STORM DRAINAGE INVENTORY SYSTEM- THE GWINNETT COUNTY CASE HISTORY

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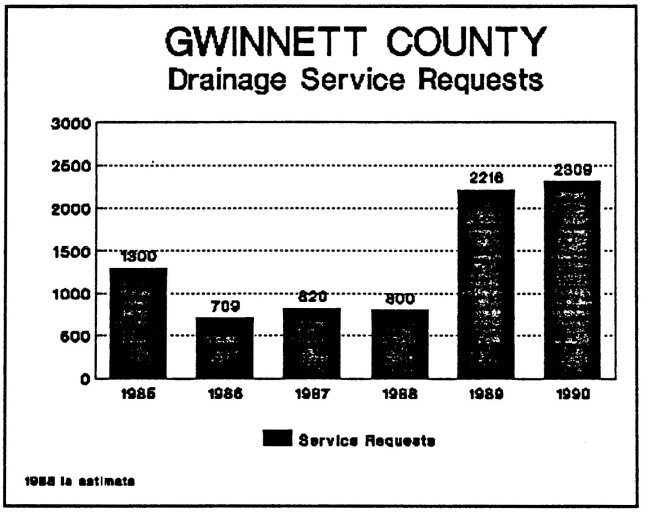
INTRODUCTION

The need for an storm drainage inventory system quickly becomes evident to those responsible for the maintenance of a storm drainage system. Reasons a system is needed and Gwinnett County's efforts to obtain a storm drainage system inventory and track maintenance records are documented. The inventory system Gwinnett County currently uses is presented along with steps Gwinnett County is taking to prepare for the EPA Storm Water Discharge permits.

NEED FOR A STORM DRAINAGE INVENTORY

The storm drainage inventory can be visualized as being at the center of an integrated solution to storm water management. Storm Water Management design, maintenance, financing, and EPA regulations need an inventory of the drainage system. Design of drainage projects should be based on the basin upstream and existing conditions downstream. The designs need to be tied together and the design policy should be based on how the system is expected to function as a whole. Maintenance policies should be based on the size and condition of the system. The maintenance history needs to be recorded so it can be determined how many times a part of the system has been repaired and if other parts of the system nearby have been repaired. Also preventative maintenance can be scheduled once the size and condition of the system is known. Financing is affected by the size and condition of the system. Determining budget and staffing needs becomes possible with a maintenance history and an inventory. Past performance can be analyzed and the cost of future repairs and preventative maintenance can be estimated. Lastly, the EPA regulations require an inventory of outfall pipes along with other data about the basin and the storm water discharge from the basin.

Gwinnett County recently experienced a need to know the size and condition of the storm drainage system to answer questions concerning drainage maintenance policies. Gwinnett County has been the fastest growing



County in the nation for several years. Heavy rainfall in July, 1988, which came after a two-year drought, resulted in an outcry from the public concerning drainage conditions in the County and maintenance policies.One recurring request which surfaced during this period was for the County to assume maintenance of detention ponds and ditches in the County. Before such an action could be recommended to the Commissioners, an estimate of the cost of such action was needed. The cost depends, of course, on the number and the condition of the ponds and ditches and that information was not available. An inventory had not been made due mainly to a lack of staff.

HISTORY OF INVENTORY EFFORTS

The County has tried on several occasions to determine the size of the Storm Drainage System that must be maintained. One of the first major efforts to inventory the system started in 1986 and continued for almost two (2) years. One employee started to inventory detention ponds.

The field data was written on a form and transferred to a software program called "Professional File." He covered 183 land lots out of 1100 or about one-sixth of the County

in a 8twenty (20) month period. At that rate an inventory of the County would have taken ten years. Then we would have needed to start over to pick up all the new subdivision ponds. The information was consolidated by sticking pins in a County map scaled at 1" = 4000'. During this effort, two (2) employees also started to inventory the drainage systems. They were able to gather information in only ten (10) land lots before they stopped. One of the employees was a part-time employee and when he left, the project stopped.

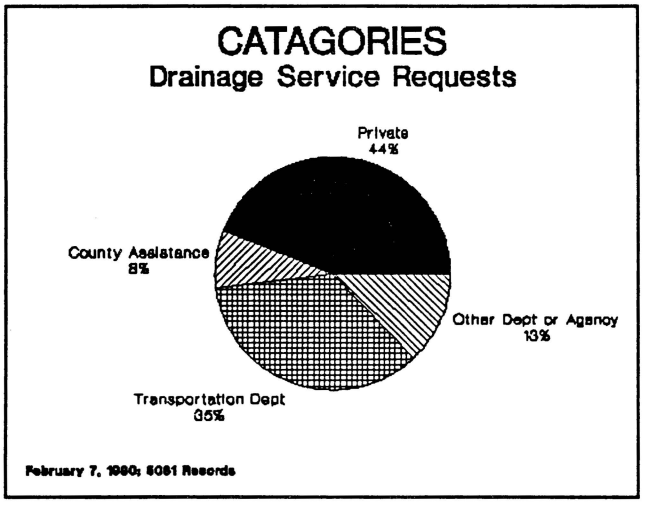
Lessons learned were, 1) collecting field data was very time consuming, 2) field work was easier when final subdivision plats were obtained prior to going into the field, 3) a software program with a database was needed to produce reports, and 4) a reproducible map was needed.

The second major effort was in 1989, when another part-time employee was available for inventory. This time no field data was collected. Pipe data was taken from final plats and input into the computer using Lotus 1-2-3. The pipes were plotted on tax maps to consolidate the data. In nine (9) weeks he collected information on twenty-two (22) miles of pipe in 26 land lots out of 1100, or one-fortieth (1/40) of the County. At that rate, an inventory of the County would have taken seven (7) years. Again when the employee left, the project stopped. Lessons learned concerned the difficulties in numbering the system and the size of the database. The Lotus 1-2-3 file exceeded the memory capacity of the PC which was 1 megabyte and so we could not keep the database in one file. Although Lotus 1-2-3 can be used as a database manager, that is not the main feature of the program.

HISTORY OF TRACKING SERVICE REQUESTS

The second brief history presented here concerns our maintenance records. In 1987 the Drainage Engineering Section started to track complaints using a computer. The service request number, name of complainant, address, date, priority, and type of problem were entered into a Lotus 1-2-3 spread sheet. At first, only the active jobs were kept on the computer. This allowed the production of a priority list of active jobs. The priority was based on the severity of the problem and age of complaint. All service requests were filed by street name.

Late in 1988 we started keeping track of all service requests on the computer and a status column was added in mid 1989. By tracking all the service requests, reports can be generated on the number of investigations handled as well as what percentage of the complaints fall into different categories. Forty-four (44) percent of the drainage service requests are determined to be private and require no further action by the County. Eight (8) percent qualify for County assistance under two property owner assistance programs called Pipe Extension and ROCK. Thirty-five (35) percent are the responsibility of the



Department of Transportation to correct, the remaining thirteen (13) percent are referred to other agencies or County departments.

A status column allows the determination of how many service requests need designs, right-of-entries, or are ready for construction. In October of 1990, there were 520 active projects. Of these projects, 200 required design, 114 needed right-of-entries, 172 were on the construction list, and 34 were requests for rip rap under the ROCK program.

A problem encountered was the database was too large for the PC memory. The solution was to split the file into active and inactive jobs. This was not a good solution because the reports could not be automated and data was constantly being transferred. By mid-1990, the problem had become intolerable. The data was split into eight (8) files so it could be accessed.

SYSTEM DEVELOPMENT

The experience gained with the inventory efforts as well as the tracking system was used to develop a new system. Major aspects of the system are the record index, graphics, software, procedure, and staffing.

Record Index

There were three major problems to be solved with a record index. First, the maintenance records were kept by street address and so there was not a well defined maintenance history of our system. The service request at a particular street address could be for the catch basins next door or for the ditch in their backyard. Second, a way to tie the inventory and the maintenance records together was needed. The third question was how to describe and number the system. It was felt that trying to

number the system consecutively by line number or by basin would be hopeless. This method either became complex quickly or would require a lot of coordination when several people were collecting information. It also would not allow a partial inventory of the system because the entire system had to be known in order to number it. Other problems with this method would be caused by additions to the system and later discoveries in the field.

The solution was to break the system into two broad categories of links and nodes, and to simply give each link or node a unique number. A link is a conveyance system that channels storm drainage from one location to another. An example is a ditch or a pipe. A node is the intersection of two or more links. An example is a catch basin or a headwall. The connectivity of the system is maintained by recording the upstream and the downstream node with each link.

The inventory database is related to the service request database with the use of a table containing the service request number and the node(s) or link(s) to which that service request relates.

Graphics

The drainage system is currently being drawn onto prints of aerial photographs of the County. Orthophotos, which are aerial photos that have been adjusted so they are true to scale, of the County are being developed, but in the interim the prints of the uncorrected aerial photographs are being used. Once the orthophotos are available, the information will be transferred to them. Ultimately, the information will be digitized from these orthophotos to a Geographic Information System (GIS). The tax maps were considered as in the 1989 effort, but they were not used because the scale is often incorrect and the field data gathered by the investigator would be lost because there was not an easy way to relate what he observed in the field to the tax maps. It was also decided to proceed without the orthophotos or the GIS system in place, because it was felt that the project would never start if everything had to be in place before starting.

Software

It was obvious that a true database management program was needed. Two (2) inventory software programs investigated were Sewer Inventory Management System (SIMS) by Chappell and Associates Incorporated and Wastewater Collection Management System (WCMS) by Hansen Software Incorporated. Neither system was selected for two (2) major reasons. First, they were proprietary software and could not be altered to fit our needs without some expense. Second, the County was trying to select and obtain GIS software and so any program selected had to be compatible with what the Gwinnett County Management Information System Department wanted. The Drainage Engineering Section decided to switch to a relational database program called R-Base and began the task of automating our reports. The change was well worth the difficulties. One of the advantages that caused a lot of work was that the entire database was now available for analysis and errors in the data were discovered very quickly. As more detailed reports were automated, more errors in the database were found.

The Drainage Engineering Section was also able to start keeping better track of the jobs that were given to Construction and for the first time we began compiling actual cost data. In the past, the estimated cost of outstanding jobs was based on a best guess, but now the cost is estimated based on past history. As more data is obtained, the cost estimates will be done by the type of work done rather than the broader categories of construction or maintenance. Age reports are also done now to identify projects that may need special attention.

Procedure

In January of 1990, one person was assigned to start a field inventory of a three (3) square mile drainage basin. This was to be a pilot study to determine what was the best way to collect data and how much data was reasonable to collect in the field with just one person. Initially he collected detailed information that could be used in the future, but was not needed immediately. It was reasoned that it would not take him long to get the information since he was already there. One such detail was the size of the catch basin openings. The plan was to check inlet capacities in the future. After several iterations and modifications, we developed an inventory sheet that was easy to use and eliminated some of the data that was nice to have, but would not be used in the near future.

The inventory method that appears to work best is for the investigator to collect as much information as possible from final plats before he goes into the field. Thus the investigator's effort in the field is mostly verifying data collected from plans which is easier than collecting raw data from the field.

Staff

One major obstacle to obtaining an inventory is staffing. After reviewing the section's procedure, it seemed that an opportunity to inventory the drainage system was being missed. A technician investigating a service request was looking at the drainage system. All he needed was an easy way to record what he saw. The technicians who

investigate the service requests were asked to fill out an inventory sheet on the system they looked at as well as respond to the service request. After modifying the form to make it easier to use and after they became familiar with what information was needed, the resistance to change passed. The form is now almost a check-off form with only a few fill-in-the-blank questions.

NPDES STORM WATER DISCHARGE PERMIT

The National Pollution Discharge Elimination System (NPDES) regulations for storm water discharge define a major outfall as a conveyance (pipe or ditch) discharging into waters of the United States with a contributing drainage basin of fifty (50) acres or more in residential areas or of twelve (12) acres or more in an industrial area. Breaking the County up into over 6000 basins and collecting data on these basins will be a monumental effort. This effort is even more difficult because almost no inventory exists and none of the permit data required for each outfall is available.

The Drainage Engineering Section decided to make a broad pass at the County and break it up into approximately sixty (60) basins. Once data required by the EPA is collected on these basins, then these basins will be broken down into smaller sub-basins.

SUMMARY

The need to keep up with the number of service requests and their location is important. All managers responsible for system maintenance need to keep good records of their activities and not throw them away once they are completed. This information provides the documentation needed to justify storm water management staffing and funding levels. If the information is put in a database management software program, reports can be created which can document productivity and status of outstanding projects. By creating an easy to use inventory form, the drainage investigators can inventory the system while performing their primary task of investigating complaints. An added benefit is that an inventory allows the service requests to be tied to each pipe or structure in the system to create a maintenance history of that component.

An off-the-shelf database management program was selected to store the drainage system inventory and drainage service request information. Its ability to store and report on the drainage system inventory as well as the County's maintenance activities has been most satisfactory.