THE POWER OF WATER: THE NECESSITY OF STORMWATER DRAINAGE SYSTEMS IN MINNESOTA

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The city of Eagan's mission is to "serve the needs and interests of its present and future citizens by providing quality public services, personal and property protection, a healthy environment, a stable tax base, attractive amenities, a sense of community and ethical representation" (www.cityofeagan.com). The city's utility department operates its stormwater drainage network, which is necessary to minimize or prevent severe flooding. This utility system is especially important in Minnesota where there is a vast amount of rainfall, snowfall, and runoff. The stormwater pond inventory is conducted once every 10 years; I conducted the 2000 inventory.

Eagan experienced severe flooding in the summer of 2000. In July of that year, two consecutive night storms (July 7 and 8) produced a total accumulation of 14 inches of rain. More than 200 homes suffered substantial water damage. The Eagan City Council declared a state of emergency to initiate the process of determining the community's ability to receive federal and state disaster relief. Much tree debris clogged the drains and inhibited proper stormwater drainage. Several of the city's main roads were closed due to water flowing over them, and the ground was so saturated that water could not be physically pumped out of the system. People had to just wait for the water levels to decrease (Foote 2000a and 2000b).

The city faced many unhappy citizens. People were concerned because the storm drainage system did not drain the water; the system was too stressed to handle such a huge amount of water in such a short amount of time. An inventory of the existing stormwater ponds therefore had increased importance; specifically, an inlet and outlet assessment was needed to figure out the drainage problems caused by the July 2000 storm.

Eagan's stormwater drainage system consists of a series of interconnected lakes and ponds that drain into the Minnesota River. Catch basins, manholes, flared ends, and directional pipes aid in the water flow. Manholes in this system are openings that allow people to enter the pipelines. Catch basins catch the stormwater runoff from the roads, parking lots, or other impervious surfaces and direct the water to the directional pipes. The underground directional pipes carry water to the designated drainage area. Inlet and outlet structures are the openings in the system that allow water to run in or out of ponds. The water flows in or out of the pond toward the end point—the Minnesota River. This system was designed to mitigate flooding by funneling the excess water to the Minnesota River. Every developed area (i.e. housing neighborhood, business building, or school) is required to have a stormwater drainage system that connects to the city's matrix. The developed area drainage pattern consists of a pond that accepts water accumulation during floods, snowmelt, or storms. A pipeline will be created that connects to the city's main drainage network unless the pond has the capability to absorb all of the incoming water.

METHODS

The pond inventory was conducted within the city boundary of Eagan, Minnesota from May to August of 2001. The methodology to perform the inventory included pond location, on-site data collection, and formulation of a computer archive.

The city is divided into sections, and ponds have a name and number corresponding to their section. The utility department has produced GIS maps from aerial photographs, and location maps for each individual pond were used during the on-site data collection. City "as-built" maps (blueprints for the existing structures and locations within the city) were also used for pond location. In the previous inventory in 1990, GPS, GIS, and digital photography were not incorporated into the project; instead, pond information was recorded on handwritten data sheets. The individualized pond maps, the as-built maps, and the files from

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the 1990 inventory were used in the field during data collection.

Two people worked in the field at the same time. One person collected the GPS data by standing directly on top of the structure (inlet or outlet) or by offsetting the measurement (in cases where it was not feasible to stand on the structure). The GPS data recorded structure type (inlet or outlet), structure kind (inlets could be flared end, submersed, or unknown; outlets could be flared end, submersed, skimmer, or unknown), GPS location, and pond name, which consisted of a section letter, a P, and the pond number—JP-10 depicts pond number 10 in section J. The other person took digital photos of the structure and the pond while recording the manual data. Two photos were taken for each structure, one facing the structure and the other facing the pond from the perspective of the structure. Any other noteworthy observations were recorded, such as if the structure needed attention or if a structure could not be found. If the structure needed immediate attention the utility maintenance manager was informed to fix the problem.

The computer archive was continuously updated. The digital photos and GPS data were downloaded daily, and the GPS data were added weekly into the GIS portion of the project. The GIS project often had to be altered because of aerial photograph and field discrepancies. If the problem could not be resolved a red flag was placed for that pond so the problem could be solved in the future when there is more information.

RESULTS AND DISCUSSION

The stormwater pond inventory was completed by August of 2001. Each pond had been surveyed and updated in the computer database. During this analysis, problematic flow structures were found and reported for repair. This increased the efficiency of the drainage network by addressing individual pond and structure problems.

The archive of information regarding the stormwater drainage network was expanded, an updated, digital version of the drainage network was created, and links were established for each pond corresponding to tabular data of each inlet and outlet. Utility managers will use this database to address the future stormwater flow management regime for the city of Eagan. Further connections linking digital photographs to each pond still need to be created, and additional studies need to be conducted to address the specific areas of flood control measures.

CONCLUSION

The inventory of the stormwater pond drainage network and the establishment of the computer database will improve flood control mitigation for Eagan, Minnesota. With the updated computer archive, photographs, and tabular information, city managers can evaluate the drainage network so that stormwater will be transported out of the city and into the Minnesota River.

ACKNOWLEDGEMENTS

I am grateful for the assistance of Eagan Utility Superintendent Wayne Schwanz, Senior GIS Technician Tami Maddio, conductor of the 1990 inventory Marc Ruhn, and my co-worker Leah Taylor.

LITERATURE CITED

Foote, J., 2000a. Eagan Council declares a state of emergency. City of Eagan Press Release, July 9, 2000.
Foote, J., 2000b. Eagan still on alert as some lakes and ponds continue to rise. City of Eagan Press Release, July 11.