City of Galveston Experiences and Future Plans

Rob Winiecke
Director of Infrastructure and Engineering
City of Galveston
Galveston, Texas

The City of Galveston, located on Galveston Island, is the largest community in the United States established on a barrier island. The Gulf of Mexico forms the southern boundary, and Galveston Bay serves as the northern boundary of the city. This geographic location places the city in the top 10% of Texas jurisdictions with a high level of vulnerability to natural hazards as reflected in the GLO Composite Disaster Index (CDI) which ranks the level of community risk from natural hazards. The high CDI index is reflective of the frequent hurricanes, tropical storms, and tidal flooding originating in the Gulf of Mexico. These frequent events often create intense rainfall accompanied by high tides that cause severe flooding of the lower elevations on the island. Following the 1900 Hurricane, the eastern portions of the island were raised behind a seawall which was completed in various phases from 1904 to 1961 while areas west of the seawall continue to retain the natural barrier island characteristics.

In addition to storm water run-off, sand is another contributor to drainage system woes on Galveston Island. Galveston sand is very fine which makes it easy to become airborne due to the prevailing onshore breeze. This sand is deposited over the areas directly adjacent to the south side (i.e. beach side) of the island and eventually drains into and gets deposited into the City's storm drain system. This accumulated sand creates an ongoing maintenance concern for the existing drainage system which is described by the City's Drainage Master Plan as being undersized due to current evaluation criteria requiring clean and debris free storm drain infrastructure. As the levels of sand and silt rise during natural events, the capacity of the current system often becomes over-burdened resulting in increased storm water runoff, ponding, and frequent flooding.

Reviews of original construction plans indicate that much of the existing storm drain system was constructed with a drainage capacity to accommodate the two-year storm using monolithic box culverts and clay pipe inlet leads. Many of these inlet leads are smaller than 18-inches in diameter which are easily blocked by debris and silt that limit conveyance capacity. Galveston's drainage system also relies heavily on bridge blocks, or small pipes that connect roadside gutters across intersections. The bridge blocks are sometimes rectangular, square or small concrete pipes (<15-inch) and generally serve areas where existing storm drains do not exist. These structures also contribute to inefficient conveyance of storm water runoff in the urbanized areas of Galveston.

Runoff in the city generally flows from south to north towards Galveston Bay. Elevations across the island generally range from approximately 1 to 18-feet above sea level. As a result, the island has several service areas that experience frequent flooding, inundation of storm sewers, and ponding in streets due to the flat topography, inadequate system capacity, and tidal backflow. This frequent flooding has the potential to impact the primary evacuation routes on the island the island; Broadway, Harborside, 61st Street,

and FM3005 as well as access to critical community lifelines such as the University of Texas Medical Branch (the county's only Level 1 Trauma Center), Galveston National Laboratory (GNL), and the Island Community Center which serves as a transportation HUB for the evacuation of residents during major disasters. In addition, the current capacity of the existing storm drain system is inadequate to control flooding even during minor storms which has resulted in the repetitive flooding of residential neighborhoods and temporary loss of emergency vehicle access to several of these areas.

During the 2020 and 2021 Atlantic Hurricane Seasons, Galveston saw itself in the crosshairs of several hurricanes and tropical storms during that timeframe. In 2020 a total of 30 named storms were identified in the Atlantic Basin with 3 presenting major threats to the island; Hurricane Laura, Tropical Storm Beta, and Hurricane Delta. The 2020 season was followed up by another above average hurricane season in 2021 that produced a total of 21 named storms with 1 major threat to the island; Hurricane Nicholas. Current predictions indicate that the 2022 hurricane season will be above average and it is reasonable to expect more of this in the coming years given the climate trends being observed today.

Needless to say, the topic of drainage on the island is a hot button issue for the entire community both today and looking forward. Aside from severe weather threats, typical flooding experienced on the island ranges from flooding as a result of rainfall events to "sunny day flooding" where tidal water backflows into the storm drain system and infiltrates local roads and neighborhoods. The city has heard the residents' pleas for assistance and the development of solutions to these problems and is currently working on developing a new island-wide Stormwater Master Plan that considers the City's existing drainage system, current drainage design criteria, sea level rise, implications of the Texas Coastal Spine project (aka Ike Dike) on the island and future methods for handling stormwater runoff. The Stormwater Master Plan will include a recommended list of capital projects that will become a basis for seeking a future bond election.

Galveston is currently planning the design and construction of two stormwater pump stations; the 14th Street Pump Station and the South Shore Pump Station. The 14th Street Pump Station will service a portion of the urbanized section of the island bounded by 13th Street and 17th Street; and Seawall Blvd. and the Galveston Ship Channel. The improvement area also includes the replacement of the storm drain conveyance system, connections to side streets, and inlets placed at regular intervals, pavement restoration, tidal backflow prevention, and a 700 cfs outfall pump station at the Galveston Ship Channel. The 14th Street Pump Station is currently at 95% completion on the design phase. The South Shore Pump Station will service one of the lowest residential neighborhoods on the island that is routinely impacted by "sunny day flooding" and is bounded by 57th Street and 61st Street; and Seawall Blvd. and English Bayou. The improvement area is expected to include new storm drain conveyance features, potential green infrastructure features, and a new outfall pump station with an approximate capacity of 1,200 cfs. This project is currently under design and moving towards 30% completion. The City has plans for adding additional stormwater pump stations into the system but is waiting for the completion of the hydrologic & hydraulic analysis and list

of recommended projects to be developed under the Stormwater Master Plan. It is anticipated that the results will include additional stormwater pump stations, tidal backflow prevention devices, storm drain system improvements, and other potential drainage improvements.