**Memorial Day 2015 Event: FAS Performance in the TMC and Meyerland Flooding**

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Beginning on the evening of May 25th 2015, and continuing through the morning of May 26th, the Harris County area experienced severe thunderstorms and heavy precipitation that resulted in widespread flooding and damages. This storm event originated from a jet stream positioned directly over central and east Texas, which lifted warm, moist air in the atmosphere and caused the formation of towering cumulus clouds. The weather system was fueled by a continuous stream of heat and moisture from the Gulf of Mexico and developed into a severe thunderstorm. Due to the position of the jet stream and the moisture from the Gulf, there were continuous thunderstorms that lingered over the Houston area and resulted in heavy precipitation for several hours. Since the Houston region had experienced several rainfall events in the weeks leading up to the Memorial Day storm, the ground was almost completely saturated, allowing for little infiltration of rainwater. The Brays Bayou watershed, which is located in southwest Harris County, received extremely intense precipitation during the event and consequently high flows in the bayou. In fact, some areas of Brays received 100-yr precipitation totals (10.8" in 24hrs), which caused severe over-bank flooding in the middle portion of the bayou. Figure 1 shows 12 hour rainfall amounts for different gages in Brays Bayou watershed. This case study explains the response of Brays Bayou to the Memorial Day event, and specifically analyzes flooding effects in the Texas Medical Center (lower reach of the bayou) and the Meyerland neighborhood (middle reach of bayou).

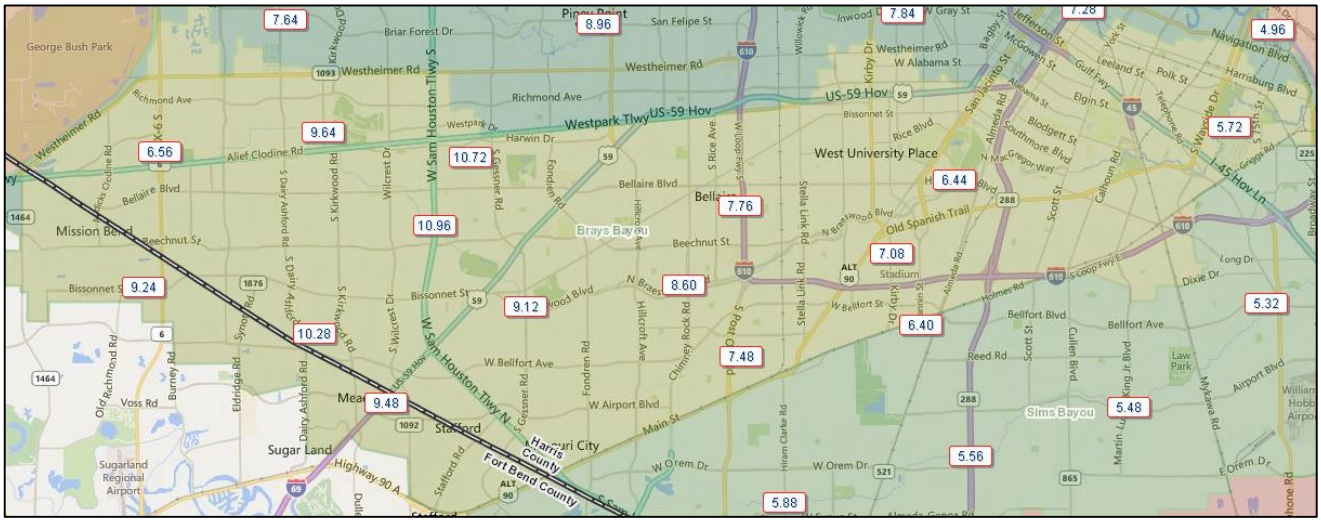

Figure 1: 12 hour rainfall totals for Brays Bayou watershed during May 2015 Storm

The Houston region experienced significant damages as a result of the May 2015 storm event. It is estimated that around 4,000 homes had flood damage and seven people were killed by the severe flooding (Fernandez & Perez-Pena, 2015). However, near the Texas Medical Center (TMC) flood damage was much less severe. The early warning provided by the Flood Alert System (FAS3) allowed personnel in the TMC to implement their flood control protocols well in advance of the peak of the storm. FAS3 predicted a peak flow in Brays Bayou of 28,264 cfs to occur on May 26th, 2015 3:00am, and the peak observed flow was 28,500 cfs at 2:25am. Thus, the FAS3 model was able to predict the peak flow with only a 0.83% margin of error. Figure 2 shows the predicted vs observed hydrograph at 3:30am. While the peak of the storm occurred 35 minutes earlier than the predicted time, the TMC was still adequately prepared due to the 2-3 hour advance warning they were given. In addition, the model was able to accurately predict the time when flows would exceed 18,000 cfs, which is the threshold for flood protocol action in the TMC. The performance of the FAS3 during the Memorial Day storm exemplifies a near ideal response to severe storm events. The model was able to predict the storm hydrograph shape with reasonable accuracy, predict the peak flow with exceptional accuracy, alert TMC emergency personnel several hours in advance, and then confirm predicted results with the Bayou cam and observed storm hydrograph.

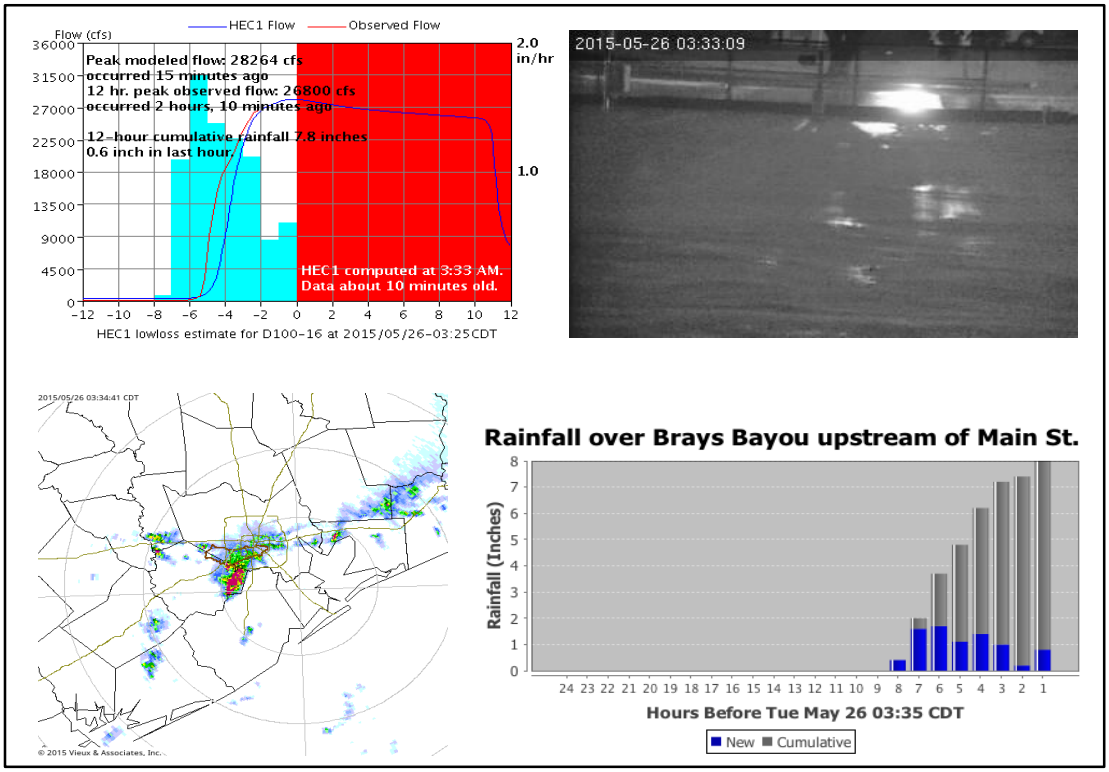

Figure 2: Comparison of Modeled vs Observed Flows in Brays Bayou during May 2015 Storm

In contrast to the response of the TMC to the May 2015 storm, the Meyerland neighborhood upstream of the TMC was far less prepared to protect themselves from high bayou flows. This community, and specifically residents located along Brays Bayou between I-610 and US-59, experienced some of the worst flooding in Houston. According to reported damages, around 730 homes were at least partially inundated due to over-banking of Brays Bayou between I-610 and US-59. Damage claims from these homes ranged from 6 inches of observed flooding to 3 ft of flooding (Morris, 2015). The Meyerland area experienced between 8-10 in of precipitation during the storm event, which led to high runoff into the Bayou and subsequent over-banking.

The US Army Corps of Engineers and Harris County Flood Control District (HCFCD) have investigated the issue of riverine flooding along Brays Bayou since the 1960s, and a flood control project to mitigate over-banking was completed in 1968. However, flooding along the Bayou continued during the next several decades until HCFCD issued a new proposal for the Bayou in 1994. This initiative became known as Project Brays, and constitutes a comprehensive re-design of Brays Bayou that includes widening the channel, replacing/renovating bridges crossing the bayou, and adding detention basins for greater stormwater storage. As of May 2015, Project Brays was roughly 50% completed, with upper reach renovations nearly completed and lower reach renovations underway as well. However, at the time of the storm, renovations in the middle reach (near the Meyerland area) were still in their early design and construction phase. An analysis of the current floodplain along Brays Bayou for the May 2015 storm compared to the floodplain that would have been generated if Project Brays had been completed demonstrates that Project Brays renovations will remove a substantial number of homes from the floodplain. Of the homes that reported flooding during the May 2015 event, around 30% of them would have been removed from the floodplain if Project Brays had been completed (Bass et al., 2015). Although the flood reduction benefits of Project Brays are substantial, this initiative will not mitigate all flooding issues in the Meyerland area, and many residences along the Bayou will remain in the floodplain. Thus, future analysis should be conducted on ways to completely protect Meyerland homes from riverine flooding.

References

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