ArcGIS Analysis of Impervious Surfaces to Create a Stormwater Utility Fee in Pittsboro, NC

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Introduction

I completed an analysis of impervious surfaces in the Town of Pittsboro. This was done in order to calculate an ERU (Equivalent Residential Unit) for a Stormwater Management Program that the Town is working to develop. This ERU is then used to calculate the fees that will be charged to properties for funding the Stormwater Program. In order to make this fee fair, the ERU is based off of impervious surfaces, as impervious surfaces directly cause an increase in the quantity of stormwater that the Town must handle. Single Family Residential parcels are used in order to calculate the ERU as they form the backbone of the fee payers, and represent a "normal" impervious surface to parcel area. Thus, I used various layers and tools in ArcGIS in order to get a reasonable approximation of the area of the impervious surfaces for 'single family residential' parcels inside of the Pittsboro ETJ. This ERU was then used to set three tiers of fees for 'single family residential' parcels and to calculate the fee charged to commercial properties. This process—and its results—is what is detailed in this report.

Gathering Data

By using ArcGIS, I was able to create a table with an approximation of impervious surfaces in square feet by parcel. ArcGIS is a mapping and geographical analysis program that is used often by the Town and all forms of government and business. I began with layers that I was able to gather from the County ArcGIS website (http://www.chathamgis.com) and from Catherine Deininger, who has recently done work that involved studying impervious surfaces in the Robeson Creek Watershed. A listing of the important layers that I used for creation of my maps and analysis follows:

Chatham County Building Footprint Layer: A layer that represents with polygons all the footprints from buildings across Chatham County in 2007 (maybe 2008?). Used in creation of a Master Impervious Surface Layer, as the footprint of a building represents a large part of the impervious surface on any given property.

Pittsboro Land Classification Layer: A raster layer that shows different types of land cover in Pittsboro. To quote the layer's summary: "The Global Ecosystem Center (GEC) created the spatial resolution land cover data layer (raster) for the year 2012 with the National Agriculture Imagery Program (NAIP) imagery. The purpose of the data layer was to evaluate the land cover land use in 5 classified categories. These land cover categories included 1) Tree Canopy, 2) Impervious Surfaces, 3) Open Spaces, 4) Water, and 5) Barren Land or Bare." The impervious surface classification in this layer was used as the base for the Master Impervious Surface layer that I created.

Aerial Photo of Chatham County: A very high resolution aerial photo of Pittsboro from 2013. Used as a backdrop and to make certain that all (or most) of the features being marked as impervious were in fact impervious surfaces.

Chatham County Parcels: A layer that represents all the parcels of Chatham County along with a host of information for every parcel (Deed Size, Billing Address, Zoning Data, etc.).

Used to find the parcel data for Pittsboro, and to determine if a parcel was 'single family residential.'

Pittsboro Zoning Layer: A layer that represented the zoning for the town of Pittsboro, used to determine which parcels were Residential.

County Roads: A layer representing the roads for the entire county. I trimmed this down just to Pittsboro Roads.

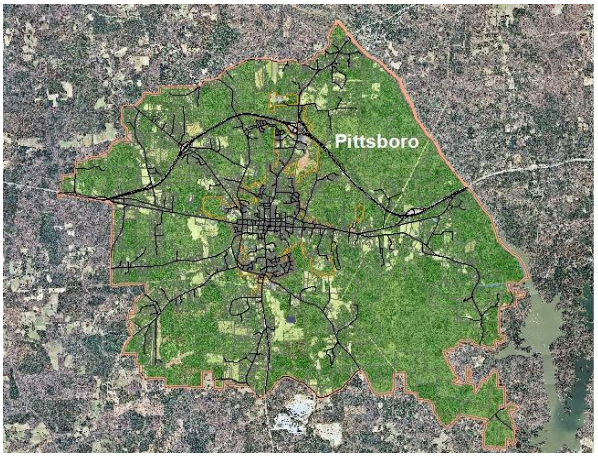
Pittsboro ETJ Limits & Pittsboro Town Limits: Used to give visual guidance and to trim many of the other layers.

After gathering all the data that I would use for this project, the first step was to 'clip' the data to the size of Pittsboro's ETJ, as that was the only area that I was interested in studying, and the only area for which I had the crucial Land Classification Layer. After this, I could move on to creating the Master Impervious Layer, which would show all the impervious surfaces and would be what I would use to do my analysis.

Creation of the Master Impervious Layer

The Land Classification Layer

This layer was the first that I needed to work with, as I wanted its impervious surface feature to be the base that I would use for the Master Impervious Layer. I had a raster layer for all of Pittsboro's ETJ, but I wanted it to be in a Polygon format, as that would be easier to work the later analysis on. This required a quick conversion in ArcGIS, and may have caused a slight loss of precision in the data. I also knew that the impervious surface features in the Land Classification layer included the impervious surfaces from roads and highways, and I knew that I did not want that information. The majority of the roads were on public land and thus were very easy to remove by simply clipping the Land Classification layer to the Parcels layer that I had, which, as the roads are not on parcels, removed the problem areas. However, some roads were built on private property with easements, and thus were not removed by the clipping process. In order to try to remove these, I gave all the road centerlines a 15 foot buffer, and used that to erase that data from the Land Classification layer. This gave me the maps that follow.



Map 1: Land Classification of Pittsboro

Map 2: Land Classification of Downtown

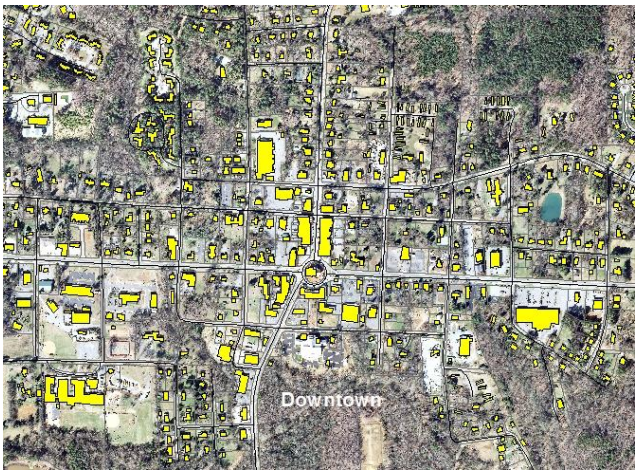
As you can see in Map 1, the vast majority of Pittsboro's ETJ is still forests and tree canopy as is shown by the dark green. The bits of lighter green is open space, usually grass and pastures. The downtown map, Map 2, shows how the impervious surfaces are registered in this layer. The impervious surfaces are shown there in gray, and the very few blotches of tan show barren land, usually bare soil, and the blue shows water. It can be seen in Map 2 that the roads have an empty space around them with no filling color, as I removed that data in order to not count the public roads in my calculations.

From these maps I pulled out only the gray pieces. This became my initial Impervious Surface layer, and it works very well as that. There are, however, a few places where it messes up. Since it was created using aerial photos—imagery and reflectivity analysis—it had difficulty registering some buildings that were beneath the tree canopy. This is why I decided to supplement this layer with the building footprint layer.

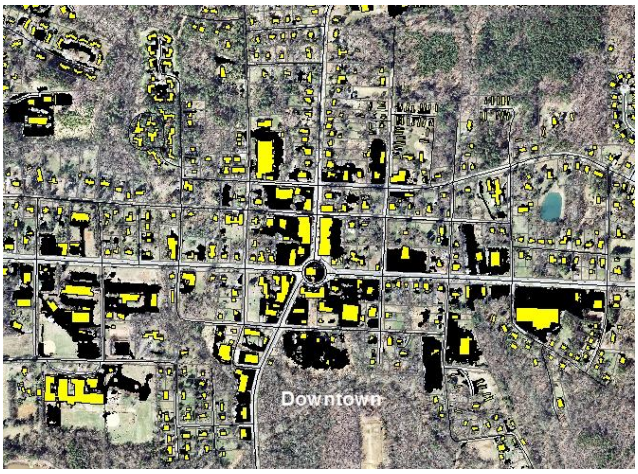
The Building Footprint Layer

This layer was initially for all of Chatham County, and is a little dated (roughly 2007). I was able to easily clip it down to just Pittsboro's ETJ, but I could not find a more recent building footprint layer.

I again clipped this layer with the Parcels layer, as some of the building footprints hung over the edge of the parcels and into public property, most noticeably in the downtown. The layer clearly shows all the buildings in Pittsboro, though, since it is outdated, some are definitely missing, and others are incorrectly there, but in general, it matched the aerial photo from 2013 very well.



Map 3: Building Footprints for Downtown



Map 4: Building Footprints and Impervious Surface Land Classification for Downtown

In both maps, the Building Footprints Layer is shown in yellow, and in Map 4 it is contrasted with the impervious surface layer that I previously created from the Land Classification data (shown in black). Map 4 shows, especially when studied with a smaller extent, that the Building Footprints Layer actually adds some important missing features, especially some homes farther into the woods. The Land Classification layer, however, catches parking lots, driveways, patios, and other impervious surfaces that do not exist on the Building Footprints Layer at all.

Combining the Two Layers

I then needed to combine the Building Footprint and Impervious Surface Land Classification layers together in order to create a new Master Impervious Surface Layer. This took little work, simply using the correct tool so that areas covered by both maps were not counted twice, and catching that one of the layers was measured in square meters, and correcting that to square feet.

At this point I had a Master Impervious Surface Layer, which is shown on the next page in gray, with Parcels overlaid on top of it in purple.

Map 5: Master Impervious Surface Layer

Cleaning up the Master Impervious Surface Layer

It is not shown own the previous map, Map 5, but the Master Impervious Surface Layer was currently comprised of a bunch of different oddly shaped polygons (they aren't shown in Map 5 as I drew them without outlines). These polygons came mostly from the raster to polygon conversion I did at the beginning, which was a bit messy, and the union with the building footprint layer, which simply increased the number of polygons. In order to simplify this layer (which made the future steps much easier) I intersected the Master Impervious Surface Layer with the Parcel Layer, this actually made even more polygons, as now all the parcel boundaries were also dividing lines, but, all of these polygons now had a Parcel_Number in their data table. I used this element with the dissolve tool, which grouped all the polygons with the same Parcel_Number, creating one polygon of impervious surfaces for every parcel, which is what I wanted.

I also, at this point in time, deleted all the entries in the Master Impervious Surface Layer that had less than 300 square feet of impervious surfaces. When I was going through the table checking random entries, I found that most of the low numbers tended to error, usually bits of road that went over a property and the centerline did not cover, or that the 15 foot buffer did not catch, or something to the sort. There were many more error points above 300, but I became less certain that they all were error, and so I left them for now.

Combining the Data

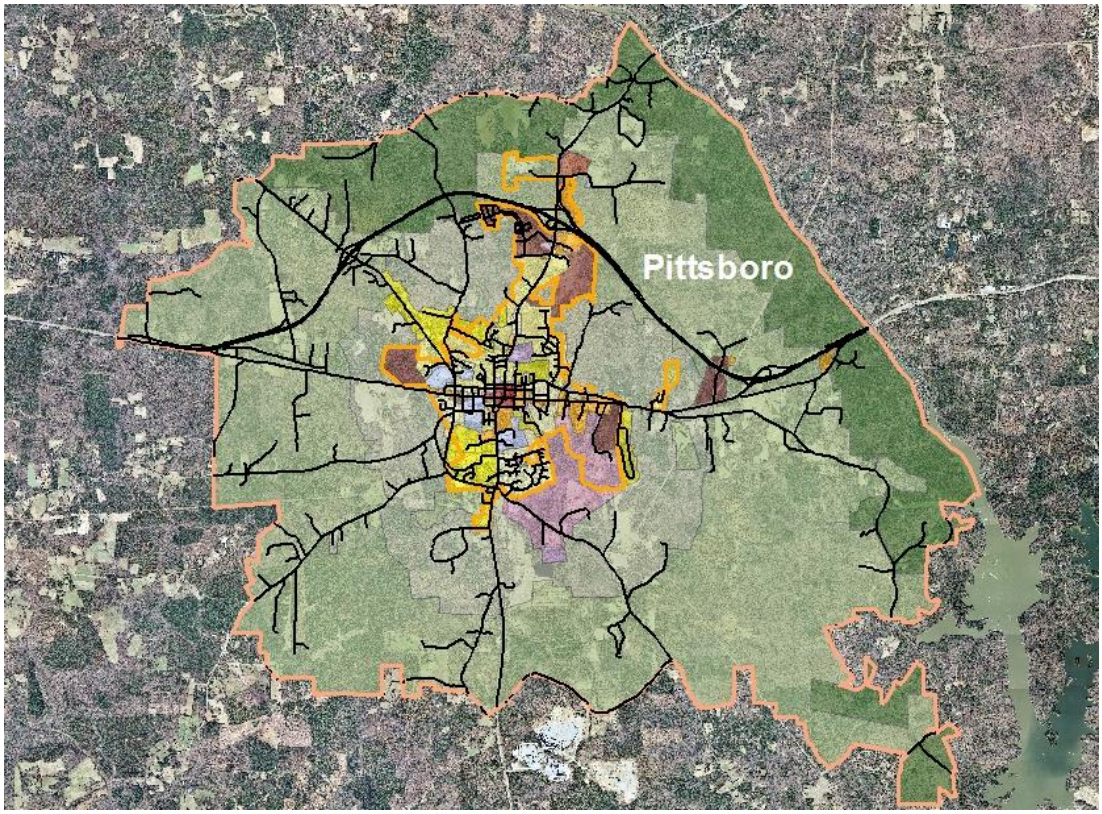
Attaching the Master Impervious Surface Data to Parcels

All polygon features in ArcGIS have at the end of their attribute table an entry called "Shape_Area". This is constantly calculated and updated by ArcGIS. This is why I wanted the Master Impervious Surface Layer to consist of polygons that corresponded to parcels. I now simply used the join tool with the "Parcel_Num" data value to join the Master Impervious Surface Layer to the Parcels Layer. This created a new Parcels Layer that was exactly the same as the old one, but had that "Shape_Area" data for the Master Impervious Surface Layer in it. That attribute told me the impervious surfaces in square feet for any parcel.

I now had the data that I was looking for, impervious surface area by parcel, but I still needed to classify each Parcel as Residential, Commercial, Governmental, etc.

Attaching Zoning Data to the Parcels

I used the Pittsboro Zoning Layer in order to begin classifying the parcels. The zoning map is shown below.



Map 6: Zoning Layer for Pittsboro

I was able to use another Spatial join to attach the data from the Zoning Layer to the Parcels that I had already attached the Impervious Surface Area to. This broadly classified parcels as 'Res' or 'Com' and proved useful for a general understanding of what type of parcel each was, but there were still plenty of businesses in the Residential section, and then there were sections such as Mixed Use, which always had both.

Attaching Data for Determining Subcategory

I realized at this point that the Parcels data that I was using did not have all the available Parcel information, some of which included the building type and style. I was able to download another Parcel Layer (Parcels_with_ASOUTR) that had this information, and combine it with the Parcel layer that I was creating with all my needed data. Then I went through the data and selected only the descriptions that were single family. Many of them said "SINGLE FAMILY UNIT WOOD F" or something to the sort, but others said "Townhouse" or "Modular Wood Frame." I also had to go through and make certain that I did not have any apartments, duplexes, or triplexes. There were two notably large pieces of property that I had to remove separately, one was the Army Corp's land and the other was the Christian Village. Both showed up as Single Family Residential properties for some reason. This points to the possibility that there are more incorrectly classified properties in my data set, but I think most are correct.

I went through all of the parcels and classified them into five broad subcategories: "Single Family", "Multi-Family", "Government", "Churches", and "Commercial". I determined

the Single and Multi-Family categories by looking at the description and zoning for every parcel, and sometimes by checking the parcel on the aerial photo. I pulled the Churches out of the dataset by searching the Deed Name for “Church”, “Chapel”, “Ch”, “St.”, etc.. The government buildings consisted of the schools (including CCCC and administrative buildings), the Town of Pittsboro, Chatham County, NCDOT , and State land. I classified each one separately, but for my analysis, I think of them all just as “Government”. The “Commercial” classification is a little misleading. It really covers everything that does not fit into the other four categories, which is for the most part just commercial properties.

Note Currently Commercial includes non-profit organizations that own land, such as Habitat for Humanity, Carolina Tiger Rescue, and others. Whether these non-profits will or will not be charged the utility fee, still needs to be discussed more (there are questions of legality in this that also need to be looked in to).

Exporting Data to Excel

At this point my data was ready to be exported to Excel, where I could more easily and quickly work with and analyze it. Once in Excel, I removed a lot of extraneous information from my data (billing addresses, deed names, etc.), and generally cleaned it up.

Extensive Editing of the Master Impervious Surface Layer

It was only at that point in time that I realized that I had a lot of data points that were being miscalculated and needed to be checked on. I did this initially by going through the top 50 ‘single family residential’ parcels that had the highest amount of impervious surface area and manually editing them. The manual editing process takes quite a while, and involves deleting, resizing, and drawing polygons that represent the impervious surfaces.

The errors that I mostly found in the data fell into two general categories: surfaces that reflected incorrectly and road bits. The surfaces that reflected incorrectly tended to be very dirty bodies of water, or sometimes even trees and barren land. This came from the Land Classification data layer, which must have incorrectly classified these when the analysis was initially run. I found that parcels that were being used for timber production often had incorrect reflection. I am not sure why that was the case (Something to do with how trees planted in a line reflect light). The road bits were remnants from the public roads that I tried to remove in earlier steps, but that for some reason or another covered more area then was expected. Quite often, a road would have pieces classified as impervious that went a good ways beyond it, which would cause a lot of otherwise empty parcels to show up with a small amount of impervious surfaces.

My editing of the Master Impervious Surface Layer became a much larger project then I was expecting after I realized that these errors were more common than the top 50 parcels would cover. I spent a good two days electronically travelling across the map of Pittsboro’s ETJ and editing anything that looked suspicious. I was able to catch a lot of empty parcels that had impervious pieces attached, and I still focused on parcels that had a large amount of impervious surfaces, as they tended to have more problems to them.

After this round of editing I had a lot more faith in my data, though I also knew for certain that it was flawed, even after editing, but I believed it to be accurate enough for calculating the ERU and a rough estimate of the fees.

Analysis

Finding the ERU with Single Family Parcels

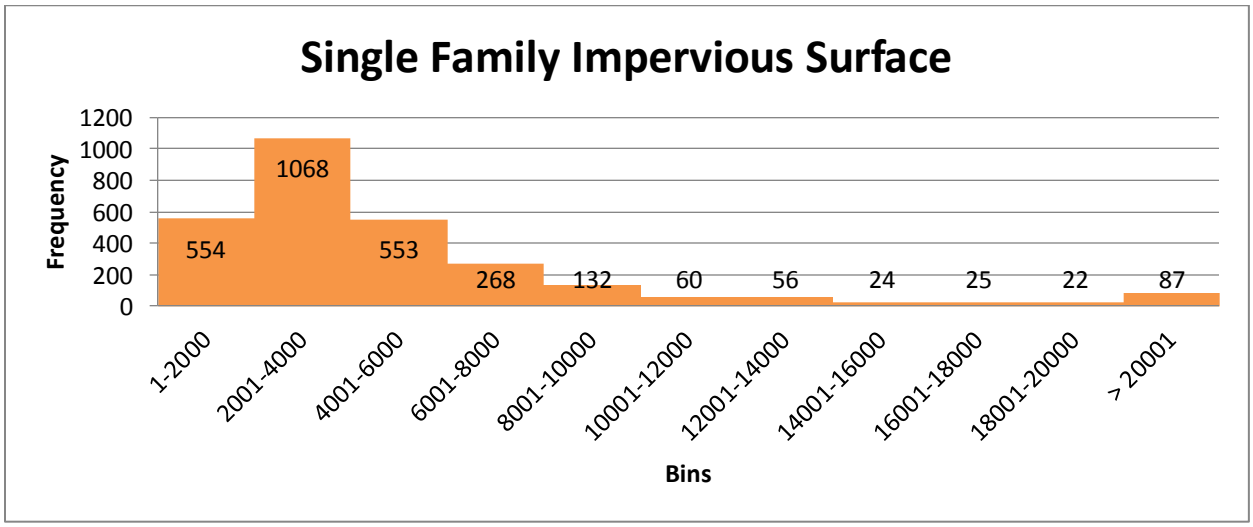
My analysis began with breaking the data from all the parcels into their 5 different subcategories: single family, multi-family, commercial, church, and government. Each category could thus be handled separately, which was especially useful as I was primarily interested in the single family category for most of the analysis.

I ran some Summary Statistics analysis on the Square Feet of Imperious Surfaces for Single Family Residential parcels (the parcels that I classified as 'single family'), and gained these results:

Single Family Impervious Area Analysis	
Mean	5,277
Standard Error	122
Median	3,585
Range	96,598
Minimum	300
Maximum	96,899
Sum	15,034,532
Count	2,849

The most important numbers from this analysis are the Mean and Median, denoting the average and center of the data set, respectively. The Mean is pulled quite a bit to the right of the median because there are a few parcels that have a very high amount of impervious surfaces, and that affects the average more than the center. The Median has 50% of the data on either side of it, and is the more useful number for us (and has been highlighted because of that.

Here is a histogram that graphically represents the data:



Graph 1: Single Family Residential Parcels by Impervious Surface Area, in bins of 2,000

Graph 1, the histogram, shows the frequency, or number of occurrences of a parcel, in each "bin". I set the bin size to be 2,000 square feet of impervious surfaces. The first bin covers 1-2,000 square feet of impervious surfaces, and as the histogram shows us, there are 554 parcels that fall within that category (seen by the number hovering in that column and by the height of the column). The bins go all the way up to 20,000 square feet of impervious surfaces, and then there is a final bin that holds all the parcels greater than 20,000. This simply saves space, as it would require many more bins to get to the maximum value.

I did do a bit of analysis where I calculated which parcels were outliers, and then threw those ones out and re-ran all the summary statistics and graphing. This brought the Mean much closer to the Median, but it only lowered the Median by a few hundred square feet, not a huge amount. The graph for the data looks identical, except it is missing all the values greater than 10,000 square impervious feet, as those were the outliers. It seemed to me that taking out the outliers did not help make the data any more understandable, and as this is a census rather than a survey, I think it is actually useful to have all the parcels represented, especially if we are going to use them to calculate what we will charge as the fee.

It is important to note that the vast majority of the parcels (90% in fact) are under 10,000 square feet of impervious surfaces. After looking some of the largest parcels (in terms of impervious square feet) up on the map, I found that they tended to derive most of their area from long paved drive ways (though it must be noted that gravel driveways also often showed up as impervious, and could be incorrectly increasing the impervious area for some parcels). There are also parcels that from the tax data seem like they should be zoned as residential, but then have things such as long chicken (or some animal) houses. I do not know if these should be changed to commercial, and this requires further study.

The analysis of the Single Family Residential parcels leads to one important conclusion, or at the least points to it—ERUs. As an ERU (Equivalent Residential Unit) should represent an "average household's impervious surface area", it make sense to set one ERU equal to 3,500 square feet of impervious surfaces, or roughly the median of the data set. At the very least, the ERU should be set between 3,000 and 4,000 (maybe 5,000) square feet of impervious surfaces. With some ideas in mind about what the ERU should or could be, it was possible to start seeing what the fee could be set to.

Levels of Service

I knew from discussions with Fred Royal, the Town Engineer, that we had three separate levels of service that we wanted to know how much the fee to fund each would be. Each would be used in the survey that we planned to send out in order to give people a choice experiment in that would hopefully show us their willingness to pay. The three levels of service are shown with their total cost and a short description:

Level of Service	Estimated Cost to Town (Annual)	Description of Service
1 The Current Program	$50,000	+ A continuation of the current Stormwater Program. Serious defects may be fixed only when the system fails; little or no regular maintenance. + Administration of Stormwater Ordinance Rules for **new** development to reduce stormwater pollutants (required by Jordan Lake Rules).
2 Essential Maintenance of System	$150,000	+ Administration of required Stormwater Ordinance Rules for new developments. + Public Right of Ways Drainage Maintenance and Improvement. Probably two minor stormwater projects a year (essential maintenance). + Maintenance of Existing Best Management Practices (BMPs). BMPs include rain gardens and retention ponds that reduce stormwater runoff.
3 Proactive Maintenance of System	$250,000	+ All the services described in Scenario 2, plus… + An Increase in public education on stormwater management + More improvements focused on water quality: stream restorations, watershed studies, BMP retrofits and improvements + Ability to develop a Capital Improvement Program (CIP) for drainage improvements (proactive maintenance).

These levels of service (and their respective costs) were used to then determine what the utility fee should be. The aim was to have three separate fee amounts that would fund each of the three service levels.

Calculating the Fee

There are many different methods to use for paying for a Stormwater Management Program. Even under the auspices of a Stormwater Utility Fee there are still many variations to choose from. All parcels can be charged a single flat price or the fee could be based off of parcel size or impervious surface area (the one we are using). Even then, some programs charge Residential properties only a flat rate, and use the ERU to calculate the rate for commercial properties. It was decided that our program would have a tier system for the single family residential properties, and would charge the other properties based off of their ERUs. This keeps the system fairer and easier for a single family to be able to manage their costs.

Setting the Fee

Now that I had all the data for the square feet of impervious surfaces for every parcel, a rough idea of what the ERU size could be, and the costs for each level of service, I could finally

begin determining possible values for the fee. I set up an "overview" page in Excel that had all the input variables (ERU size, Fee cost) and then set equations up for every parcel that would calculate its relative ERU and Fee, and then summed up the data for the five different subcategories: single family, multi-family, governmental, commercial, and churches. This data I then sent to my overview page, and combined the single family, multi-family, and commercial sums to calculate total revenue of the program. The governmental and churches sums were combined to see how much revenue was not being collected.

This overview page let me very easily play with the different possible fee and ERU sizes and then easily see the results in the revenue gathered. I also set up a system of equations that allowed me to create tiers for the single family residential parcels, and then set specific fees for each tier. I created three tiers for this.

The data table below will show the inputs—ERU size, fee, tier sizes, tier fees—and the outputs—revenue gathered per year and revenue not gathered per year. For more information on this, see Appendix A.

Scenario	Inputs				Outputs	
	ERU Size	**Fee per ERU per Month**	**Tier Sizes**	**Fee for Tier per Month**	**Revenue not Gathered per Year**	**Revenue Gathered per Year**
1	3,500	$1	1-3,500	$1	$13,284	$83,268
			3,500-7,000	$2		
			>7,000	$3		
2	3,500	$2	1-3,500	$2	$26,568	$166,536
			3,500-7,000	$4		
			>7,000	$6		
3	3,500	$3	1-3,500	$3	$39,852	$249,804
			3,500-7,000	$6		
			>7,000	$9		
4	3,500	$4	1-3,500	$4	$53,136	$333,072
			3,500-7,000	$8		
			>7,000	$12		

I did not change the ERU size for any of the inputs, as it was determined previously that 3,500 was roughly the median ERU size, and so it seemed the best to set it as. However, it should be noted that, if you decreased the ERU size, the revenue gathered would increase, and vice versa. As Pittsboro continues to grow and change, the ERU size could be changed to account for that.

The Tier Sizes also do not change for any of the four scenarios, and I based the tier sizes completely off of the ERU size. The first tier covers one ERU, the second tier covers two ERUs, and the third tier covers three ERUs and up. This simply makes certain that the few houses that for some reason or another have a ridiculously large amount of impervious surfaces do not end

up being charged a much higher amount than all the other homes. There is, however, still an encouragement to decrease or limit your impervious surfaces, in order to get into or stay in a lower tier.

Each scenario charges one, two, three, or four dollars per ERU, and those numbers are used to determine how much to charge each tier. Tier one pays one ERU worth, Tier Two pays two ERUs worth, and Tier Three pays three ERUs worth.

The final two columns show how much revenue is not gathered—due to it being a church, school, or other governmental property—and it shows how much revenue is gathered. The revenue that is gathered is highlighted in green.

If we compare our revenue gathered back to our three levels of service, and their respective costs, we can see that they match up pretty well. The first level of service is more than covered by the first scenario for fees, the second level of service fits nicely within the second scenario for fees, and the third level of service is almost exactly covered by the third scenario for fees. The fourth scenario for fees just shows what happens if the trend is continued.

Here is the table with the three levels of service again, but also with the Estimated fee for an Average Household:

Scenario	Estimated Cost to Town (Annual)	Description of Service	Estimated Fee for Average Household
1 Funding the Current Program	$50,000	+ A continuation of the current Stormwater Program. Serious defects may be fixed only when the system fails; little or no regular maintenance. + Administration of Stormwater Ordinance Rules for **new** development to reduce stormwater pollutants (required by Jordan Lake Rules).	$1 per Month
2 Essential Maintenance of System	$150,000	+ Administration of required Stormwater Ordinance Rules for new developments. + Public Right of Ways Drainage Maintenance and Improvement. Probably two minor stormwater projects a year (essential maintenance). + Maintenance of Existing Best Management Practices (BMPs). BMPs include rain gardens and retention ponds that reduce stormwater runoff.	$2 per Month
3 Proactive Maintenance of System	$250,000	+ All the services described in Scenario 2, plus… + An Increase in public education on stormwater management + More improvements focused on water quality: stream restorations, watershed studies, BMP retrofits and improvements + Ability to develop a Capital Improvement Program (CIP) for drainage improvements (proactive maintenance).	$3 per Month

Conclusion

With this information it is possible to move on to future steps in creating a Stormwater Management Program, some of the steps I know about are discussed below. A very important point to remember is that there is still lots of error and estimation in this analysis. While I think the data that I created in this project is useful, it should not be considered a perfect representation of Pittsboro, and it should not be used to create a Master Billing System (in order to actually charge a fee, in other words).

It would be useful to do a parcel by parcel analysis of Pittsboro's ETJ and to manually draw out all the Impervious Surfaces and to make certain all the Parcel classifications are correct. That project, however, would take some substantial time, and may even require a newer Aerial Photo (though the one we have currently is not that old).

The most immediate next step is to work on the Stormwater Survey, which would hopefully be able to tell us more information about the citizen's willingness-to-pay (an economic term) and help determine which level of service should be offered and which fee levied. Additional Public Education pieces would also be created in this step. They would be short documents or brochures explaining specific details, the need for Stormwater Program, or the such.

A quick recap of what we now have:

1) A data layer for ArcGIS that shows Impervious Surfaces by Parcel
2) The impervious surfaces of the "average" Pittsboro household, or one ERU (3,500 square feet)
3) An idea of three possible levels of service for the Stormwater Management Program
4) An estimation of the fee that would need to be charged in order to fund each of those levels of service

Next Steps

-Use ERU's and Fee to create a survey for the town (in progress)
-A more thorough editing process for the Master Impervious Surfaces that goes through parcel by parcel, perhaps even using this to create a preliminary Billing Database
-A more in depth description of each level of service
-A short document that describes the calculating of ERUs and Fees in depth
-Perhaps work on the Stormwater Brochure?

Appendix

Appendix A: Fee Overview Analysis Pages

In this appendix are three of the "Overview" pages that I talked about in the Section "Setting the Fee". These Overview pages are for Fees of one, two, and three dollars for the average household.

Average Household Fee: $1

All ERUs System					
ERU Size	Fee Charged Per ERU				
3500	$ 1.00				
	Churches	Commercial	Government	MultiFamily	SingleFamily
Revenue Per Month	$ 148	$ 2,019	$ 959	$ 95	$ 5,664
Revenue Per Year	$ 1,776	$ 24,228	$ 11,508	$ 1,140	$ 67,968
	Money Gathered	Money Not Gathered			
Rev. Per Month	$ 7,778	$ 1,107			
Rev. Per Year	$ 93,336	$ 13,284			

Tier System for Single Family Parcels					
	Tier 1	Tier 2	Tier 3		
Max Value	3500	7000	> 7000		
Count	1378	963	507		
Fee Per Month	$ 1	$ 2	$ 3		
Fee Per Year	$ 12	$ 24	$ 36	SUM	
Rev. Per Month	$ 1,378	$ 1,926	$ 1,521	$ 4,825	
Rev. Per Year	$ 16,536	$ 23,112	$ 18,252	$ 57,900	
	Churches	Commercial	Government	MultiFamily	SingleFamily
Revenue Per Month	$ 148	$ 2,019	$ 959	$ 95	$ 4,825
Revenue Per Year	$ 1,776	$ 24,228	$ 11,508	$ 1,140	$ 57,900
	Money Gathered	Money Not Gathered			
Rev. Per Month	$ 6,939	$ 1,107			
Rev. Per Year	$ 83,268	$ 13,284			

Average Household Fee: $2

All ERUs System					
ERU Size	Fee Charged Per ERU				
3500	$ 2.00				
	Churches	Commercial	Government	MultiFamily	SingleFamily
Revenue Per Month	$ 296	$ 4,038	$ 1,918	$ 190	$ 11,328
Revenue Per Year	$ 3,552	$ 48,456	$ 23,016	$ 2,280	$ 135,936
	Money Gathered	Money Not Gathered			
Rev. Per Month	$ 15,556	$ 2,214			
Rev. Per Year	$ 186,672	$ 26,568			

Tier System for Single Family Parcels					
	Tier 1	Tier 2	Tier 3		
Max Value	3500	7000	> 7000		
Count	1378	963	507		
Fee Per Month	$ 2	$ 4	$ 6		
Fee Per Year	$ 24	$ 48	$ 72	SUM	
Rev. Per Month	$ 2,756	$ 3,852	$ 3,042	$ 9,650	
Rev. Per Year	$ 33,072	$ 46,224	$ 36,504	$ 115,800	
	Churches	Commercial	Government	MultiFamily	SingleFamily
Revenue Per Month	$ 296	$ 4,038	$ 1,918	$ 190	$ 9,650
Revenue Per Year	$ 3,552	$ 48,456	$ 23,016	$ 2,280	$ 115,800
	Money Gathered	Money Not Gathered			
Rev. Per Month	$ 13,878	$ 2,214			
Rev. Per Year	$ 166,536	$ 26,568			

Average Household Fee: $3

All ERUs System					
ERU Size	Fee Charged Per ERU				
3500	$ 3.00				
	Churches	Commercial	Government	MultiFamily	SingleFamily
Revenue Per Month	$ 444	$ 6,057	$ 2,877	$ 285	$ 16,992
Revenue Per Year	$ 5,328	$ 72,684	$ 34,524	$ 3,420	$ 203,904
	Money Gathered	Money Not Gathered			
Rev. Per Month	$ 23,334	$ 3,321			
Rev. Per Year	$ 280,008	$ 39,852			

Tier System for Single Family Parcels					
	Tier 1	Tier 2	Tier 3		
Max Value	3500	7000	> 7000		
Count	1378	963	507		
Fee Per Month	$ 3	$ 6	$ 9		
Fee Per Year	$ 36	$ 72	$ 108	SUM	
Rev. Per Month	$ 4,134	$ 5,778	$ 4,563	$ 14,475	
Rev. Per Year	$ 49,608	$ 69,336	$ 54,756	$ 173,700	
	Churches	Commercial	Government	MultiFamily	SingleFamily
Revenue Per Month	$ 444	$ 6,057	$ 2,877	$ 285	$ 14,475
Revenue Per Year	$ 5,328	$ 72,684	$ 34,524	$ 3,420	$ 173,700
	Money Gathered	Money Not Gathered			
Rev. Per Month	$ 20,817	$ 3,321			
Rev. Per Year	$ 249,804	$ 39,852			