

RESPONSE TO SEPTEMBER 21, 2009 FLOOD EVENT GWINNETT COUNTY STORMWATER MANAGEMENT

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Abstract. In the eight-day period beginning at 8 am on September 14, 2009 through 8 am September 21, 2009, the National Weather Service reports that approximately 19-inches of rainfall fell in portions of the Yellow River Watershed near Lawrenceville, GA with approximately 8-inches in a 24-hour period ending September 21. With saturated soil conditions in place and 24-hour rainfall totals exceeding a 1-percent annual chance (100-year) event, Gwinnett County, like much of the Metro Atlanta Area, received a record flood beginning the morning of September 21, 2009.

At approximately 8 AM on September 21, 2009, the auxiliary spillway for Yellow River Watershed Dam No. 15 (Y15) was observed flowing. That was the beginning of a series of events that included the auxiliary spillways for Yellow River Watershed Dam Nos. 14 (Y14), 16 (Y16), and 17 (Y17) engaging in addition to widespread flooding and multiple culvert failures Countywide. A total of six (6) demand contractors and seven (7) demand consultants were utilized to address stormwater infrastructure repairs and evaluate the flood event. The total capital cost is \$7.5 million with a total operating cost of \$0.75 million. This paper will discuss Gwinnett's response to the flood event of September 21, 2009.

INTRODUCTION

While the culmination of the 2009 floods that impacted Gwinnett County occurred on September 21 and 22, the rainfall event that set the stage for the flooding began September 14. The National Weather Service (NWS) Precipitation Analysis webpage provides observed 24-hour precipitation estimates for periods ending 8:00 AM EDT (1200 GMT). Observed precipitation estimates are derived using a multi-sensor approach, using hourly precipitation estimates from WSR-88D NEXRAD that are compared to rainfall gauges. A correction factor is applied to the radar data to produce the reported precipitation estimates (National Weather Service).

NWS data reported the first measureable rainfall leading up to the flood event for the period ending at 8:00 AM EDT on September 15. In the six-day reporting period from September 15 through September 20, NWS precipi-

tation estimates indicate that most of Gwinnett received greater than 5-inches of rainfall with some areas receiving greater than 8-inches. For the 24-hour period ending at 8:00 AM EDT on September 21, the County received rainfall varying from approximately 2-inches in the eastern and northern regions of the County to 7.5-inches in the Yellow River watershed located in central Gwinnett, approximately equal to the 24-hour 1% annual chance rainfall of 7.7 inches. While streams and rivers throughout the County began rising toward crest stage, approximately 2- to 5- inches fell over the next 24-hours. Flooding problems were reported Countywide, and the worst of the flooding occurred in the Yellow River watershed. All total, the Yellow River watershed received 8- to 11-inches of rainfall over a 2-day period from 8:00 AM September 20 to 8:00 AM September 22, and some areas received over 18-inches for the 8-day period from September 15 to September 22.

READY TO RESPOND

It is typical to observe and comment on an agency's response to a natural disaster based solely on actions taken during and in the aftermath of the event. However, Gwinnett County was ready to respond as a result of three (3) major initiatives that began in the 1990's, the Floodplain Map Modernization Program, Natural Resources Conservation Services (NRCS) Watershed Dam Rehabilitation Program, and Stormwater Utility Implementation.

Floodplain Map Modernization Program. Gwinnett County launched a comprehensive Countywide program in 1999 to update floodplain modeling and mapping. Detailed studies were developed for all streams, with the exception of the Chattahoochee River, up to at least the 1-square mile drainage area point. Once complete, the program increased detailed study streams from approximately 230-miles on the previously effective Flood Insurance Rate Maps (FIRMs) to about 390-miles in the current FIRM. Furthermore, floodplain models and maps are georeferenced resulting in a Digital FIRM can be access on a geographic information system (GIS) platform and provides for improved floodplain management. The models

developed flood profiles for the 50-percent through the 0.2-percent annual chance flood event, including a future landuse conditions model for the 1-percent annual chance event. All studies were completed by March 2005 and the Final Countywide DFIRMs, including all municipalities, were issued September 29, 2006.

Additionally, Gwinnett continued proactive floodplain management by developing limited detail studies for the remainder of the streams in the County. Limited detail studies leveraged the effective model hydrology and the County's stormwater inventory to develop the 1-percent annual chance floodplain for both existing and future landuse conditions. The studies extended from the upstream limits of the effective detail studies up to the 100-acre drainage point for all streams throughout the County. In March 2009, Gwinnett completed limited detail floodplain modeling and mapping for approximately 400-miles of streams.

In the midst of Floodplain Map Modernization Program, Gwinnett recognized the leverage that new studies afforded. The geo-referenced models made it easy to identify bridges and culverts that overtopped from flooding. As a result, the County implemented a Capital Improvement Project (CIP) study that identified all County-maintained bridges and culverts that overtopped in the future conditions 1-percent annual chance flood event. The CIP structures are ranked based on frequency/depth of flooding, road class, structure condition, and the availability of alternate access. Concept level designs such as structure replacement, flanking structures, or additional barrels were developed for each CIP structure. The CIPs are maintained in a geo-database which is updated as structures are upgraded through capital projects.

NRCS Watershed Dam Rehabilitation Program. Of the three hundred fifty-seven (357) watershed flood control dams the Natural Resources Conservation Service (NRCS) constructed in the State of Georgia under the Watershed Protection and Flood Prevention Conservation Program, fourteen (14) were constructed in Gwinnett County between 1965 and 1980. Gwinnett County is a local co-sponsor and is the primary operator responsible for the continued operation and maintenance for each of the dams.

Each of the dams fall under the jurisdiction of the Georgia Safe Dams Program (GASDP); however, they were designed and constructed either before the Georgia Safe Dams Act was passed or were exempt from the requirements of the Act at that time. By the 1990's lawmakers recognized that these dams would experience age related problems and could pose a threat to public safety. As a result, the Safe Dams Act was amended to cease the exemption. The exemption ceased on November 1, 2000 (Bramblett, 2004).

Recognizing that the County's NRCS dams were losing their exemption under the Safe Dams Act, Gwinnett County began a Capital Improvement Program in 1999 to study and upgrade as necessary the auxiliary spillways for each dam in order to bring into compliance with the Safe Dams Act (Fleming, 2005). The \$20 million program included \$7 million NRCS grant funding matched with \$13 million Gwinnett County funds. At the time of the September 2009 flood event, ten (10) of the fourteen (14) dams were in compliance with spillway stability and capacity standards, including spillway upgrades to Y14, Y15, Y16, and Y17.

Stormwater Utility Implementation. The third major initiative that prepared Gwinnett for the response to the September 2009 floods was implementation of a stormwater utility. On January 1, 2006, Gwinnett County launched a Stormwater Utility to provide funding for County stormwater operations and capital improvements. The utility provides support for stormwater operations and capital improvement programs such as stormwater infrastructure upgrades, flood reduction, floodplain management, compliance with regulatory requirements, and reduction of pollutants carried by stormwater to waterways (Gwinnett County). Each parcel in unincorporated Gwinnett and the City of Lilburn pay a service fee based on measured impervious area within the parcel. A stepped rate structure was implemented that began at \$0.77 per 100 square feet (SF) impervious area in 2006 increasing to \$2.46 per 100 SF in 2009 which generates approximately \$35 million annual revenue.

NEVER SAY NEVER

Never in the lifespan of the fourteen (14) NRCS watershed dams in the County has it ever been reported that any of the auxiliary spillways had engaged. That fact had been a point of contention when implementing the capital program to upgrade auxiliary spillway design capacity for dams. Through public outreach efforts associated with the NRCS Watershed Dam Rehabilitation Program, many questioned the use of public funds to upgrade spillways that had never been reported to flow. That came to an end on September 21, 2009.

After six (6) days of steady rainfall from September 14 to September 20 and heavy rainfall in the overnight hours of September 20 into September 21, the auxiliary spillway at Y15 was observed flowing around 8 AM. Shortly after that, the spillways of Y14, Y16, and Y17 were observed to be flowing. Gwinnett County Stormwater Management (GCSWM) which already had Construction and Maintenance Crews dispatched to multiple locations throughout the County, immediately sent staff and enlisted three (3) consultant teams to monitor a total of sixteen (16) dams across the County which included the fourteen

(14) NRCS Watershed Dams. The only dams whose auxiliary spillway engaged were Y14, Y15, Y16, and Y17. County staff and consultants monitored each of the dams until flow in the auxiliary spillways ceased.

Y14, Y15, Y16, and Y17 had all been upgraded under the NRCS Watershed Dam Rehabilitation Program to provide additional auxiliary spillway capacity and stability with a roller compacted concrete (RCC) chute spillway over the top of the dam. As a result, only minor damage totaling approximately \$180,000 occurred to the vegetative cover over the RCC chute spillways for Y15, Y16, and Y17. By being proactive with the NRCS Watershed Dam Rehabilitation Program, a potential disaster was averted.

LEVERAGED CIPS

In addition to spillways flowing at the four (4) Yellow River Watershed dams, the flood event also caused roads to flood at bridges and culverts throughout the County. A total of sixty-two (62) roads were temporarily closed due to overtopping and an additional twenty-five (25) roads had extended closures. Teams from three (3) consultants were dispatched to each of the temporary closure locations to conduct inspections and compile a list of repairs to be addressed at each location.

Of the twenty-five (25) extended closures, fifteen (15) required full culvert replacement. Seven (7) of the culvert replacements had been previously identified through CIP studies under the Floodplain Map Modernization Program; four (4) of which had completed designs and another three (3) were under design. The remaining eight (8) culvert failures were located in the limited detail floodplain study reaches that had been completed in March 2009. The limited detailed studies were leveraged to develop quick design solutions based on available pipe and precast box culvert inventory from the local manufacturers. All total, six (6) annual contractors completed the culvert replacements with construction oversight being provided by Gwinnett County Staff and six (6) consultants. The total cost of the culvert replacements was \$7.4 million.

WET WEATHER ACTION

The flood event brought an increase in the number of citizen generated drainage service request investigations with over a month's worth of service requests called in during the 10-day period after the flood event. As a result, Gwinnett County Stormwater Management (GCSWM) implemented their Wet Weather Customer Response Plan in order to maintain the necessary level of service for the rate payers. All leave for thirty-five (35) GCSWM personnel was suspended and overtime was allowed. Staff who's duties and responsibilities typically involve office work were reassigned to assist with Drainage Service Re-

quest Investigations increasing the number of Investigators from five (5) to twenty-five (25). GCSWM investigated over five hundred (500) service requests from September 21 to October 1 and a total of eight-hundred eighty-seven (887) drainage service requests (the majority of which were within the Yellow River Watershed) in the month following the event.

HIGH WATER MARKS

A significant flood event does offer the opportunity to collect data for flood model calibration. Gwinnett utilized two (2) consultants to collect over three-hundred high water marks (HWM) across the County. HWMs were focused primarily at bridges and culverts in the Yellow River Watershed with a high density of HWMs at NRCS Dams Y14, Y15, Y16, and Y17. Since HWMs are perishable, they were flagged within two (2) weeks of the flood event. Field personnel would mark debris or flow lines with utility paint, duct tape, and/or grade stakes. Up to three (3) HWMs would be identified at each structure in order to isolate erroneous points and improve accuracy of the measured elevation. Each HWM was photographed, assigned a unique identifier, cataloged in a shape file with identifying information such as flooding source, date of event, date marked, type of HWM, quality, and location and provided to surveyors. Survey crews then surveyed in the vertical and horizontal location of each HWM.

HWM data is currently being used by the County to calibrate flood models. In addition, the HWM data associated with NRCS Dams Y14, Y15, Y16, and Y17 are being used for loss avoidance studies. The loss avoidance studies involve routing the September 2009 flood event through the old auxiliary spillways to determine the potential consequences had the spillways not been upgraded. As of this date, the studies had not been finalized.

DISASTER ASSISTANCE

While the Stormwater Utility provided the necessary funds to respond to the flood event, Federal funding became available through Presidential Disaster Declaration No. 1858 (DR-1858). DR-1858 allowed for reimbursement of up to 75-percent from the Federal Emergency Management Agency (FEMA) and an additional 10-percent the Georgia Emergency Management Agency (GEMA) was possible. Eligible costs included upgrading pipe materials from corrugated steel to reinforced concrete and increasing design capacity level of service for culverts. However, betterments to adjacent stormwater systems were deemed ineligible and reimbursements for road cuts and landscape repairs were limited on a case by case basis. The total capital cost for repairing the NRCS Dams and repairing/replacing damaged culverts as a result of the

September 2009 flood event totaled \$7.5 million with eligible reimbursements of \$4.7 million. GCSWM also had an additional \$0.75 million in operating costs with eligible reimbursements of \$0.65 million.

SUMMARY

Gwinnett County's readiness to respond to the September 2009 flooding was the best response to the event. This was as a result of a proactive stormwater program that included improved floodplain management, watershed dam upgrades, planned culvert capital improvement projects, and a stormwater utility that provided dedicated funding for these programs along with necessary staff to carry out daily and emergency operations for events such as this one.

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