

Data Sets That Enable the Plan II: Storm Water Project Tracking

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Abstract

In a utility focused on customer service, maintaining and improving a seamless project tracking system that distributes knowledge to the enterprise in a timely manner is a key business requirement. This system has evolved from an Excel workbook which created simple datasets to a custom SQL based application with an Access front-end. SQL scripts pull data nightly from a customer service database located on an oracle server to populate the tracking system. Included in this customer service data is the Parcel ID, when populated into the system is associated with its proper x,y coordinate and can be spatially represented. Among the tasks, it is used to track project locations, costs, types of work, associate project photos, assists in answering City Council inquiries, inventory collection verification and staff productivity. Yearly, the system is utilized to prepare GASB 34 Asset Tracking Reports, determine trends in land development, forecast staffing and contract resources.

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Background

Charlotte

Home of the second largest banking community in the United States and to one and a half million people within its metropolitan area, Charlotte is the 20th largest city in the United States and still growing. Three-hundred-six 'Fortune 500' companies are located in this North Carolina city with many being headquartered in the "Queen City". The City government strives to provide efficient services to its residents at minimal cost. These services include transportation infrastructure, sanitation, water, sanitary sewer and storm water management.

Storm Water

With the continuing expansion of the Queen City in commerce and residents, the utility infrastructure required to support this growing society continues to expand. Charlotte's Storm Water Services utility was established in 1993 by acquiring the City's first National Pollutant Discharge Elimination System (NPDES) permit, one of the earliest storm water utilities in the nation. Storm Water Service's goal is "to provide the community with a quality storm drainage system that is safe, clean, and cost-effective". The utility was set up to address problems that were caused wholly or in part by storm water runoff from public streets.

Storm Water Utility is strategically divided into four teams to accomplish its mission. These teams are:

- A-team
The Administrative Team oversees financial functions, maintains oversight for resident communications, GIS, and technology management.
- Q-team
The Water Quality Team manages the enforcement of the environmental regulations mandated by the NPDES permit.
- E-team
The Engineering Team works with consultants to plan and construct neighborhood-wide Capital Improvement Projects (CIP's) of the storm water management systems.
- M-team
The Maintenance Team provides repair on a citizen-by-citizen basis.

This system results in all requests for service first being sent to the M-team for assessment before being redistributed to other teams for work. The M-team works closely with the other three Storm Water teams to track execute and complete citizen requests.

This paper will focus on the development and implementation of a sql based tracking system to complete work utilizing a GIS data set. Additional focus will be placed on how this data works in conjunction with Charlotte's Enterprise GIS to aide in Storm Water tasks.

Storm Water Program: Executing work

Process

Each project begins with a "Request for Service". Customers call the City's 311 information line or complete an online form to report their storm water issue. This information is stored in a custom database system known as Emerald. Emerald was created

in 1989 in the wake of Hurricane Hugo. At the time, the city did not have a way to track customer service calls except pen and paper. During the cleanup of Hugo the city needed a way to track downed power lines or fallen trees. It also helped the police department by tracking roads that were blocked.

In one weekend Emerald was born and became the first customer service application for our call center. It was originally built on a FoxPro platform, over the years it has been updated and moved to an Oracle system. It is still used and maintained today by our call center for Storm Water, Solid Waste and Charlotte-Mecklenburg Utilities.

An inspector visits the site and determines if the problem qualifies for service and what priority it should be assigned. Each request is classified based on the following criteria:

- 'A' - High priority problem that may consist of living space flooding, imminent structure damage, or flooding that poses a threat to the traveling public.
- 'B' - Medium priority that may consist of crawl space flooding, severe erosion threatening secondary structures, pipe or drainage structure failure, or erosion that adversely affects water quality.
- 'C' - Low priority that may consist of moderate erosion or standing water.
- 'DNQ' - The problem does not receive runoff from a public street. Permission is then obtained from the affected property owners; the project is then designed and constructed. The request is then closed out.

Managing Work: Project Tracking

The City of Charlotte is divided into eight watershed work areas. Once a citizen's request has been qualified, it is assigned to a watershed work area based on the geographical location. Each watershed has an assigned number of Drainage Specialists, based on workload, to handle requests. A project begins with assessment of the problem and determining the scope of work. After permission is granted from the affected property owners, the project is designed to City standards and assigned to a contractor for construction. Prior to Project Tracking, each Drainage Specialist had a different way of designing and producing project documentation. A system was needed to merge the best of each Drainage Specialist's methods and incorporate the ability to track all aspects of work geographically.

Project Tracking: The how, what and why of it all

Microsoft Excel Tracking

The original Project Tracking was an Excel workbook made of spreadsheets that utilized visual basic code to create and export dbf files. These were then sent to GIS and geocoded. While this workbook provided a solution at the time, there were a variety of aspects we knew could be improved. The workbook was time consuming to complete, lacked data validation and could not be integrated with the customer service database. The workbook was only utilized by the M-team, which meant only maintenance and point repair projects were being tracked.

For these reasons, it was determined that a single database, distributed throughout Storm Water different divisions, should be created. This 'new' Project Tracking would track all aspects of Storm Water projects as well as the parcels that are currently or have in the past required Storm Water service.

SQL Database

The programming necessary to create a database of this magnitude required that we work with a consultant. A sql database application was created with an Access front end. This new application is project based, meaning every service request is now attached to a project. By taking this approach, multiple requests can be tied into one project; bringing in the parcel information for those requests. Examples of information that is tracked by project include the consultant, cost, time to complete, hard structures, NPDES permit types, street degradations and warranty inspections.

Data validation was added to every field. This was easily done by including drop down options which creates consistency in reporting. Some of the reports that are generated from this data are team production reports detailing all aspects of spending, project costs, inventory, GASBY reporting items and production workloads

A new feature of Project Tracking is the screen displaying 'My Requests' which aids the user in managing their own workload. Not only are users able to sort 'Requests for Service' by any of the column headings but the database is designed to organize. The system can prioritize request or projects, finding a balance between the priority assigned and the date received.

Request	Address	Project Name	Received Date	Status	Priority	View
3901	6623 Pencade Ln	6623 Pencade Ln	6/14/1993	Open	C	View
8954	9628 Vinca Cir		12/20/1995	Open	C	View
10905	9624 VINCA CR		3/25/1997	Open	C	View
11178	9624 Vinca Cir		5/19/1997	Open	C	View
11745	9622 Vinca Cir		8/14/1997	Open	A	View
13192	9622 Vinca Cir		4/22/1998	Open	A	View
14924	423 Long Creek Pky		4/15/1999	Open	C	View
369993	9603 Vinca Cir		2/16/2000	Open	B	View
663587	8336 Dunstaff Rd		5/31/2001	Open	C	View
672859	422 Cannings Ln		6/14/2001	Open	C	View
805681	7538 Melstrand Way		1/18/2002	Open	C	View
855137	2117 Highland St	Columbus Circle	4/11/2002	Open	C	View
966828	10453 Roundleaf Dr		9/25/2002	Open	C	View

Once it is determined that a request is moving forward into a project, the user searches the database of all existing request to identify any other pending requests within the same geographical area. This allows multiple requests to be built into one project from conception, not discovered later and added as an afterthought.

Project Tracking

Request #: Watershed:

Received Date: To:

House #: Status:

Street Name: Assigned To:

Zip: Priority:

Project Name: Parcel ID:

Citizen Name:

Allow Multiple Select

Request #	Address	Project Name	Received Date	Priority	Status	Selected
8954	9628 Vinca Cir		12/20/1995	C	Open	<input type="checkbox"/>
10905	9624 VINCA CR		3/25/1997	C	Open	<input type="checkbox"/>
11178	9624 Vinca Cir		5/19/1997	C	Open	<input type="checkbox"/>
11745	9622 Vinca Cir		8/14/1997	A	Open	<input type="checkbox"/>
13192	9622 Vinca Cir		4/22/1998	A	Open	<input type="checkbox"/>
369993	9603 Vinca Cir		2/16/2000	B	Open	<input type="checkbox"/>

Upon completion of construction on a project, the user will press the 'Construction Complete' button. This generates an email to the inventory team letting them know a project is complete and inventory information needs to be collected. This step allows us to attain one of the Storm Water departmental goals of collecting 100% of the inventory on completed projects. Once the inventory for a project is complete, the QA/QC specialist will enter a unique Inventory Tracking number and verify that inventory information is complete.

The screenshot shows a software window titled 'Project' with a search icon in the top right corner. The main area contains the following fields:

- Project Name:** 1525 W Tyvola Rd
- Address:** 1525 W Tyvola Rd
- Description:** repair headwall
- Parcel ID #:** 143-231-03

Below these fields is a tabbed menu with the following tabs: Status, Details (selected), Properties, Emerald Requests, Parcels, Hard Structure Items, Folder Content Checklist, Degradations, Inventory, and Inspections.

The 'Details' tab contains the following information:

- Project Number:** 571-07-007
- Construction Start Date:** 2/4/2008
- Construction End Date:** 2/11/2008
- Capital Improvement:**
- No Work Required:**
- Photo(s) Location:** [Search icon]
- Estimated Mobile Days:** [Empty field]
- Est. Construction Cost:** [Empty field]
- Consultant:** [Empty dropdown]
- Contractor:** Kip Corporation
- Inspector:** Alzate, Carlos
- Inspector #2:** [Empty dropdown]
- Main Objective:** Maintenance & Repairs
- Object Code:** 35240
- Assigned To:** McMahan, Brian
- Project Phase:** Construction Complete
- Total Daily Mobilization:** 6
- Number of Blue Cards:** 1
- Total Days in Construction:** 7
- Total Project Cost:** \$25,219.91
- Requires Landscape:** (Through Tree Planting Contract)
- Final Monthly Estimate #:** 50

A 'Work Description' text area contains the following text: "Repaired blowouts in existing endwall and plug joints in 84" CMP. Constructed ditches to divert water from top of headwalls to help prevent future erosion. Matted ditches with C-125 and other areas with DS-150."

At the bottom of the window are four buttons: Construction Complete, Approve Project, Close-Out Project, and Reassign Project.

The user can now close out the project by simply pressing this single icon. As soon as this is done, a report opens with all the detailed information that is filed into a paper folder. This Closeout Report records the following:

- request(s) for service that are closed through the user's work
- parcel identification number(s) where the project was completed
- easements acquired, if applicable
- total cost of the project
- hard structures used to construct the project
- status of the GIS asset inventory.

Charlotte Storm Water Services
Project Tracking Form

Request Number: 2448254 B Contract: FY-2008 A

#	Dir	Street Name	Type	Parcel ID	Maint./Channel	Begin	End	Project #	Contractor	Inspector	Inspector #2	Drain Spec.
3627		Durham	Ln	04532233	Maintenance & Repairs (M-M)			671-06-001	Showwater Construction	Dressler, Jeff		Honeycutt, David

All request numbers completed with this project: 2448254 B
 All properties involved in this project: 04532233 3627 Durham Ln

Hard Structure Inventory Items	Quantity	Total Cost	Folder Content Checklist:
18" R.C. Pipe Culverts - LF	112	\$3,016.16	All design information <input checked="" type="checkbox"/>
18" R.C. Flared End Sections - EA	1	\$460.00	Consultant contracts / Invoices <input checked="" type="checkbox"/>
Masonry Drainage Structures - EA	1	\$1,177.60	Easements (filed & copied) <input checked="" type="checkbox"/>
Frame With Cover, Sto: 840.548 - EA	1	\$307.20	Material tickets <input checked="" type="checkbox"/>
			Permit information <input type="checkbox"/>
			Project Photos sent to 'P' Drive <input type="checkbox"/>
			Right of entries <input type="checkbox"/>
			Survey notes (E-Team Digital) <input type="checkbox"/>
			Updated sketch plan (if changed) <input type="checkbox"/>
			All resolved Emerald requests <input checked="" type="checkbox"/>
			Deiry <input checked="" type="checkbox"/>
			Final quantities <input checked="" type="checkbox"/>
			Notice to proceed <input checked="" type="checkbox"/>
			Planning/geotech rpts. <input type="checkbox"/>
			Relevant correspondence <input type="checkbox"/>
			Sketch plan / profile <input checked="" type="checkbox"/>
			Topo map (with drainage area) <input checked="" type="checkbox"/>
			Work order <input checked="" type="checkbox"/>

Detailed Description of Work Completed: Installed 112 Lf of 18" RCP & PES, with one drainage structure. Other work performed to install pipe was tree removal, chain link fence removal & reset, & seeding.

Type of Work: System Replacement

Inventory Verification: Miller, Kemp Date: 5/12/2008 Number of Blue Cards: 2 Total Daily Mobilization for this Project: 8

Properties Served: 2 Requests Closed: 1 No Work Required: Total Project Cost: \$17,682.16

Permit Types: Nationwide 3 Fund/Cost Center: 2701 359.00 Repairs to Existing Storm Drain Calendar Days: 29

Monthly Estimate Number: 117

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ESRI ArcMap feature class

In order to map this data, a sql view was created querying the project tracking database for only construction complete projects, no work required projects and completed projects. The most essential fields were included in the query, such as project name, parcel ID, project cost, Contractor, Drainage Specialist, Inspector, etc. If more information is needed, the application itself can be referenced.

In ArcMap an OLE DB connection is made to the sql server in ArcMap and that view is added to the table of contents. From the Enterprise server, the parcels feature class is added and a join is then made. The join to the county parcel layer is attained through the COMMONPID, or common parcel information number field and the ppa_par_id, or parcel ID field, in the Project Tracking view. Only parcels identified in the Project Tracking view are maintained in the join process and are then exported to a new feature class in the storm water data model.

Project Tracking is attached to Storm Water's 'Add Common Themes' tool bar, a user friendly menu kept current by the GIS staff. This makes the system easily accessible without having to surf multiple data access points.

Why Project Tracking?

The Project Tracking layer is available for continued analysis with all other Enterprise data such as construction projects, parcels and road resurfacing. By maintaining this data, Storm Water is able to plan future work based on easements acquired through existing projects, save money by working with other city entities that have projects in the same area and assess trends. Trends found through multiple request or projects in the same geographic area allow evaluation to determine if a larger problem exists that may need to be dealt with as a Capital Improvement Project. Before the Project Tracking application, many files and individual memories had to be queried, to attempt to identify flooding patterns and what previous action was taken in response to request. With Project Tracking, the facts of who, what and when can be pulled instantly using GIS to efficiently plan projects and assist in forecasting the future workload in any given area.

The use of GIS in Storm Water provides the City a better understanding of where its' Storm Water fees are being spent and the communities and citizens who are benefiting from the storm water utility.

Other Uses

GASB Reporting

The Government Accounting Standards Board establishes financial accounting and reporting standards for state and local governments which demonstrates accountability and stewardship of public resources. The report is widely used by the municipal bond industry to assess a city or county's ability to repay its debt and is one of the factors involved in determining an entity's bond rating. As part of the GASB reporting, Storm Water submits an account of the Hard Structure Inventory Items. This is the amount and value of all tangible items installed throughout the fiscal year such as pipe, culverts, and other drainage structures. Before the implementation of Project Tracking, it took weeks of compiling data from many different sources to collect the required information. Now, the report can be prepared from a Project Tracking database which contains all inventory items. This is now completed in a matter of minutes instead of weeks.

Council, Citizen and Media inquiries

Storm Water Services receives information requests from City Council members, citizen groups and the media. All inquiries can be handled easily using Project Tracking. One of the most common inquiries is in regards to areas where Storm Water service has been provided in the past. By using the Project Tracking GIS layer in combination with other layers, maps are easily produced to display the information graphically. Simultaneously, the data can be exported to a spreadsheet for further analysis.

Employee and Contractor Performance

Employee and contractor performance can be assessed easily using Project Tracking. Employees are able to track their own performance throughout the year and adjust their workload accordingly to meet preset goals. Contractors' performance is tracked to insure construction output and spending rates remain on target through the year.

Workload, work force and budget forecasting

Project Tracking is used to forecast production quotas for future departmental goals. By accurately tracking vital project information, trends can be identified, thus workforce and budgetary requirements are more accurately and easily determined.

What's next?

WAM – Work Asset Management

Charlotte is currently undertaking an initiative that will create a citywide work asset management software program. Over the coming years, the city will implement a single application that will integrate a customer service, request for service, work order tracking and spatial interface. At present, the call center has over a dozen different customer service tracking applications. In order to provide efficient service, every application has to be open and queried at any given time to provide necessary feedback. While the current system works, it is tedious for call center operators and often information is untimely, incomplete and inaccurate. Unfortunately the human component in data compilation is prone to error when there are multiple source applications. A single asset management software program will compile all necessary data and allow immediate, complete and accurate data to be dispersed at the push of a single button, creating cohesion throughout the division.

The Project Tracking system enables Storm Water to effectively and accurately track projects from conception and follow them to completion. In the current tracking system data is available through ArcGIS to provide project analysis and monitor Storm Water work throughout the city. As Charlotte continues to grow, GIS solutions, like Project Tracking, will continue to be an integral part of the infrastructure for city development and predicting the needs for the future in our 'Queen City'.