	Y	Y	B	Y (yearly)				
Tacoma	Y	Y	A	N		1		
Vancouver	Y	Y	A	N			1	
Wooster	Y	Y	A	N				1
Total					0	4	9	1

(1) The key for the entries is:
A = facilities on public property maintained by utility; facilities on private property maintained by private entity
B = SFR maintained by utility; comm./ind. maintained by private entity
C = utility maintains water quality structures
D = utility removes sediments from drainage areas

maintained by the utility; facilities that serve commercial, industrial, or other nonresidential facilities are maintained privately. The Austin utility has an additional criterion for establishing maintenance responsibility: the utility maintains any facility constructed primarily for purposes of water quality management. The Austin utility also is responsible for removal of sediments from drainage areas.

Although 15 of the utilities report having responsibility for regulation and enforcement (Table 2), only two (Austin and Seattle) report that local regulations specify how frequently private facilities shall be inspected (Table 13). These utilities both are required to make annual inspections. Both, however, make these inspections only if time is available. In addition to the Austin and Seattle utilities, utilities in Louisville and Tacoma also inspect facilities annually if time is available. Nine utilities, almost half of the sample, report that private facilities are inspected only in response to complaints. Two of these (Everett, Vancouver), however, do not have responsibility for regulation and enforcement. One utility (Wooster) reported that it does not inspect private facilities.

The methods used by utilities to estimate annual costs of maintenance appear to be straightforward. Eleven of the utilities project maintenance costs simply from historical records (Table 14). Only four (Austin, Cincinnati, Ft. Collins, Seattle) project costs from unit cost estimates for particular types of activities. One (Everett) inspects facilities to estimate costs.

Grigg (1986) identifies three levels of maintenance for stormwater facilities: routine, restoration, and rehabilitation. Utilities were asked to specify whether each of these were done in-house or by contractors (Table 14). Seventeen do routine maintenance in-house, 12 exclusively; five also contract for assistance with routine maintenance. Sixteen utilities do restorative maintenance in house; six exclusively. Ten utilities also contract for assistance with restorative maintenance; thus, contracting is more common than for routine maintenance. One utility (Ann Arbor) contracts for all restorative maintenance. Contacting is more common for rehabilitative maintenance than for any other type. Thirteen utilities both contract for and do rehabilitative projects in house. Two do all rehabilitation in house (Auburn, Portland). Auburn and Portland are the only utilities that do all work, including rehabilitation in house.

The basic criteria for contracting are the scope and complexity of the needed work, whether staff has the necessary expertise, whether the utility has the necessary equipment, and the cost of the work. In Tacoma, the utility is required to

Table 14. Maintenance Costs and Contracting Practices (1).

Utility	Basis for Projecting Maintenance Costs				Maintenance Activities and Contracting					
					Routine		Restoration		Rehabilitation	
	Historical Records	Unit Cost Estimates	As percent of Capital Investment	Other	In House	Contract	In House	Contract	In House	Contract
Ann Arbor					1			1		1
Auburn					1		1		1	
Austin		1			1		1		1	1
Billings					1		1		1	1
Boulder	1				1	1	1	1	1	1
Cincinnati		1			1		1	1	1	1
Corvallis	1				1		1		1	1
Everett				1 (inspections)						
Ft. Collins	1	1			1	1	1	1	1	1
Kent					1	1	1	1	1	1
Louisville	1									
Medford	1				1	1	1	1	1	1
Portland	1				1		1		1	
Renton	1				1		1	1	1	1
Roseville	1				1		1	1		1
Seattle		1			1	1	1	1	1	1
Tacoma	1				1		1	1	1	1
Vancouver	1				1		1	1	1	1
Wooster	1				1		1		1	1
Total	11	4	0	1	17	5	16	11	15	15

(1) A "1" indicates an affirmative response.

contract for all work valued over $10,000.

Public Relations and Implementation

Table 15 includes information on public relations programs conducted by communities prior to the formation of utilities. Sixteen of the utilities report undertaking public relations programs. The most common component of a program was public meetings; these were held in 14 communities. Eleven utilities each prepared slide shows and mailed informational brochures to city residents. Initiatives to establish utilities were supported by existing citizen's groups in seven communities, six communities created formal citizen's advisory boards, and six retained consultants to assist with the public relations efforts. Communities also reported purchasing advertisements in newspapers and on radio and television.

Respondents were asked to rank their promotional campaigns on a scale ranging from not helpful at all to critical to successful implementation. Three respondents did not respond to this question; it is not known whether public information programs were undertaken in these communities. None said the programs were not helpful, although the representative from the Everett utility reported that mailing sample bills to residents was a "disaster." Two ranked their informational programs as somewhat helpful. Five utilities reported their programs as helpful, five as very helpful, and four as critical to successful implementation of the utility.

Experts in survey research argue that asking people to rank the effectiveness of an aspect of their own work does not provide really useful information because there is such a great potential for bias in responses. These data, therefore, are useful mostly in a relative sense. They indicate that there is some variance in the way people view the effectiveness of their work. While some respondents ranked public relations programs as critical, and many respondents stressed their importance, perhaps as many as three did not even undertake programs, and programs were only somewhat helpful in two others. The only conclusions that are possible are that public information programs are usually undertaken, generally helpful, but not essential in all cases.

Reasons for and Opposition to Utilities

Information on reasons for formation of the utilities and whether people opposed the utilities is presented in Table 16. The data indicate that most utilities were formed to fund operations and maintenance and flood control programs

Table 15. Public Relations and Implementation (1).

Utility	PR Program	Program Effective(2)	Hired Consultant	Public Meetings	Slide Show	Mailed Brochures	Sample Bills to Residents	Help from Citizen's Groups	Created Citizens Advisory Board	Other
	Aspects of Public Relations Programs									
Ann Arbor										
Auburn	1	D		1	1	1			1	
Austin	1	B		1						1 (newspaper ads)
Billings										
Boulder	1	E		1	1	1		1		
Cincinnati	1	E		1	1	1	1	1		
Corvallis	1	C	1	1						
Everett	1	E	1	1	1		1	1	1	1 (newspaper ads)
Ft. Collins	1	C		1	1	1				
Kent	1	D	1	1	1	1			1	
Louisville	1	D	1	1	1	1		1	1	
Medford	1	D	1	1	1	1	1	1		
Portland	N									
Renton	1	B		1			1			
Roseville	1	D		1	1	1				1 (newspaper articles)
Seattle	1	E	1	1	1	1	1	1	1	
Tacoma	1	C		1		1				1 (news., radio, TV)
Vancouver	1	C			1	1		1	1	
Wooster	1	C								
Total	16		6	14	11	11	5	7	6	4

(1) A "1" indicates an affirmative response (i.e., the utility performed the particular activity).
(2) Letters indicate the following responses:
(The numbers in parentheses refer to the number of utilities with the particular response.
A = Not helpful at all (0)
B = Somewhat helpful (2)
C = Helpful (5)
D = Very Helpful (5)
E = Critical to successful implementation (4)

Table 16. Reasons Formed, Opposition to, and Success of Utilities (1).

Utility	Reasons Utility Formed: Fund Flood Control Programs	Fund Water Quality Programs	Fund O&M	Other(2)	Special Circumstance for Utility	Utility Opposed	Legal Challenge to Utility	Effectiveness of Utility
Ann Arbor			1					
Auburn	1	1	1			1		successful
Austin		1	1		severe flood			somewhat successful
Billings	1		1				1	very successful
Boulder	1		1		front-range flooding			successful
Cincinnati	1		1		two 100 yr. storms in four months			very successful
Corvallis			1			1		successful
Everett	1	1	1			1		
Ft. Collins	1		1		effect of flood			successful
Kent	1							very successful
Louisville	1	1	1			1	1	
Medford	1		1					very successful
Portland				1				successful
Renton	1	1	1					successful
Roseville	1	1	1	1				very successful
Seattle	1	1	1		rapid dev. & flooding; water qual.	1		successful
Tacoma	1		1			1	1	very successful
Vancouver		1			water quality	1	1	somewhat successful
Wooster	1				severe flood	1	1	very successful
Total	14	8	15	2		8	5	

(1) A "1" indicates an affirmative response.
(2) Other reasons cited include (a) utility fees are more fair than taxes (Roseville), and (b) to separate storm sewer costs from sanitary sewer costs (Portland).

and that funding of water quality programs has not been as important. Fifteen of the utilities identified funding of O&M as a reason for formation; 14 identified funding for flood control programs. Eight cited the need for funding for water quality programs as a reason for formation. Two of these (Kent, Wooster) cited funding of flood control programs exclusively, two (Ann Arbor, Corvallis) cited O&M exclusively, and only one (Vancouver) cited water quality exclusively. The respondent from Roseville reported that one reason for implementation was that utility charges were more fair than property taxes. The respondent from Portland said that a reason for formation was to separate storm sewer costs from sanitary sewer costs.

Six respondents cited severe flooding as special circumstances that led to formation of the utility. Two cited concern over poor water quality.

Eight respondents said that there was organized opposition to the utility from citizen's or taxpayers organizations. Legal actions have resulted in at least five communities. Four suits were brought by groups opposing the formation of a utility; one suit was initiated by the City of Wooster against a the owner of a large mall who refused to pay. The Wooster case still is in court. In Billings, owners of vacant properties challenged the imposition of charges on undeveloped land and won refunds and exemptions until properties have been improved. In Vancouver/Clark County, the utility was challenged on the basis of whether it provided direct benefits to property owners; the utility was upheld in the Washington Supreme Court. In Tacoma, the Washington Department of Transportation (WDOT) sued to prevent charges from being levied on freeways. Although WDOT won the case, the state legislature subsequently changed the law to allow charges. The utility in Louisville/Jefferson County also has been challenged, but no decision has been reached.

Representatives of utilities also were asked to rank their effectiveness on a scale with the choices: not successful, somewhat successful, successful, very successful. Again, the data are of limited usefulness for the reasons noted above (i.e., potential for bias). The responses do not show much variability: seven respondents each ranked their utilities successful and very successful; only two ranked the utility as somewhat successful. None considered the utilities not successful.

APPENDIX A

3.0 LITERATURE CITED

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UPDATE TO A SURVEY OF STORMWATER UTILITIES

AUGUST, 1990

Prepared by:

Greg Lindsey

MARYLAND DEPARTMENT OF THE ENVIRONMENT
SEDIMENT AND STORMWATER ADMINISTRATION
2500 BROENING HIGHWAY
BALTIMORE, MARYLAND 21218

(301) 631-3553

UPDATE TO A SURVEY OF STORMWATER UTILITIES

August 1990

Background

The Maryland Department of Environment (MDE), Sediment and Stormwater Administration (SSA) surveyed 25 stormwater utilities in September 1987 for detailed information about their operations that could be used to advise local governments in Maryland interested in establishing utilities to finance stormwater programs. State officials conducted the survey because of concern that inadequate financing of stormwater programs, including maintenance of stormwater facilities, is a major obstacle to achievement of stormwater management objectives. The results of the 1987 survey are included in the attached paper, A Survey of Stormwater Utilities.

1990 Survey Update

The SSA surveyed the same utilities by telephone in June, 1990 to update information related to utility charges. SSA staff collected data about current charges to single family homeowners, total utility revenues from charges, total utility revenues, and number of accounts. These data are presented in Table 1.

Typical monthly charges for single family residences (SFR) currently range from a low a $1.07 per month in Roseville, Minnesota to a high of $7.45 per month in Bellevue, Washington. These monthly charges are equivalent to annual charges, respectively, of $12.84 and $89.40 per homeowner per year. The median typical SFR charge currently is $2.15 per month ($25.80 annually). Twelve of the 21 utilities for which data are available (57%) charge more than $2.00 per month ($24 annually).

Total annual utility revenues from charges range from $75,000 to almost $10.5 million. Excluding Montpelier (which collects $75,000 annually in charges), the lowest sum of charges collected is $482,500 in Vancouver, Washington. Fourteen of 20 utilities reported revenues from user charges exceeding $1,000,000 annually. The percentage of total user charges paid by single family residences ranged from a low of 15% in Auburn to a high of 78% in Montpelier.

Utilities rely on revenues for user charges almost exclusively. Revenues from user charges account for 100% of total revenues in 13 utilities. Among all utilities, the lowest percentage of total revenues from user charges is 82%.

Comparisons with 1987 Survey

The 1990 data (Table 1) can be compared with 1987 data (see page 22 in the attached report) to determine trends and changes in utility charges and revenues during the past three years. Seven utilities increased charges to single family homeowners during the past three years (Ann Arbor, Bellevue, Boulder, Portland, Seattle, Tacoma, Vancouver). The magnitude of the increases ranged from a low of 6% (from $2.49 to $2.64 in Seattle) to a high of 141% (from $1.67 to $4.03 in Boulder). The 1990 data, coupled with historic data collected in 1987 (see page 22), indicate that utilities are able to increase charges over time.

Table 1

UTILITY CHARGES AND REVENUES (1)

UTILITY	NUMBER OF ACCOUNTS	TYPICAL MONTHLY SFR (2) CHARGE	UTILITY REVENUES FROM CHARGES	SFR CHARGES AS % OF CHARGES	TOTAL UTILITY REVENUES	CHARGES AS % OF TOTAL UTILITY REVENUES
Ann Arbor	21,175	$1.52	$932,244	NA	$932,244	100%
Auburn	7,000	$2.00	$820,000	15%	$820,000	100%
Austin	203,000	$1.30	$4,300,000	63%	$4,300,000	100%
Bellevue	24,000	$7.45	$4,100,000	46%	$4,100,000	100%
Billings	26,000	$1.74	$1,302,815	NA	$1,302,815	100%
Boulder	25,000	$4.03	$1,536,000	NA	$1,536,000	100%
Cincinnati	100,000	$1.28	$4,300,000	NA	$4,480,000	95%
Corvallis	11,000	$2.15	$560,000	50%	$560,000	100%
Everett	60,000	$1.83	$1,925,000	NA	$1,925,000	100%
Ft. Collins	25,000	$1.80	$4,600,000	NA	$4,750,000	96%
Kent	6,000	$2.50	$2,500,000	NA	$2,500,000	100%
Louisville	184,571	$1.75	$8,200,000	NA	$8,337,000	93%
Medford	15,600	$2.95	$1,200,000	NA	$1,460,000	82%
Montpelier	1,700	$3.00	$75,000	78%	$75,000	100%
Portland	157,370	$3.45	$10,471,000	37%	$10,471,000	100%
Renton	10,282	$2.50	$1,200,000	21%	$1,200,000	100%
Roseville	10,000	$1.07	$532,342	NA	$594,257	89%
Seattle	178,000	$2.64	$8,500,000	50%	$8,700,000	97%
Tacoma	62,450	$2.30	$2,231,400	NA	$2,400,000	92%
Vancouver	21,000	$1.40	$482,500	NA	$482,500	100%
Wooster	NA	$2.90	NA	NA	NA	NA

(1) Results of SSA telephone survey conducted in June, 1990.
(2) SFR=Single Family Residential

Seven utilities held charges to single family homeowners constant (Austin, Corvallis, Everett, Louisville, Medford, Renton, and Wooster). Two utilities (Ft. Collins, Cincinnati) apparently decreased typical charges slightly.

The median charge for SFR properties in 1990 ($2.15 per month; $25.80 annually) increased from $1.88 per month ($22.56 annually) in 1987. In 1987, seven of 17 utilities charged homeowners $2.00 or more per month, and only one utility reported charges more than $3.00 per month.[1] By 1990, 12 of 21 utilities reported charges to single family residences in excess of $2.00 per month; four utilities reported charges exceeding $3.00 per month. One experienced stormwater manager suggested in 1986 that there may be a "psychological ceiling" on fees greater than $3.00 per month.[2] While one could infer from the 1990 data that fees greater than $3.00 per month will be accepted, most fees remain below this level.

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[1]In 1987, the only utility known to be charging single family residences $3.00 or more per month was the Bellevue utility. The charge for SFR properties reported in the 1987 survey for Ann Arbor ($3.63; see page 22) actually was a quarterly charge, not a monthly charge.

[2]Cyre, Hector J. September 23, 1986. "Developing and Implementing a Stormwater Management Utility." International Public Works Congress and Equipment Show, New Orleans, LA.
Also see discussion in Lindsey, Greg. August, 1988. Financing Stormwater Management: The Utility Approach. Maryland Department of the Environment, Sediment and Stormwater Administration, Baltimore, Maryland 21224, p. 38.