

Howard County Bureau of Utilities



Sewer Surcharge Study Phase II



Final Report

Black & Veatch
Enterprise Management Solutions
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BACKGROUND

All recipients of U.S. EPA Construction Grants are required, as a condition of grant acceptance, to implement a User Charge system which, if appropriate, can incorporate a High Strength Surcharge to be applied to dischargers who discharge higher than normal strength effluent. In order to meet that requirement, Howard County developed a methodology for determining the cost of removing BOD, TSS and TP (see Appendix A- acronyms) in the early 1980's. In the mid 1980's this methodology was implemented for Food Service Establishments (FSEs). Since that time there have been multiple upgrades to the County's Little Patuxent Water Reclamation Plant (LPWRP) and a dramatic increase in the number of FSEs.

Not only have the number of FSEs increased, but their variety has as well. The issue of how to reasonably classify and charge FSEs for any above average strengths that they may contribute to a system is being evaluated by many sewer systems and is the focus of Phase II of this study.

SCOPE OF SERVICES

In recognition of the changes to LPWRP and the increases in FSEs, the County issued an RFP in August 2005 for a Sewer Surcharge Study with the following objectives:

Methodology for Determining Treatment Costs for BOD, TSS, TP, TN and FOG

- Identify alternative methodologies for determining treatment costs for BOD, TSS, TP, TN and FOG
- Discuss advantages and disadvantages for each
- Recommend the best cost allocation methodology for recovering the cost of treating these strength parameters
- Evaluate laboratory analysis and LPWRP data for O&M and capital costs and identify any additional information needed
- Develop an Excel spreadsheet for calculating treatment costs based on the recommended methodology

Methodology for Calculating Surcharges for FSEs

- Identify alternative methodologies for calculating surcharges for FSEs
- Discuss advantages and disadvantages for each
- Recommend the best surcharge methodology
- Develop an Excel spreadsheet for calculating surcharges for FSEs

Final Report

- A final report consisting of a hard copy and a Compact disc shall be submitted at the completion of the study

PROPOSED METHODOLOGY

In October 2005, Black & Veatch Corporation (B&V) was selected to perform the study for Howard County. B&V proposed a six task effort in two phases and one additional optional task:

Phase I

- High Strength Surcharge Rate policy Review and Data Collection
- Develop Methodology to Allocate Treatment Costs to BOD, TSS, TP, TN & FOG

Phase II

- Define average residential or domestic strength (addressed in the Phase I Report, included in Appendix C)
- Define protocols for characterization of FSE strengths
- Develop methodology to calculate surcharges for FSE customers on shared meters
- Project meetings and administration

Optional Task

- Implementation assistance

During negotiations, Howard County accepted responsibility for determining the allocation of treatment plant costs to strength cost components and laboratory testing protocols for the sampling data.

In July 2006, B&V submitted a Final Report for the Phase I studies. This Final Report on the Phase II studies is a complementary report to the Phase I report.

FINDINGS

Methodology

There are two primary approaches to meeting the high strength surcharge requirements of the Clean Water Act – 1) the “quantity/quality” approach in which users are charged the actual costs of removing or treating each effluent component (resulting in separate charges for volume, BOD, TSS etc.) and 2) the “surcharge limit” approach in which high strength surcharges are applied only to high strength components above a defined “floor” concentration (some systems use “typical” residential strength concentrations as a basis for establishing the floor concentrations). B&V recommends that the surcharge methodology be used since it is consistent with the previous methodology used by the County and the majority of utilities surveyed by the National Association of Clean Water Agencies that apply extra strength surcharges use the same methodology.

Phase II of the Sewer Surcharge Study addresses the identification of the wastewater strengths associated with FSEs, the classification of these customers, and the basis to charge them for extra strength contributions to the Little Patuxent Water Reclamation Plant. After completion of Phase I of the study, which established a new methodology for calculating extra strength sewer surcharges, discussions were held with County staff to discuss the direction of the Phase II studies. It was decided that the focus of Phase II would transition from developing a methodology for calculating FSE surcharge rates to the classification of FSE customers and the determination of “typical” standard strengths for the FSE customer types.

The process of evaluating FSE customer classifications and strength determination consisted of:

- Review of national approaches to handling FSEs
- Review of local approaches to handling FSEs
- County initiation of FSE wastewater sampling
- Categorization of FSEs
- Characterization of FSE category strengths
- Allocating flow between FSE customers on shared meters for property owners
- Incentives for grease traps

National Approaches to Handling FSEs

Many utilities address high strength surcharges for FSEs by assuming average wastewater loading strengths. Rarely do utilities address the issue by actually taking wastewater samples to assign individual wastewater loading strengths to each FSE account. This approach is often impractical unless the number of FSEs is relatively small. Some utilities may use sampling to develop a standard average overall strength for a select group of commercial enterprise types, including FSEs. We have discovered at least one instance in which a utility has developed a separate customer class volume rate for FSEs (presumably reflecting their overall assumed strength characteristics). In summary, utilities take the following approaches to address high strength surcharges for FSEs:

- Simply assume strengths
- Base strengths on actual individual customer wastewater strength data
- Base strengths on a sampling of customer wastewater strength data for a customer class

Local Approaches to Handling FSEs

Black & Veatch also sought to determine how local utilities address FSEs. Surprisingly, not many utilities in the Washington, DC metropolitan area specifically address the high strength surcharges associated with FSEs, other than through FOG reduction programs. However, we did find that Anne Arundel County directly addressed surcharges for FSEs by establishing three (3) surcharge categories (along with standard average wastewater loadings for each category):

- Full Service Restaurant
- Fast Food Restaurant
- Miscellaneous Food Preparation

Obtain FSE Wastewater Samples

The County selected FSEs from which to obtain wastewater samples to help categorize them and characterize their wastewater strength contributions. The County obtained wastewater samples from 28 FSEs, ranging from fast food restaurants to supermarkets to the cafeterias in assisted living facilities. Each sample was tested for the following wastewater load strengths (the detailed sampling results are provided in Appendix C):

- BOD
- TSS
- TP
- TN
- FOG

Classification of FSEs

There are many approaches to classifying commercial sewer customers. Some of the more common classifications are base-extra strength (the County's approach), strength-based (low, medium, high), identified industries (hotels, restaurants, beverage makers, commercial laundries, etc.), or a hybrid involving some combination of the three.

Commercial Customer Classification Approaches:

- **Base-Extra Strength** – A base loading is estimated (generally based on assumed normal residential strengths) and those commercial and industrial customers with measured or assigned strengths exceeding that base figure are assigned an extra-strength surcharge.
- **Strength-Based** – Commercial customers are classified as having a low, medium or high strength based on a range determined by assumed industry standards or by actual customer strength samples.
- **Identified Industries** – Commercial customers who are believed or known to produce higher than average strengths can be grouped by industry category, such as hotels or restaurants.
- **Hybrid** – Any combination of two or more of the preceding classification approaches

Howard County currently combines a base-extra strength approach with identified categories (e.g., food service establishments).

Howard County Department of Health FSE Categorization

The Howard County Department of Health (DOH) was contacted to determine the manner in which it categorized FSEs and to determine if there was a formal mechanism or process within DOH that would allow Utilities to know when an FSE was coming into the County. DOH has a system for categorizing FSEs. However, the four categories used by DOH are not based on the strength characteristics of FSE wastewater. Rather, they are categorized based on health risk posed by the type of operation. The FSE categorizations proposed in this report will be easier to apply than those utilized by DOH. Also, at the time of the study, DOH did not have a formal process or mechanism that would notify or allow Utilities to determine when a new FSE was coming into the County.

FSE Categorization Based on Sampling Data

The results of the FSE wastewater sampling formed the basis for the proposed categorization of FSE customer types. Four of the existing FSE surcharge categories were maintained and two categories were revised as shown in the Table 1 on the following page:

Table 1 – FSE Categories

Current FSE Categories	Proposed FSE Categories
<ul style="list-style-type: none">• Full Service Restaurant	<ul style="list-style-type: none">• Full Service Restaurant
<ul style="list-style-type: none">• Fast Food Restaurant	<ul style="list-style-type: none">• Fast Food Restaurant
<ul style="list-style-type: none">• Non-Surchargeable	<ul style="list-style-type: none">• Grocery with Food Preparation
<ul style="list-style-type: none">• In-House Food Service	<ul style="list-style-type: none">• In-House Food Service
<ul style="list-style-type: none">• Baked Goods	<ul style="list-style-type: none">• Baked Goods
<ul style="list-style-type: none">• Intermittent Food Service	<ul style="list-style-type: none">• Shared Meters

The two revised categories of FSE are defined as follows (definitions for all six categories are provided in Appendix B):

Grocery with Food Preparation

This category represents the FSEs that were essentially listed as non-surchargeable food service. It encompasses the various grocers, delis and supermarkets that prepare food. Sampling data suggests that their wastewater significantly exceeds floor concentrations established by the County.

Shared Meters

This category essentially comprises malls that have FSEs as tenants and share a common water meter. Most major indoor malls contain comprehensive food courts and other types of FSEs intermingled among the other stores. Many outdoor strip malls also contain FSEs, especially fast food restaurants. However, the owner of the mall receives the bill for sewer service with all tenants sharing a common meter. These types of enterprises can be significant contributors of excess wastewater loading, especially during various holiday periods. Black & Veatch conducted some research into how other systems address the issue of shared meters. We found that they basically do not address the issue specifically. EPA staff were also contacted regarding how to address sewer surcharges for customers of shared meters. Sampling data suggests that the wastewater loading for malls using shared meters can significantly exceed floor concentrations established by the County.

Characterization of Food Service Establishment Strengths

Many utilities instituted wastewater classification systems as a means to determine which commercial and industrial customers should be charged for contributing above domestic strength wastewater to their sewer systems. For some progressive utilities, the emphasis over time has shifted from merely recovering the costs associated with treating the high strength wastewater loadings to actually reducing the introduction of high strength wastewater into their systems.

That approach can alleviate some of the problems related to maintaining the collection system and enhances the optimal operation of the wastewater treatment plants.

As progressive utilities expanded the classification of sewer surcharge customers, they began to rely upon wastewater characterization studies and/or actual customer sampling and analysis to more accurately identify, aggregate and charge high strength customers. Tables 2 through 4 show how some other utilities have characterized the wastewater strength of their FSEs.

Table 2 – Other Utility Characterizations of BOD (mg/l)

Category	Los Angeles	Salem, OR	Anne Arundel County, MD	Lower Colorado River Authority	Texas Study
Full Service Restaurant	1,000	1,000	1,100	818	1,523
Fast Food Restaurant	1,000	1,000	1,540	818	1,523
Grocery with Food Preparation	-	800	2,180	-	-
In-House Food Service	-	-	-	-	-
Baked Goods	1,000	825	-	-	-
Shared Meters	-	-	-	-	-

Table 3 – Other Utility Characterizations of TSS (mg/l)

Category	Los Angeles	Salem, OR	Anne Arundel County, MD	Lower Colorado River Authority	Texas Study
Full Service Restaurant	600	600	430	219	664
Fast Food Restaurant	600	600	600	219	664
Grocery with Food Preparation	-	800	1,030	-	-
In-House Food Service	-	-	-	-	-
Baked Goods	600	470	-	-	-
Shared Meters	-	-	-	-	-

Table 4 – Other Utility Characterizations of FOG (mg/l)

Category	Los Angeles	Salem, OR	Anne Arundel County, MD	Lower Colorado River Authority	Texas Study
Full Service Restaurant	-	-	-	148	197
Fast Food Restaurant	-	-	-	148	197
Grocery with Food Preparation	-	-	-	-	-
In-House Food Service	-	-	-	-	-
Baked Goods	-	-	-	-	-
Shared Meters	-	-	-	-	-

FSE Wastewater Characterization Based on Sampling Data

After the County obtained representative wastewater samples and provided the data (see Appendix C) to Black & Veatch, a meeting was held to discuss the results, decide standard category wastewater strengths and to determine how to implement the new FSE surcharge categories. The detailed data listed in Table C1 was reviewed for potential outliers and then the summary data in Table C2 was used as a guide in setting standardized charges. Each surcharge characteristic was discussed between the County and B&V for each proposed FSE customer class, except for the shared meters category, and a consensus (and are not solely based upon the average strengths presented in Appendix E) was arrived at during that meeting.

In Phase I of the study, a model was developed to allow the County to calculate sewer surcharges. The RFP originally requested a methodology for assessing surcharges to FSEs. However, the County agreed that there was no need to develop a separate methodology for sewer surcharges for FSEs. Therefore, the primary issue was to decide the standard wastewater strengths for each FSE category and how to allocate costs to customers on shared meters. The proposed surcharge strengths by FSE category are presented in Table 5 below.

Table 5 – FSE Standard Wastewater Strengths (mg/l)

Category	BOD	TSS	FOG	TP	TN
Full Service Restaurant	1,600	500	175	15	30
Fast Food Restaurant	2,400	750	200	15	30
Grocery with Food Preparation	1,200	300	100	12	25
In-House Food Service	1,500	650	700	25	115
Baked Goods	500	500	125	12	55
Shared Meters	400	150	800	5	20
Howard County “Floor” (mg/l)	300	300	100	12	40

The standard strengths in Table 5 should have the “floor” allowances for the wastewater characteristics that are subtracted from their standard strength in computing the surcharge. The County has not currently defined floor concentrations for FOG or TN. However, the figures in Table 5 are proposed floor concentrations based on median values reported in the 2005 NACWA survey (see Appendix E), if the County decides to surcharge customers for FOG and/or TN. An example of how the surchargeable strength and surcharges would be determined is provided below (based on current County surcharge components, not those suggested in this study):

Customer – Acme Fast Food

Volume for Billing Period – 120,000 gallons

Assumed Wastewater Strengths – BOD = 2,400 mg/l, TSS = 750 mg/l, TP = 15 mg/l

“Floor” Strengths – BOD = 300 mg/l, TSS = 300 mg/l, TP = 12 mg/l

Surcharge Rates from Phase I Report – BOD = \$0.168/lb, TSS = \$0.057/lb, TP = \$1.493/lb

Table 6 – Calculation of Surchargeable Strengths (mg/l)

Component	Assumed Strength	“Floor” Concentration	Surchargeable
BOD	2,400	300	2,100
TSS	750	300	450
TP	15	12	3

Table 7 – Example Calculation of Extra-Strength Surcharges

Component	Volume	Surcharge Strength	Conversion Factor	Wastewater Loading ¹	Surcharge Rate	Surcharge ²
<i>Units</i>	<i>(gal)</i>	<i>(mg/l)</i>	<i>(lbs•l/mg•gal)</i>	<i>(lbs)</i>	<i>(\$/lb)</i>	<i>(\$)</i>
BOD	120,000	2,100	8.344×10^{-6}	2,103	0.168	353.25
TSS	120,000	40	8.344×10^{-6}	451	0.057	25.68
TP	120,000	3	8.344×10^{-6}	3	1.493	4.48
Total	-	-	-	-	-	\$383.41

1. Volume times the surcharge strength times the conversion factor produces the wastewater loading weight.

2. Wastewater loading times the surcharge rate produces the surcharge revenue.

In the Phase I report, we recommended surcharge rates for BOD, TSS, TP, and TN, but not for FOG. The Phase I report shows no allocations to FOG, as requested by the County. Therefore, it is not shown or discussed in the Phase I report. However, the sewer surcharge rate model provided to the County is structured to allow the allocation of costs to FOG and the County already possesses the allocation factors that could be used to allocate costs to FOG for the purpose of developing a sewer surcharge rate.

In Table 5, standard strengths are shown for all five major wastewater characteristics. However, the County does not currently charge customers for FOG or TN. To establish a surcharge for either one or both, the County would have to apply that policy to all commercial and industrial customers because it can not discriminate between customer classes. In spite of this, the possibility exists that those two surcharges could potentially only apply to FSEs in a practical sense based on the floor concentrations for surcharging. The determination of which customers would be affected by a potential new surcharge would need to be evaluated further by the County to make certain that the surcharge would still produce the desired results.

Site Specific Testing

Black & Veatch recognizes that there is some variability in the actual strengths of FSEs, and in particular there was some concern about the significant variability within the shared meters category. However, based on discussions with County staff, if a specific FSE in the shared meters category wants to review their assumed strength, they can pay for the expense of having their specific site’s wastewater strength tested.

Allocating Costs Between Customers on Shared Meters

One aspect of the utility enterprise that is an inconvenience for many modern utilities is the issue of billing sewer customers on shared meters. An objective of the Phase II study was to help the County determine if there were any alternative approaches to estimating the flow and associated

surcharges for FSE customers on shared meters. B&V contacted a number of utilities to ascertain how they address the issue of multiple customers on a single meter. The utilities that responded indicated that the problem is addressed primarily in two ways – flow estimates based on the number of seats or delegating the responsibility for breaking up the bill for a shared meter to the property owner/manager.

While the County does not necessarily want to assume the responsibility of allocating flow and surcharge cost for property owners/managers, it did want to be able to provide them with some guidance based on the standard wastewater strengths by FSE type provided in this report. Examples of how to allocate customer flows when a single or multiple FSEs share a meter and the type of documentation that could be provided to property owners/managers to facilitate their bill allocations are provided in Appendix D.

Incentives for Grease Traps and FOG Reduction

Fats, oil and grease (FOG) are typical components of FSE wastewater. Most of the oil and grease found in restaurant wastewater is free oil which rises to the surface of the water in which it is contained. Conventional grease traps and recovery systems are basically designed to recover free oil by either skimming the water surface (grease recovery systems) or the oil can be allowed to congeal on the water surface for later collection (conventional grease traps). Another form of oil in wastewater is mechanically emulsified oil. This is caused by agitating a free oil and water mixture until the oil breaks up into very small droplets. Hot water and use of liquid vegetable oils contribute to mechanically emulsified oil. Oil and grease may also become chemically emulsified through the use of detergents and other alkalis. Chemically emulsified oil particles are very small and do not rise to the surface of the water regardless of how much time is allowed. Chemically emulsified oil may be a significant portion of the total grease in food service wastewater.

FOG can clog collection system mains and lift stations, potentially causing backups or overflows. Utilities must expend more time and effort (i.e., money) to maintain their collection systems when there is a significant level of FOG in the wastewater. FOG can also disrupt the effective operation of wastewater treatment plants. The County continues to work hard to reduce sanitary sewer overflows (SSOs). However, for the time period of January 2001 through October 2006, 22% to 44% of the County’s overflows have FOG as the primary cause, as shown in Table 8 below.

Table 8 – Howard County FOG Related SSOs

Year	Total SSOs ¹	FOG Related SSOs		% SSOs FOG Related	
		Low ²	High ³	Low	High
2001	23	3	11	13%	48%
2002	27	11	17	41%	63%
2003	36	4	12	11%	33%
2004	16	4	6	25%	38%
2005	20	5	7	25%	35%
2006 ⁴	11	2	6	18%	55%
Total	133	29	59	22%	44%

1. Source – Maryland State Department of the Environment.
2. Directly identified grease related SSOs.
3. Possible FOG related blockages added to low figure.
4. Through October 2006.

The County is not the only major wastewater service provider in Maryland dealing with this problem. The Washington Suburban Sanitation Commission (WSSC) is also working to address SSO problems caused by FOG. From December 2005 through November 2006, 40% of WSSC's overflows were grease related.

Industry studies have shown that grease traps can greatly reduce the strength of wastewater from restaurants. Studies on restaurant wastewater in the states of Wisconsin and Washington have suggested that grease traps can remove up to 50-60% of FOG, 50-80% of BOD, and 50-80% of TSS.

The suggestion of a FOG surcharge is intended as a means to encourage FSEs to install grease traps. The County's objective is to have less FOG in the collection system, not to generate more revenue. Many businesses may be able to avoid or significantly reduce their sewer surcharges by installing and maintaining grease traps.

Other Issues

During the course of the study, Black & Veatch learned that the County did not have a formal process to address all of the permitting documentation that the Bureau of Utilities needs to have in the matter of surcharge administration and enforcement. County staff has had to develop informal means of obtaining new FSE data that is needed to enforce County requirements and regulations as it pertains to wastewater discharges and sewer use ordinances. This has also been a problem for the County in identifying when commercial customer occupancy and associated usage characteristics change.

Additionally, during the course of obtaining FSE wastewater samples, County staff occasionally encountered sites where there was difficult or no access to catch basins downstream of grease trap facilities. In those instances, the County was unable to obtain wastewater samples.

RECOMMENDATIONS

Our Phase II recommendations are listed below:

- The County should drop the non-surchargeable and intermittent food service FSE categories.
- The County should consider adding a Grocery with Food Preparation FSE surcharge category to address high strength contributions by grocers, delis and supermarkets.
- The County should consider adding a Shared Meters FSE surcharge category to address high strength contributions by malls with FSE tenants on a shared meter.
- The County should consider the implementation of a FOG surcharge to further encourage FSEs and other commercial/industrial customers to reduce the level of the pollutant

which is introduced into the sewer system. The model developed in Phase I has the capacity for the calculation of a FOG surcharge and the cost allocation basis including FOG has already been developed for the County.

- The County should adopt a schedule of FSE standard wastewater strengths and review and update it regularly (at least triennially). The FSE categories and the proposed strengths shown in Table 5 are based on measured strengths and should be incorporated into the surcharge system.
- The County should confer with its staff in the Department of Technology and Communication Services to determine whether the utility billing and information system will allow the assignment of standardized strengths to individual FSEs.
- Those FSEs that choose to test their wastewater (past their grease traps) at their own expense, in accordance with County testing guidelines, and whose sampling results indicate that they have lower than assumed wastewater strength, but higher than the “floor” for high strength surcharging can have their strengths adjusted to reflect those test results.
- The County should implement a program to communicate the financial benefits of installing grease traps in FSEs.
- The County should consider adding FSE categories to its planning documents and billing database during the permit process.
- The County should consider adding the wastewater discharge permit into its planning process, including change of use notifications.
- The County should consider establishing standards for the installation of grease traps to ensure County access downstream of and to the interceptors.

In conducting our analyses and research, and in forming an opinion of the standard categorical food service establishment wastewater strengths summarized in this report, Black & Veatch has made certain assumptions with respect to conditions, events, and circumstances that may occur in the future. Such assumptions and methodologies are summarized in this report and are reasonable and appropriate for the purpose for which they are used. While Black & Veatch believes the assumptions are reasonable and the wastewater strength determination methodology valid, actual results may differ materially from those projected, as influenced by conditions, events, and circumstances that actually occur.

APPENDIX

BOD – Biochemical oxygen demand

Emulsion – A suspension of small globules of one liquid in a second liquid with which the first will not mix: *an emulsion of oil in vinegar*

FOG – Fats, oils & grease

TN – Total nitrogen

TP – Total phosphorous

TSS – Total suspended solids

Appendix B – Food Service Establishment Category Definitions

The description of each category of Food Service Establishment is provided below. The descriptions indicate the service characteristics that differentiate it from other types of FSEs.

Full Service Restaurant. This FSE typically prepares and serves food in a dining setting. Attending patrons are provided food items served on plates with utensils and cloth napkins that have to be washed after the patrons have completed their meals. Cookware is also cleaned on the premises. Food preparation comprises the many activities that constitute the provision of service at a full service establishment – baking, frying, grilling, broiling, boiling, etc. The overwhelming majority of service is provided in seating areas with a relatively small amount of carryout business.

Fast Food Restaurant. This FSE prepares for intended for immediate consumption. Its food items are often provided in paper or other types of disposable wrappers and containers along with disposable utensils. The patrons of fast food establishments dine in a seating area or take their food on a carryout basis. Cookware is cleaned on the premises. Food preparation comprises the many activities that constitute the provision of service at a full service establishment – baking, frying, grilling, broiling, boiling, etc.

Grocery with Food Preparation. This category represents some of the FSEs that were formerly listed as non-surchageable under the County’s previous FSE categorization system. This FSE encompasses the various grocers, delis and supermarkets that prepare food. Food preparation comprises the many activities that constitute the provision of service at a full service establishment – baking, frying, grilling, broiling, boiling, etc. The patrons of these establishments buy food that is ready for consumption and they usually take the food items with them when they leave the establishment, although some may have relatively small areas for patrons to consume food. Cookware and utensils are cleaned on the premises.

In-House Food Service. This FSE category comprises establishments that basically provide food service to the tenants or employees of a commercial, multi-unit/group residential or institutional facility. The food service is prepared and provided in the location of the facility, usually in a cafeteria with seating. Depending on the type of facility, the food may be delivered to the room of the patrons or they can consume their food in a dining area. The employees of the food service establishment usually work for or are contracted by the facility in which the food is served.

Baked Goods. This FSE typically prepares a variety of baked goods, such as bread, pastries, and cakes for retail sale and for consumption by patrons who come to the establishment for baked goods for immediate consumption. The area dedicated to serving walk-in patrons is relatively small compared the total size of the facility with an equally small area dedicated to on premise consumption.

Shared Meters

This FSE category essentially comprises malls that have FSEs as tenants and share a common water meter. Most major indoor malls contain comprehensive food courts and other types of FSEs intermingled among the other stores. Many outdoor strip malls also contain FSEs, especially fast food restaurants.

The data below reflects the detailed FSE wastewater sampling data obtained by County staff for the study. The summary calculations are presented on the following page.

Table C1 – Summary FSE Wastewater Sampling Data

Facility Name	TYPE	FOG	TP	TSS	BOD	TN
Bob Evans Farms Inc. #376	FS	187.0	30.6	400.0	1,940.0	20.2
Carrabba's Italian Grill	FS	72.4	14.1	388.0	1,370.0	33.6
Chick-fil-a (6375 Dobbin)	FF	87.1	12.7	256.0	2,080.0	46.3
Copeland's of New Orleans	FS	170.0	11.2	296.0	729.0	19.0
Don Pablo's (Mexican)	FS	68.9	3.4	60.0	491.0	12.4
Double T Diner	FS	77.7	26.8	164.0	1,350.0	38.8
Famous Daves BBQ	FS	23.9	8.0	82.0	587.0	13.9
Fuddruckers #353	FS	1,050.0	18.3	940.0	3,690.0	52.4
Giant Food Store #300	GF	132.0	15.4	345.0	826.0	22.7
Heartlands Residence Inn	IH	1,420.0	39.9	1,240.0	2,870.0	222.0
Kentucky Fried Chicken	FS	75.3				
Kentucky Fried Chicken	FS	114.0	7.8	665.0	1,680.0	33.1
Krispy Kreme	BG	195.0	18.0	1,040.0	277.0	83.1
La Palapa Grill (Mexican)	FS	104.0	11.1	165.0	894.0	23.1
Longhorn Restaurant	FS	70.4	18.0	1,170.0	2,700.0	50.7
Mars Super Markets, Inc.	GF	96.7	9.0	230.0	1,610.0	28.4
McDonald's	FF	200.0	39.3	1,350.0	2,760.0	33.7
McDonald's	FF	375.0	19.1	680.0	3,860.0	47.5
McDonald's	FF	118.0	5.4	84.0	519.0	11.6
McDonald's	FF	97.8	2.9	102.0	747.0	7.5
Melting Pot Restaurant	FS	228.0	6.8	300.0	1,570.0	37.6
Morningside House	IH	18.1	6.2	56.0	177.0	6.9
Panera Bread	BG	66.4	5.6	176.0	705.0	23.8
P.F. Chang's China Bistro	FS	24.6	5.7	515.0	948.0	16.7
Red Robin	FS	39.9	4.6	66.0	490.0	14.8
T.G.I. Friday's	FS	88.5	18.3	230.0	1,030.0	19.6
Columbia Mall	SM	1,760.0	5.0	104.0	540.0	11.7
Cherry Tree Crossing	SM	120.0	5.2	214.0	287.0	25.0

The table below reflects basic statistical calculations on the sampling data. While the calculations formed the base of the assigned FSE wastewater strengths, they were not the sole factor in assigning strengths.

Table C2 – Summary FSE Wastewater Sampling Data Statistics

FSE Category	TYPE	FOG	TP	TSS	BOD	TN
Full Service = FS	Total					
Fast Food = FF	Min	18.1	2.9	56.0	177.0	6.9
Grocer w/Food = GF	Med	100.9	11.1	256.0	948.0	23.8
In House = In House	Max	1,760.0	39.9	1,350.0	3,860.0	222.0
Baked Goods = BG	Avg	252.9	13.6	419.2	1,360.3	35.4
Shared Meters = SM						
	Full Service (FS)					
	Min	23.9	3.4	60.0	490.0	12.4
	Med	77.7	11.2	298.0	1,190.0	21.7
	Max	1,050.0	30.6	1,170.0	3,690.0	52.4
	Avg	159.6	13.2	388.6	1,390.6	27.6
	Fast Food (FF)					
	Min	87.1	2.9	84.0	519.0	7.5
	Med	118.0	12.7	256.0	2,080.0	33.7
	Max	375.0	39.3	1,350.0	3,860.0	47.5
	Avg	175.6	15.9	494.4	1,993.2	29.3
	Grocer with Food Preparation (GF)					
	Min	96.7	9.0	230.0	826.0	22.7
	Med	114.4	12.2	287.5	1,218.0	25.6
	Max	132.0	15.4	345.0	1,610.0	28.4
	Avg	114.4	12.2	287.5	1,218.0	25.6
	In-House (IH)					
	Min	18.1	6.2	56.0	177.0	6.9
	Med	719.1	23.1	648.0	1,523.5	114.5
	Max	1,420.0	39.9	1,240.0	2,870.0	222.0
	Avg	719.1	23.1	648.0	1,523.5	114.5
	Baked Goods (BG)					
	Min	66.4	5.6	176.0	277.0	23.8
	Med	130.7	11.8	608.0	491.0	53.5
	Max	195.0	18.0	1,040.0	705.0	83.1
	Avg	130.7	11.8	608.0	491.0	53.5
	Shared Meters (SM)					
	Min	120.0	5.0	104.0	287.0	11.7
	Med	940.0	5.1	159.0	413.5	18.4
	Max	1,760.0	5.2	214.0	540.0	25.0
	Avg	940.0	5.1	159.0	413.5	18.4

The two examples in Appendix represent alternative approaches to calculating FSE flows and surcharges as compared to the current methodology.

Example D1 – Calculating FSE Discharges from a Mixed Use Retirement Home

Background

A nursing home consisting 224 of one-person apartments has an on site Food Service Establishment (FSE) that prepares and serves three meals a day on site. If it is single metered, what methodology should be used to determine FSE discharges for calculating a bill and calculating high strength discharges? Although all customers share a single meter, there is only one FSE involved and the flow attributable to the on site FSE is calculated and then the standard wastewater strength characteristics for that FSE type are applied to that flow.

Calculation

1. If there is water used for irrigation, the following calculation should be done using winter quarter readings (on the assumption that no outdoor water use occurs during that time).
2. Estimate the number of residents. If the exact number is not known and if the retirement home does not distinguish between one and two person apartments (some do), assume an equal number of each. In this case, let's assume that there are 224 apartments with one resident in each.
3. Calculating indoor water used by residents requires an average value of indoor gallons per capita per day. The Massachusetts Water Resource Authority, which has a slightly older building inventory, recently lowered its design standard (after much analysis) to 65 gpd. Since few residents do their own cooking 50 gpd would be a very conservative estimate.
4. Calculate indoor water used by employees. Since this is likely to be a small amount, you may elect to skip this step (particularly of it will be difficult to get this data). With reasonably efficient water using fixtures (i.e., toilets and urinals), an estimate of 20 gpd per employee would be conservative.
5. Wastewater generated by the FSE is winter quarter water use less residents' indoor water use, less employee water use.

Example

FSE Type = In-House Food Service

Winter quarter use = 3,320 units (one unit = 748 gallons)

Number of units = 224 residential units @ 1 person per unit

Number of employees = 30

Residents' Indoor Use = $224 \times 50 \times 90 \div 748 = 1,348$ units

Employee Use = $30 \times 30 \times 90 \div 748 = 108$ units

FSE Water/Wastewater Use = $3,320 - 1,348 - 108 = 1,864$ units or 1,394,272 gallons

Table D1 – Calculation of Surchargeable Strengths (mg/l)

Component	Assumed Strength	“Floor” Concentration	Surchargeable
BOD	1,500	300	1,200
TSS	650	300	350
TP	25	12	13

Table D2 – Example Calculation of Extra-Strength Surcharges

Component	Volume	Surcharge Strength	Conversion Factor	Wastewater Loading ¹	Surcharge Rate	Surcharge ²
<i>Units</i>	<i>(gal)</i>	<i>(mg/l)</i>	<i>(lbs•l/mg•gal)</i>	<i>(lbs)</i>	<i>(\$/lb)</i>	<i>(\$)</i>
BOD	1,394,272	1,200	8.344 x 10 ⁻⁶	13,960	0.168	2,345.38
TSS	1,394,272	350	8.344 x 10 ⁻⁶	4,071	0.057	232.09
TP	1,394,272	13	8.344 x 10 ⁻⁶	151	1.493	225.44
Total	-	-	-	-	-	\$2,802.91

1. Volume times the surcharge strength times the conversion factor produces the wastewater loading weight.
2. Wastewater loading times the surcharge rate produces the surcharge revenue.

Example D2 – Calculating FSE Discharges for Customers on a Shared Meter

Background

A strip mall consisting of three FSEs, four non-FSEs and an empty unit shares a single meter. The three FSEs comprise a full service restaurant, a fast food restaurant, and a baked goods enterprise. The non-FSE tenants comprise a cleaners (small), nail salon (large), barber shop (large) and liquor store (small). What methodology should be used to determine FSE discharges for calculating a bill and calculating high strength discharges?

Calculation

1. If there is water used for irrigation, the following calculation should be done using winter quarter readings (on the assumption that no outdoor water use occurs during that time).
2. Obtain or estimate the size of each tenant by square footage and identify the FSE type, if any.
3. Obtain the average number of employees working in the non-FSEs. If that information is not available, assume that small stores have 1-2 employees with a single bathroom on premise and that large stores have 3-4 employees with multiple bathrooms.
4. Calculating indoor water used by tenant employees requires an average value of indoor gallons per capita per day. Let’s assume an average of 35 gpd per employee.
5. Wastewater generated by the FSE is winter quarter water use less tenant employees’ indoor water use.
6. Allocate water use to FSEs based on square footage. It’s not perfect, but just as reasonable as the usage per seat methodology employed around the country.

Appendix D – Shared Meters Customer Cost Allocation Examples

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Example

FSE Type = Shared Meter

Winter quarter use = 398 units (one unit = 748 gallons)

Number of employees = 2 + 4 + 4 + 2 = 12

Tenant Square Footage:

<i>Dancing Donuts – 17,000</i>	<i>China Star – 19,000</i>
<i>Bob’s Subs – 16,000</i>	<i>Dry Cleaners – 17,000</i>
<i>Nail Salon – 17,000</i>	<i>Barber Shop – 17,000</i>
<i>Liquor Store – 19,000</i>	<i>Empty Unit – 21,000</i>

Employee Use = 12 x 35 x 90 ÷ 748 = 51 units

FSE Water/Wastewater Use = 398 - 51 = 347 units or 259,556 gallons

FSE Square Footage = 51,000 sq. ft.

Usage per Square Foot = 5.0893 gal/ft²

Table D3 – Calculation of Allocated Water Usage

<u>FSE Tenant</u>	<u>Square Footage</u>	<u>Allocated Usage</u>
Dancing Donuts	17,000	86,518 gal
China Star	19,000	96,697 gal
Bob’s Subs	16,000	81,429 gal

Table D4 – Calculation of Dancing Donuts Surchargeable Strengths (mg/l)

<u>Component</u>	<u>Assumed Strength</u>	<u>“Floor” Concentration</u>	<u>Surchargeable</u>
BOD	500	300	200
TSS	500	300	200
TP	12	12	0

Table D5 – Example Calculation of Dancing Donuts Extra-Strength Surcharges

<u>Component</u>	<u>Volume</u>	<u>Surcharge Strength</u>	<u>Conversion Factor</u>	<u>Wastewater Loading¹</u>	<u>Surcharge Rate</u>	<u>Surcharge²</u>
<i>Units</i>	<i>(gal)</i>	<i>(mg/l)</i>	<i>(lbs•l/mg•gal)</i>	<i>(lbs)</i>	<i>(\$/lb)</i>	<i>(\$)</i>
BOD	86,518	200	8.344 x 10 ⁻⁶	144	0.168	24.19
TSS	86,518	200	8.344 x 10 ⁻⁶	144	0.057	8.21
TP	86,518	0	8.344 x 10 ⁻⁶	NA	1.493	NA
Total	-	-	-	-	-	\$32.40

1. Volume times the surcharge strength times the conversion factor produces the wastewater loading weight.
2. Wastewater loading times the surcharge rate produces the surcharge revenue.

Appendix D – Shared Meters Customer Cost Allocation Examples

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When the same is done for the other FSE tenants, the following surcharges are produced below:

Table D6 – Example Calculation of Strip Mall FSE Extra-Strength Surcharges

Tenant	Sewer Surcharges			Total Surcharges
	BOD	TSS	TP	
Dancing Donuts	\$24.19	\$8.21	NA	\$32.40
China Star	\$172.21	\$9.20	\$2.41	\$183.82
Bob's Subs	\$239.71	\$17.43	\$2.03	\$259.17

For those property managers who allocate their own bills to tenants, we have drafted an example of an insert that could be provided to help them allocate their bills.

Information for Property Managers - Single Metered Facilities with Multiple Customers

Why is there a “surcharge” on my sewer bill?

Howard County’s wastewater treatment plants were built using U.S. EPA Construction Grants, significantly reducing our costs and your bill. One condition of using those funds is that all sewage customers be billed based on use and that high strength dischargers pay the additional costs associated with their discharge. Food service establishments (FSE) discharge high strength wastewater. The County has a program for surcharging FSEs based on the type of service they provide. The attached information sheet describes this program.

I have one meter and one bill how do I figure how much to charge my FSE tenants?

Your tenant FSEs should be billed for wastewater reflecting their usage and strength of discharge. The following example shows how you can do that calculation. Let’s assume that your quarterly water bill shows usage of 306,000 gallons. Let’s also assume that your strip mall houses:

- 3 small stores (1-2 employees each with a single bathroom on the premises)
- 2 larger stores (an average of 4 employees, multiple bathrooms)
- 3 fast food establishments, such as a Subway, Popeye’s etc.
- 1 fast food establishment that does on site baking, such as a Dunkin Donuts
- 1 full service restaurant

Step 1

Figure out how much water your non-FSE establishments use. As an average you can assume that 35 gallons per day are used by each employee. So non FSE water use during the month is:

14 employees x 35 gallons per day x 91 days in the quarter = 44,590 gallons

That leaves 261,410 gallons used by FSEs

Step 2

Figure out how much water is used by each FSE. Although it’s not perfect, assume that water use is related to square footage. Do not include any common space you have allocated to each establishment, unless you allocate common space based on square footage (in this case, it will make no difference). For purposes of this example, let’s say that the 3 fast food establishments and Dunkin Donuts have 500 square foot each and the full service restaurant has 2,000 square feet. Dividing the 261,410 gallons by the total of 4,000 square feet gives us 65.35 gallons per square foot. The sewage bill for each customer is presented in Table D7 on the following page:

Table D7 – Example of Shared Meter Usage Allocations

<u>FSE Tenant</u>	<u>Type</u>	<u>Area</u> ft ²	<u>Percent</u>	<u>Usage</u> gallons
Subway	FF	500	12.5%	32,676
Popeye's	FF	500	12.5%	32,676
Chipotle	FF	500	12.5%	32,676
Dunkin Donuts	BG	500	12.5%	32,676
Ruby Tuesday	FS	<u>2,000</u>	<u>50.0%</u>	<u>130,705</u>
Total		4,000	100.0%	261,410

Step 3

You will also receive a high strength surcharge because of the fats, oil and grease discharged by your FSEs. These components make it more expensive for us to treat wastewater and law requires that we charge dischargers for these added costs. You should bill this to your FSEs. To do that you will need to use Table D8 which identifies the estimated excess strengths by type of FSE. Use this table and the billed gallons you calculated in step 2 to determine the high strength billing to your FSEs.

Table D8 – FSE Type Excess Wastewater Strengths

FSE Category	BOD	TSS	FOG	TP	TN
Full Service Restaurant (FS)	1,300	200	75	3	NA
Fast Food Restaurant (FF)	2,100	450	100	3	NA
Grocery with Food Preparation (GF)	900	NA	NA	NA	NA
In-House Food Service (IH)	1,200	350	600	13	75
Baked Goods (BG)	200	200	25	NA	15
Shared Meters (SM)	100	NA	700	NA	NA

You can allocate the billed surcharges by multiplying the FSE percentage of FSE total square footage times the excess strength figure to calculate the surcharge allocation basis as presented in Table D9. The surcharge allocation basis is then used to allocate the BOD charges.

Table D9 – FSE Proportional Surcharge Strength Calculation

Tenant	FSE Type	BOD	TSS	FOG	TP	TN
Subway*	FF	263	56	13	0	0
Popeye's	FF	263	56	13	0	0
Chipotle	FF	263	56	13	0	0
Dunkin Donuts	BG	25	25	3	0	2
Ruby Tuesday	FS	650	100	38	2	0
Total		1,463	294	78	3	2

Appendix D – Shared Meters Customer Cost Allocation Examples

* The Subway proportional BOD figure is calculated by multiplying the 12.5% FSE square footage allocation times the excess wastewater strength of 2,100 mg/l. The same is done for each customer for each wastewater component.

The proportional surcharge strengths for each customer are then converted into percentages by column and those percentages as shown in Table D10 below are multiplied by the billed surcharge and allocated to the appropriate customers.

Table D10 – FSE Percent Allocation of Proportional Surcharge Strength

Tenant	FSE Type	BOD	TSS	FOG	TP	TN
Subway*	FF	17.95%	19.15%	16.00%	14.29%	0.00%
Popeye's	FF	17.95%	19.15%	16.00%	14.29%	0.00%
Chipotle	FF	17.95%	19.15%	16.00%	14.29%	0.00%
Dunkin Donuts	BG	1.71%	8.51%	4.00%	0.00%	100.00%
Ruby Tuesday	FS	44.44%	34.04%	48.00%	57.14%	0.00%
Total		100.00%	100.00%	100.00%	100.01%	100.00%

* The Subway allocation of proportional BOD percent is calculated by dividing its proportional BOD figure of 263 by the 1,463 total to obtain 17.95%. The same is done for each customer for each wastewater component.

Let's assume that the following surcharges are billed to the property owner:

- BOD = \$ 458.25
- TSS = \$352.85
- FOG = \$ 515.23
- TP = \$ 112.45
- TN = \$ 79.84

Applying the proportional surcharge allocations in Table D10 would produce the following allocation of billed surcharge to individual FSE customers as presented in Table D11.

Table D11 – FSE Percent Allocation of Proportional Surcharge Strength

<u>Tenant</u>	<u>BOD</u>	<u>TSS</u>	<u>FOG</u>	<u>TP</u>	<u>TN</u>	<u>Total</u>
Subway	82.26	67.57	82.44	16.07	0.00	248.34
Popeye's	82.26	67.57	82.44	16.07	0.00	248.34
Chipotle	82.26	67.57	82.44	16.07	0.00	248.34
Dunkin Donuts	7.84	30.03	20.61	0.00	79.84	138.32
Ruby Tuesday	<u>203.63</u>	<u>120.11</u>	<u>247.30</u>	<u>64.24</u>	<u>0.00</u>	<u>635.28</u>
Total	\$458.25	\$352.85	\$515.23	\$112.45	\$79.84	\$1,518.62

Is there anything you can do to lower this cost?

If you or your FSEs take steps to reduce their discharge of fats, oil and grease we will discount the high strength surcharge bill by ____%. We will accept any of the following as proof that appropriate steps have been taken by your FSEs:

Appendix D – Shared Meters Customer Cost Allocation Examples

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- Installation and maintenance of grease traps
- Submetering of tenants to allow individual billing
- Installation of other permitted FOG pretreatment technologies

Don't forget that we will be inspecting and penalize FSEs that have filed false reports or fail to maintain grease traps.

If you want any more information contact Gene Seay at (410) 880-5813.

Appendix E – Howard County Surcharge Limits vs. Industry Data

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The table below shows how Howard County’s surcharge “floor” limits compare to values from the most recent National Association of Clean Water Agencies study (2005).

Component	TSS	BOD	FOG	TP	TKN
Howard County (mg/l)	300	300	-	12	-
NACWA Median Value (mg/l)	275	250	100	12	40
NACWA Average Value (mg/l)	315	261	126	12	113
Number of Utilities reporting	61	51	9	1	6