

# **Hurricane Harvey triggered flooding and changes in water quality parameters in the Lake Houston area**

Term Paper Progress Update  
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## **1. Background and Objectives:**

When Hurricane Harvey made landfall near Rockport, TX on August 25, 2017, it became the nation's first major (Category 3 or stronger) hurricane since Hurricane Wilma.<sup>1</sup> Catastrophic flooding was caused by the slow moving system with a gauge near Cedar Bayou, Texas, measuring 51.88 inches of rainfall, a record amount in the continental United States.<sup>2</sup> On August 28, Houston Mayor Sylvester Turner announced that water influx to Lake Houston caused the submersion of a water treatment plant north-east of the city.<sup>3</sup> It was reported that 65 separate releases from waste water treatment plants in Harris county released over 20 million gallons of untreated sewage into the area.<sup>4</sup> Flooding in the area around Lake Houston, which hosts a variety of economic activity and ranches, may cause a high loading of nitrogen, phosphorous and organic matter to flow into Lake Houston.

The objective of this term paper will be to assess flood levels and the impact of Hurricane Harvey on water quality parameters like total phosphorous and total nitrogen in the Lake Houston area. These parameters are influenced by point- as well as non-point sources and was greatly affected by releases around the Lake Houston area as well as from the inflow from the Spring Creek and West Fork of the San Jacinto River. This study will utilize learning materials from class and research papers to attempt a preliminary analysis of the impact of Hurricane Harvey.

## **2. Description of work to date:**

The analysis for mapping changes in water quality parameters following a storm event has been conducted by many scientists and researchers. The first step, being a novice to GIS, has been to learn from the previously established work and build on them as needed. Previously published work, class exercises and term papers on flood mapping and water quality indices were collected. Details on the additional steps have been described below.

### **i. Data collection:**

The next step was to search and obtain valuable data worth analysis. This proved to be more challenging than previously anticipated. Shapefiles for Hurricane Harvey Best Track was downloaded from National Hurricane Center (NHC) and plotted on ArcGIS Pro, shown in Figure 1(a). While the coordinate systems of the path (line) and windswath were resolved and matched to the topographical map, the coordinate system of the shapefile of the hurricane path (points) remained unresolved. The alteration of the shapefile's geographic coordinates was conducted using the Data Management Tools → Projections and Transformations → Project. Precipitation data from NWS was collected for August-September 2017. Watershed data for the region was extracted from USGS Watershed Boundary Database. Stream gage data from USGS (Figure 2) for the stream site chosen was used visualize the extent of peak flow during and after the hurricane event for future work. Water quality data for the storm period was located in the USGS and TCEQ webpages but will be downloaded in the future for analysis.

### **ii. Map Setup:**

A topographical map of the Lake Houston area was created in ArcGIS Pro as per instructions in Exercise 4 by locating a stream site (USGS 08072050 San Jacinto Rv near

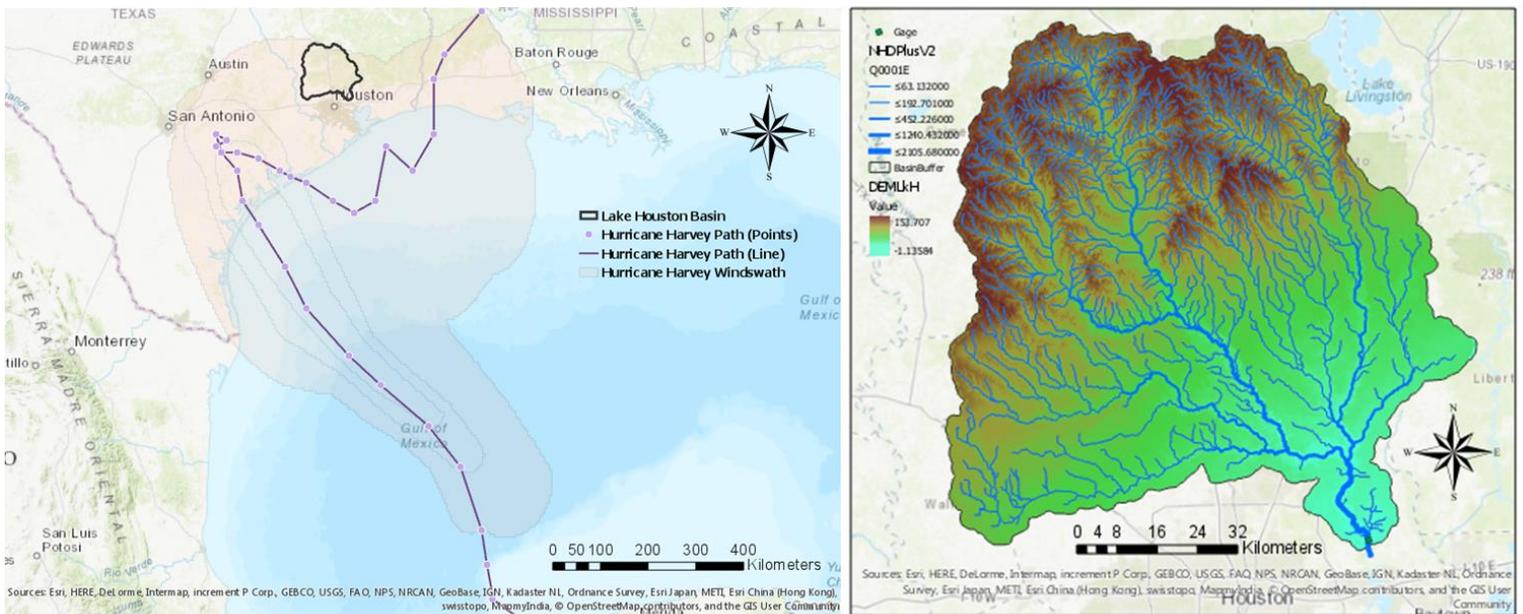
Sheldon TX) downstream of the lake. Obtaining a watershed based on a USGS Lake Site (USGS 295826095082200 Lk Houston S Union Pacific RR Bridge near Houston TX) did not provide a watershed result as compared to conducting the same process for the USGS Stream Site. Watershed draining to this stream gage and its corresponding digital elevation data was extracted and integrated into the map to learn about the hydrology and elevation features of the location. NHDPlus V2 flowlines were extracted and integrated into the map as well. The result is presented below in Figure 1(b). Watershed boundaries were visualized in the arcgis.com website as per instructions in Exercise 2.

**iii. Digital elevation model, flood mapping, high water mark data for validation:**

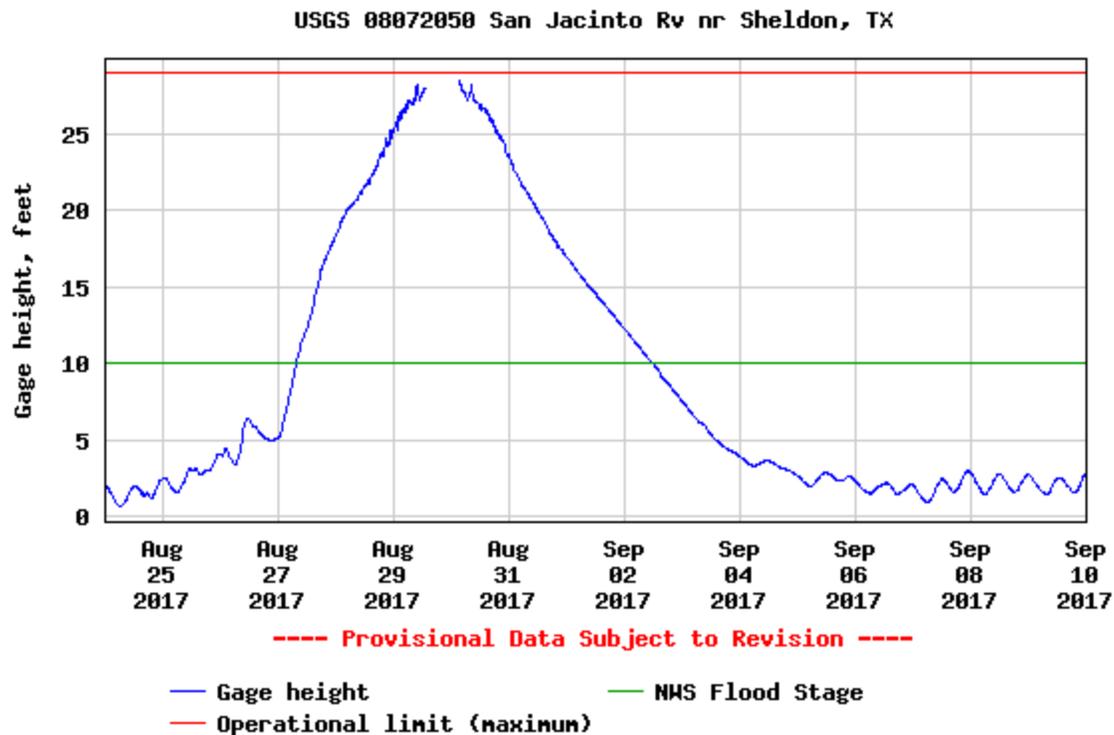
Youtube videos regarding flood inundation mapping were reviewed as starting points for further analysis. Height above nearest drainage exercise from previous years' GISWR webpage was reviewed. High water mark data was downloaded from USGS, to possibly validate the flooding levels from the models tested.

**3. Outline of further work:**

Digital elevation data and precipitation data will be utilized to map the flooding in the Lake Houston area. Water quality data from USGS will be used to map changes in water quality parameters before, during and after the storm event. The effect of land use can also be analyzed, if results indicate an increased loading of nitrogen and phosphorous.



**Figure 1.** (a) Storm path of Harvey, as extracted from the NHC web resources, and (b) Watershed above a stream gage location downstream of Lake Houston and associated digital elevation model for the basin integrated with NHDV2 Flowlines.



**Figure 2.** Stream gage data for USGS Stream Site selected downstream of Lake Houston between Aug 25 - Sep 10

**References:**

1. US Department of Commerce; NOAA; National Weather Service. Major Hurricane Harvey - August 25-29, 2017 [http://www.weather.gov/crp/hurricane\\_harvey](http://www.weather.gov/crp/hurricane_harvey) (accessed Sep 21, 2017).
2. Weather Prediction Center. Storm Summary Method <http://www.wpc.ncep.noaa.gov/discussions/nfdsccl.html> (accessed Sep 19, 2017).
3. Almkhtar, S.; Bloch, M.; Carlsen, A.; Fessenden, F.; Griggs, T.; Lai, K. K. R.; Park, H.; Pearce, A.; White, J.; Yourish, K. Mapping the Devastation of Harvey in Houston [https://www.nytimes.com/interactive/2017/08/28/us/houston-maps-hurricane-harvey.html?\\_r=0](https://www.nytimes.com/interactive/2017/08/28/us/houston-maps-hurricane-harvey.html?_r=0) (accessed Sep 19, 2017).
4. Stuckey, A. Raw sewage spilled in Houston area after wastewater plants damaged by Harvey <http://www.chron.com/news/houston-texas/article/Nearly-a-dozen-wastewater-treatment-facilities-12209605.php> (accessed Sep 21, 2017).