



North Houston District

Greenspoint Area
Concerted Revitalization Plan

August 2017

I. Background

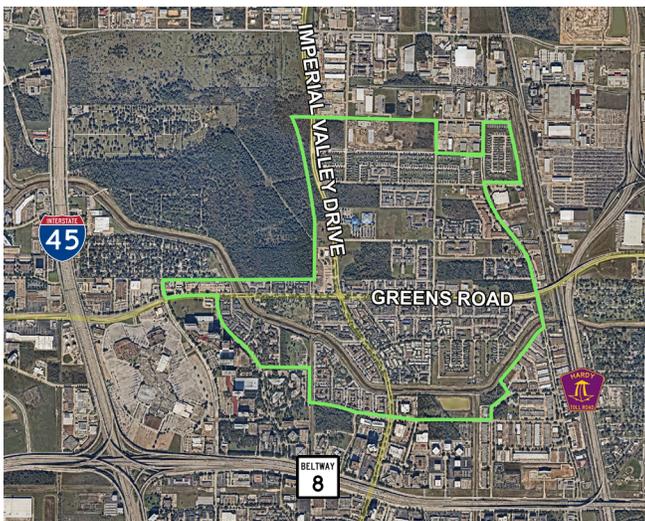
The North Houston District encompasses approximately 12 square miles and is located at the intersection of North Freeway (I-45) and the Sam Houston Parkway (Beltway 8). The area commonly referred to as “Greenspoint” is in northeast quadrant of the District.

Area Description and Demographics

This plan focuses on two areas in the District’s north-east quadrant - Greenspoint, which has a high concentration of multi-family and is located at the intersection of Greens Road and Imperial Valley Drive, and Greenbriar North, located immediately to the north of the multi-family community (see Map 1). The area has 26 apartment communities and the small single-family community mentioned above. Retail offerings are limited to a few small shopping and strip centers located along Greens Road. There is no full-service grocery in the area; it is a U.S. Department of Agriculture food desert.

The area includes major portions of three census tracts – 2401, 2405, and 2406 (see Map 2). Table 1 shows demographic data for these tracts. The population of the three tracts is approximately 17,000. Poverty levels in all three tracts are high, ranging from 26.9% to 31.5%. The data indicates a population that could be termed the “working poor” – unemployment is low, ranging from only 5.3% to 10.1%, but due to educational attainment (high school graduates or less range from 65.9% to 70.3%), incomes are modest. The area is predominantly Hispanic (ranging from 46.9% to 65.9%) with a significant number of blacks/ African Americans (ranging from 28.4% to 47.3%). The population is young, with roughly half being 24 years old or younger (ranging from 47.9% to 52.5%).

Map 1: Greenspoint Area



Map 2: Census Tracts

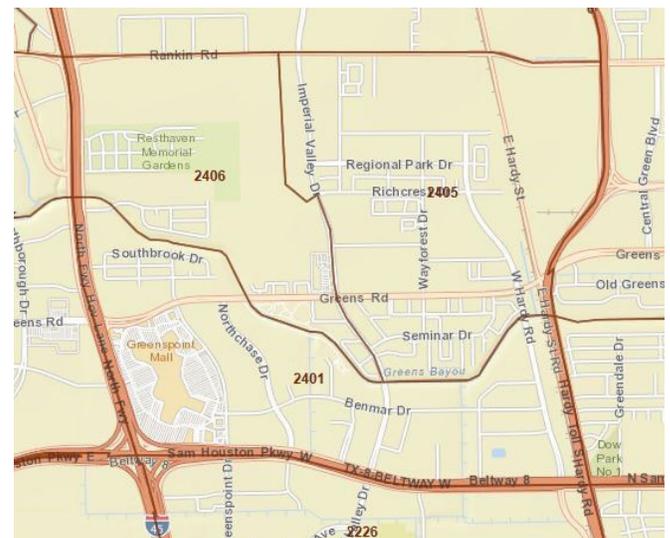


Table 1: Demographic Analysis

March 2017 Metric	Census Tract		
	2401	2405	2406
Poverty	31.5%	29.8%	26.9%
Unemployment Rate	5.3%	10.0%	10.1%
Educational Attainment, HS Grad & Less, 25 & Older	65.9%	66.1%	70.3%
Age, 24 Years & Younger	47.9%	50.7%	52.5%
Black/African American	30.4%	47.3%	28.4%
Hispanic	50.6%	46.9%	65.9%

II. The Plan

Aged Infrastructure: The Historical Development of Greenspoint

Greenspoint was largely developed between the mid-1970's and the mid-1980's. It was one of the first communities in Houston to integrate shopping, working and housing. Greenspoint Mall was North Houston's first enclosed mall, attracting shoppers from all over the region. Friendswood Development, an affiliate of Exxon, developed high-rise office buildings adjacent to the mall, with Exxon occupying the space until 2014. Apartments were simultaneously developed to house the largely single or young-couple professionals who worked in the nearby offices. The proposed revitalization area encompasses a large portion of these apartment complexes.

In the late 1980's and early 1990's, as crime accelerated in large portions of the United States including Houston, crime also increased in Greenspoint. Crime, and the perception of crime during this period, led to the departure of many of the original residents. Coincident with these occurrences, the City of Houston was challenged in keeping up with its rapid growth following a period of severe economic distress in the mid-1980's. As a result, the street and utility infrastructure in the Greenspoint area has not received the

investments for needed improvements and upgrades. **Table 2** highlights the age and condition of the infrastructure for two major thoroughfares in the revitalization area (Greens Road and Imperial Valley Drive).

As shown on **Table 2**, much of the infrastructure was built in the 1970's and is now 35-40 years old. While the City of Houston has made some improvements, the core of the infrastructure is reaching the end of its useful life and will require replacement over the next several years.

The revitalization area also lacks City of Houston civic infrastructure. Outside of a small wastewater treatment plant, the city has no buildings or offices in the revitalization area or the larger northeast quadrant of the District. Until the North Houston District began constructing parks over the last decade, the area was entirely without parks. The only other civic infrastructure in the immediate area is a Harris County library on Airline Drive in the District's southeast quadrant and a City of Houston fire station in the northwest quadrant.

Table 2: Greenspoint Revitalization Area - Infrastructure Age and Condition

System	Location	Extent	Size/Type	Year Installed
Stormwater	Greens Road	Greens Bayou to West of Imperial Valley	30" - 42" RCP	1977
Stormwater	Greens Road	Imperial Valley Intersection	24" - 30" RCP	2004
Stormwater	Greens Road	West of Wayforest to Wayforest	30" - 42" RCP	1978
Stormwater	Greens Road	Just East of Wayforest to Wayforest	24" RCP	1978
Stormwater	Greens Road	West of Seminar to Seminar	24"- 42" RCP	1978
Stormwater	Greens Road	East of Seminar to West Hardy	24" RCP	1978
Wastewater	Greens Road	East of Greens Bayou to Wussow Park East Line	8" ESCP	1976
Wastewater	Greens Road	Wussow Park to East 150'	24" RCP	2004
Wastewater	Greens Road	150' East of Wussow Park to Imperial Valley	24" RCP	1972
Wastewater	Greens Road	Imperial Valley East 118'	18" RCP	1972
Wastewater	Greens Road	118" East of Imperial Valley to West of Wayforest	12" - 15" ABS	1977
Wastewater	Greens Road	West of Wayforest to West Hardy	12" ABS	1978
Water	Greens Road	Just West of Greens Bayou to Just East of Greens Bayou	12" Steel	1974
Water	Greens Road	Just East of Greens Bayou to Wussow Park Clubhouse	12" AC	1974
Water	Greens Road	Wussow Park Clubhouse to Imperial Valley	12" AC	1976
Water	Greens Road	Imperial Valley to West Hardy	12" AC	1978
Stormwater	Imperial Valley	North of Harvest Time to South of Harvest Time	24" - 42" RCP	1978
Stormwater	Imperial Valley	Greens Road Intersection	24" RCP	1978
Stormwater	Imperial Valley	Seminar Intersection	60" RCP	1973
Wastewater	Imperial Valley	North of Harvest Time to Harvest Time	10" ABS	1978
Wastewater	Imperial Valley	Harvest Time to Greens Road	18" RCP	1978
Wastewater	Imperial Valley	Greens Road to Greens Bayou	10" - 21" RCP/ESCP	1972
Water	Imperial Valley	Imperial Valley Goodnight to South of Richcrest	12" PVC	2004
Water	Imperial Valley	South of Richcrest to Greens Road	12" AC	1978
Water	Imperial Valley	Greens Road to North of Seminar	12" AC	1976
Water	Imperial Valley	North of Seminar to Greens Bayou	12" AC	1975

Source: Houston GIMS

2016 Tax Day Floods

On the evening of April 17 and early morning hours of April 18 (Tax Day in 2016), the western and northern portions of Harris County received two heavy rainfall events within a short time span. By the early morning hours of April 18, it was apparent that the North Houston area, and more specifically the proposed revitalization area, would suffer severe flooding. By mid-day the rain ended, and rescue operations involving boats and high-water vehicles were underway. In total, approximately 2,000 apartment units across 17 complexes in the revitalization area were damaged and many thousands of people were in temporary shelters. Numerous small businesses were impacted as well.

In the coming days, the City of Houston, North Houston District and many others worked to find housing for displaced families and began the long process of debris removal and reconstruction. Many displaced residents found shelter on their own, but others were placed into nearby apartments with vacancies and others lodged in local hotels.

The area was declared a Federal Disaster Area (DR-4269). This allowed local residents and businesses to apply for FEMA assistance. The North Houston District, working with the City of Houston and FEMA, was able to locate office space nearby and a claims center was established within walking distance of the heaviest damaged areas. This would prove crucial in expediting the recovery process for residents and businesses.

As part of its leading role in post-disaster recovery, the District's board of directors promptly retained a major engineering firm to perform an analysis of the flood event and to make recommendations on projects that could mitigate damage from future severe rainfall events.



Study Recommendations

The study, performed by Lockwood, Andrews and Newnam, was completed in October 2016. It concluded that the area was not only impacted by flood waters coming from Greens Bayou, but also by significant stormwater infrastructure deficiencies that made it susceptible to heavy overland flows as well. The final recommendations are shown in **Figure 1** and include buying out structures in the floodway to not only remove residents from harm's way, but to provide needed local detention. This detention would allow for major stormwater upgrades in Greens Road, Imperial Valley Drive and West Hardy Road. The Executive Summary from the study is included as **Appendix A**.

The North Houston District has shared the results of the study with the City of Houston, Harris County Flood Control District and the U.S. Army Corps of Engineers. While a detailed estimate of all the proposed projects was not part of the study, costs for the proposed buyouts, detention projects and stormwater improvements could easily exceed \$20 million. Multiple funding sources will be required and implementation of the proposed projects will likely span several years. It is possible that an initial source of funding could be federal Community Development Block Grant Disaster Recovery (CDBG-DR) funds. With an appropriation in late 2016 and a second in early 2017, approximately \$61.5 million has been designated for Harris County. This money must be subsequently distributed between unincorporated Harris County, the City of Houston and other impacted municipalities.

It is recognized that replacement housing will be necessary for any buyouts of apartment communities in the floodway. Houston and Harris County suffer from an acute shortage of affordably priced housing and subsidized housing. Prior to the flood event, North Houston District prepared a housing strategy and revised it following the flood. The strategy recommends new housing, in a variety of options, for the area and proposes the use of tax credits and other financing mechanisms to fund replacement housing. As of the time of this plan, two efforts are underway involving local affordable housing developers.

Pedestrian Infrastructure

The North Houston District is a low- to moderate-income area and, based upon available transit data, the residents of the community are heavy users of transit. In 2016, the District retained a local engineering firm to do an inventory of its sidewalks, including the proposed revitalization area, to provide insight on the needs of pedestrians in the community. The study was completed in 2016 and a map of the existing sidewalk network is available (**see Figure 2 on page 6**). A small portion of the network is in place and up to standard. Much more is either missing or not to standard. The information will aid local governments in making infrastructure investment decisions, and the District will seek grant opportunities and leverage local dollars to provide additional sidewalks.

Figure 1

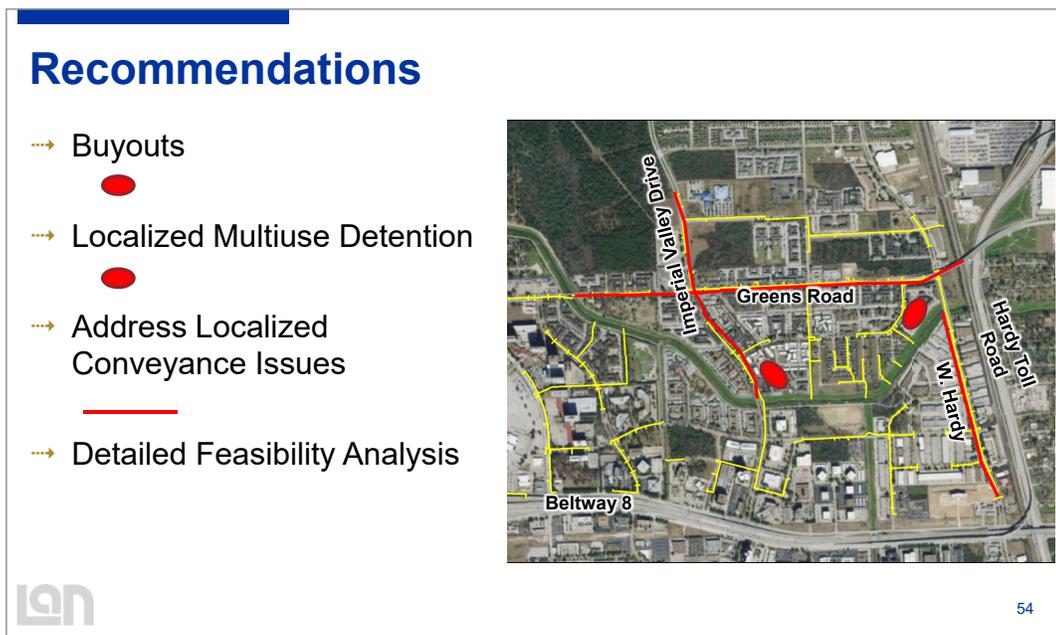
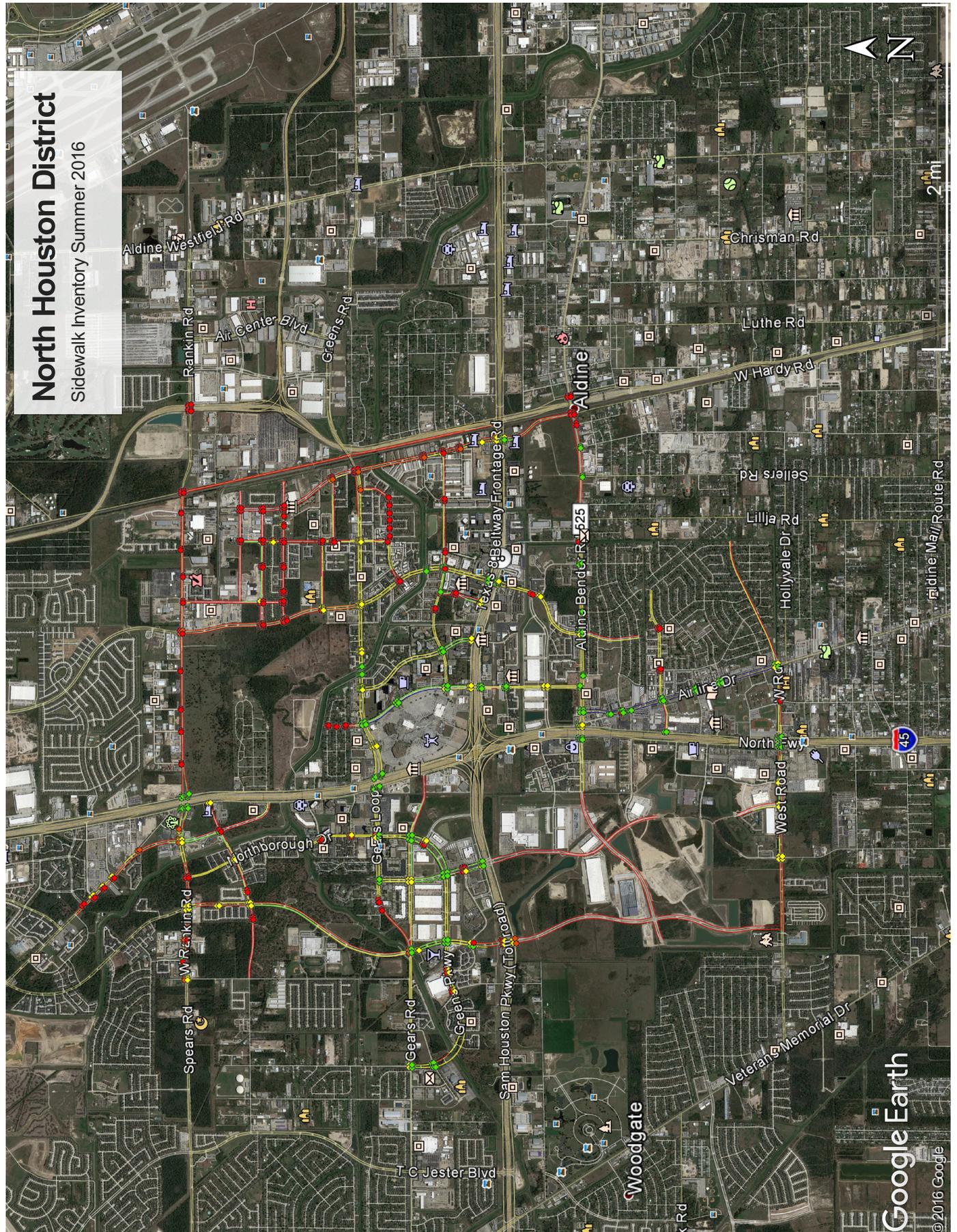


Figure 2



Public Safety

One of the primary reasons for creating the Greater Greenspoint Management District in 1991, today the North Houston District, was to provide increased public safety services. Prior to the District's existence, crime and the perception of crime, led to concerns by the local businesses and residents that impacted the vitality of the area. The District's annual investments in public safety services have been successful. Crime in the area is comparable to other similar activity centers in the urban Houston region.

Figure 3 shows the District's public safety expenditures for the years 2012 – 2016. During this period, an additional \$2,487,812 has been invested in public safety services above and beyond those provided by local law enforcement. These expenditures have been focused on direct police services via contracts with the Harris County Sheriff's Office, off-duty Houston police officers and private security companies. For the most recent period this has led to a significant decrease in crime from 2015 to 2016 (see **Figure 4**).

Additionally, the District works with local apartment communities, including those in the revitalization area, to highlight best practices in property management and safety. This has enabled apartment owners to improve operations and reduce public safety concerns for their residents.

The District also promotes crime prevention to families in the community. Events such as "National Night Out" and "Hoops and Heroes," bring together law enforcement and the community to build bonds and promote positive interactions. The District hosts these events each year with the cooperation of the Harris County Sheriff's Office and Houston Police and Fire Departments.

Figure 3: Public Safety Expenditures 2012 - 2016

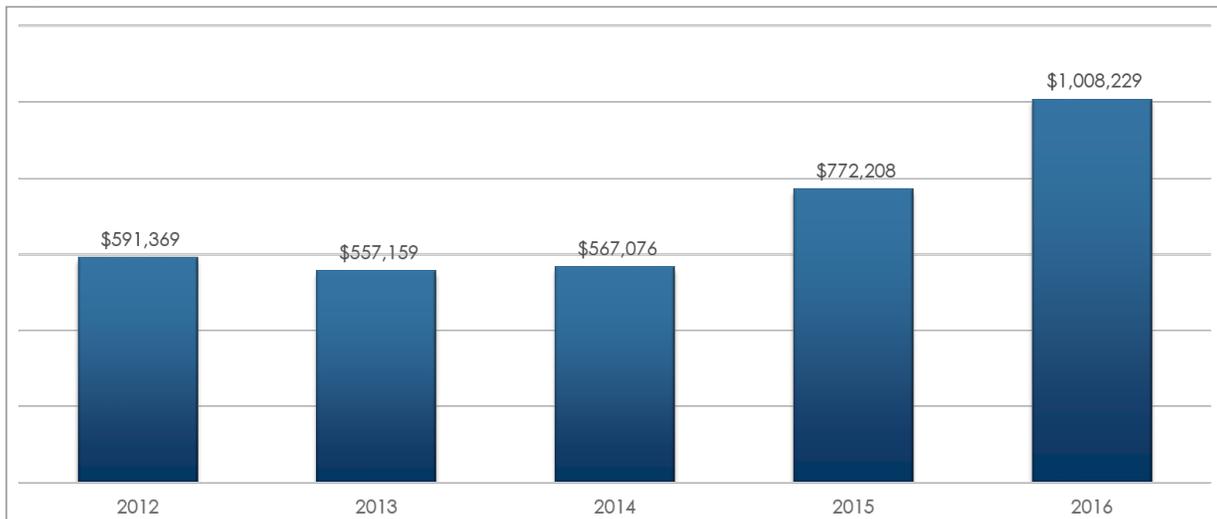
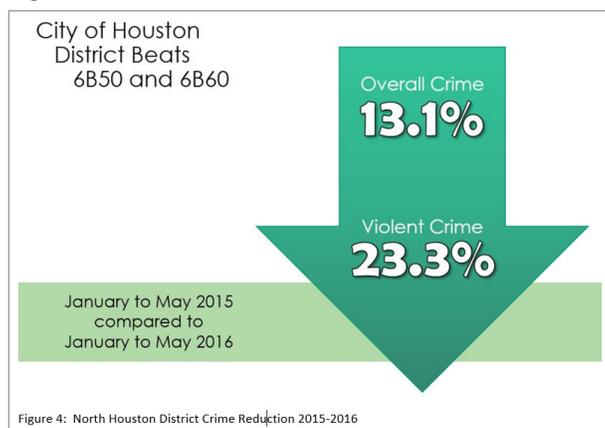


Figure 4



Housing

Residential development within North Houston District is largely multi-family. There are approximately 70 apartment complexes, totaling 18,000 units in the District. Information from an apartment data tracking firm indicates approximately 90% of these units are Class C or D and are considered naturally occurring affordable housing or "NOAH." Many of the complexes were built in the 1970's and early 1980's and are approaching the end of their economic life. As documented by various sources, the Houston area has a shortage of affordably priced units. This tight market has caused an increase in asking and effective rents in recent years. In November 2016, the Houston Business Journal identified the Greenspoint area as one of the submarkets with the fastest rising apartment rents despite having an aged inventory.

The revitalization area is a microcosm of the District at-large. In total, there are 26 apartment complexes in the revitalization area with approximately 7,300 units. Most of these units are Class C and D, though there are a few newer Class B complexes. As noted previously, during the April 2016 floods a majority of these complexes were impacted and roughly 2,000 ground-floor units were damaged.

North Houston District Housing Strategy

In June 2016, the District's board adopted a housing strategy for its service area.

- Increase housing options
- Reduce the number of apartment units in the floodway; and
- Increase economic opportunity and quality of life for all stakeholders.

The District believes that more housing options should be available for those who live in the service area. As noted above, most of the housing available today is in multi-family units. The board supports an increase in other housing options such as single-family homeownership and single-family rental. Additionally, the single-family product should be expanded from the traditional single-family detached model that has historically been available, to other forms of single-family housing, such as townhomes and patio-style homes. Market data indicates homes priced at \$250k or less would be appropriate for the area. Such alternative single-family offerings will aid in meeting the need for affordable housing options for workers in our community.

Concurrently, the District supports the number of apartment units in the floodway being reduced to prevent future tragedies like the Tax Day Flood. The remaining complexes that are most feasible from a market perspective should be upgraded.

The District believes that increasing economic opportunity and the quality of life for its residents is vital to the area's overall success. As stated in its vision, "North Houston District is a well-planned, high quality community, integrating regional and metropolitan commercial development with a stable, desirable residential neighborhood."

Going Forward

As stated previously, post-flood opportunities may be available to buyout apartment complexes located in the floodway. In addition, disaster recovery funding may become available to provide replacement housing for lost units as a result of buyouts, thus providing the opportunity to develop new multi-family and single-family rental units for residents. Specifically, new developments could provide three-bedroom and larger units that do not currently exist in the area.

Funding for new affordable housing development will likely come from multiple sources including 4% and 9% Low-Income Housing Tax Credit's, CDBG-DR funding, and other sources of city and county funds. The goal is to achieve a one-to-one replacement for every unit of housing lost in the immediate area. Providing housing lessens disruptions to children's school attendance and helps families maintain existing social networks. Fortunately, large tracts of undeveloped land are available in the area that make this a possibility.

Promoting a Better Quality of Life and Economic Opportunity

One of the core missions of municipal management districts is to promote economic vitality in its service area. The District, in cooperation with the City of Houston and others, strives to do this through its service plan. In addition to advocating for infrastructure improvements and providing supplemental public safety services, the District also provides branded street and wayfinding signage, mowing and de-littering right-of-ways, building and maintaining parks and trails, and working with stakeholders to attract new businesses to the area.

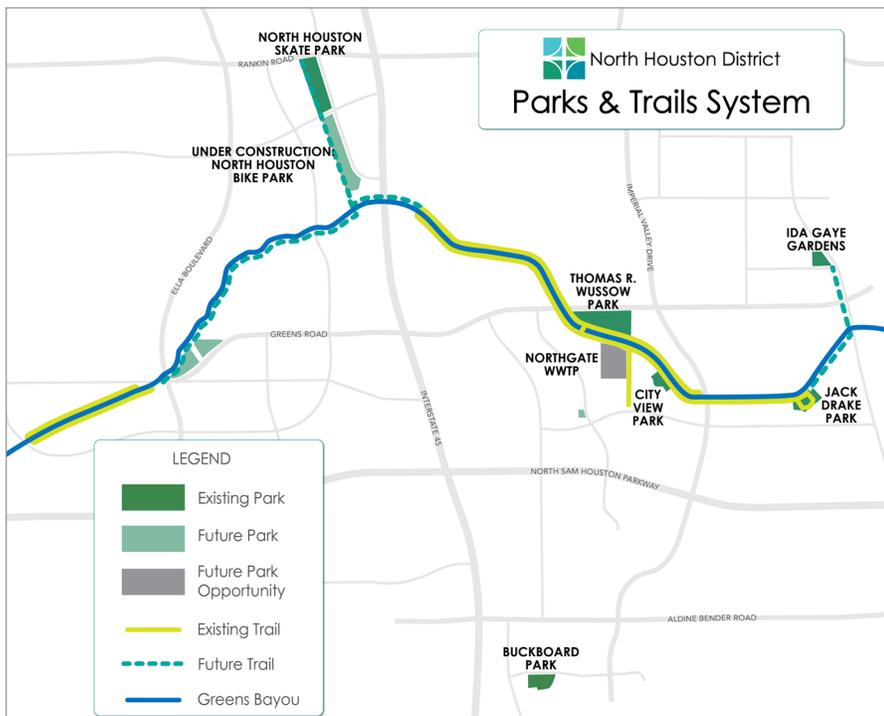
Creating a Sense of Place

District services can also help create a unique, intentional sense of place. The District has installed branded signage at all intersections in the North Houston area, including those within the revitalization area. This signage indicates to residents, business owners and visitors that they are in a community with an identity, that cares about its people and its appearance. This is also the impetus behind the added care of right-of-ways that the District performs. The District regularly mows and de-litters all the major rights-of-way in the revitalization area. This enhances the outward appearance of the area and instills a sense of pride in the community.

The District, with the support of the Greater Greenspoint Redevelopment Authority and the Greens Bayou Coalition, has built several parks and trails in the area (**see Map 3**). Prior to the District constructing Wussow Park, there were no public parks in the area. Five other parks and trails along Greens Bayou have been built since Wussow; four of the six parks are in the revitalization area. These provide recreational, nature viewing and social opportunities for area residents and workers.

Wussow Park is also the home of programs provided by the Aldine-Greenspoint YMCA. The YMCA provides after school, enrichment and sports programs to area youth, including children from the revitalization area. Such programs help kids to perform better in school, reduce youth crime and assist families in bettering their lives. The park also provides a venue for community events, such as National Night Out, holiday food drives and other local health and information fairs.

Map 3



Economic Vitality

The District also works to attract needed retail outlets and services. Presently, there are only two full-service grocery stores in the District, which qualifies the area as a food desert by several USDA measures. At the ½-mile and vehicle access measures, the revitalization area is classified as a food desert. The District is actively soliciting operators for a build-to-suit site on Imperial Valley just north of Greens Road. As the area continues to develop, it is hoped a full-service grocery operator will see the benefit of building in the area.

The District also works with the Greater Houston Partnership, the City of Houston and Harris County to recruit new businesses. The objective is to grow the tax base, provide needed services and increase jobs for area residents. In 2016, the District was actively involved in recruiting an internationally-known online retailer that constructed a large new facility and employs more than 2,500 people. The District has worked with the new business to provide transit services to its facility and recruit workers from the area.

The District also supports the commercial real estate industry by providing semi-annual submarket updates for the major property types in the area. The detailed information provided at these events helps brokers market the area and attract new tenants.

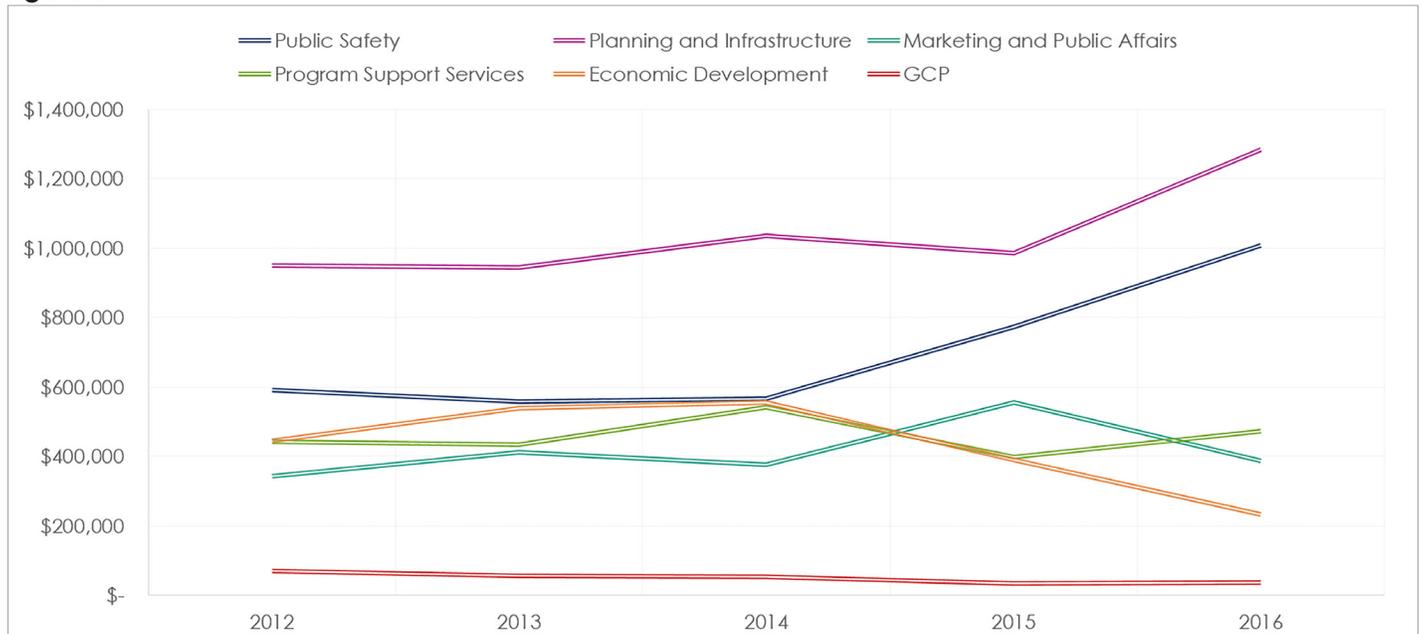
District Investments 2012 – 2016

Table 3 and **Figure 5** show the expenditures by the North Houston District for various programs for the last five years. The largest expenditures are in planning and infrastructure, which includes parks and right-of-way maintenance, and public safety. Given that the revitalization area is the most concentrated area of the district, it is reasonable to assume that 50-60% of these expenditures benefit the revitalization area. Comparable levels of expenditures are anticipated until 2030, the last year of the District’s current service and assessment plan. The chief source of funding for the District is an assessment against commercial property owners of \$0.15431 per \$100 of assessed value. This provides funding to the District to carry out these activities.

Table 3: District Expenditures 2012 - 2016

Category	2012	2013	2014	2015	2016	Total
Public Safety	\$591,369	\$557,159	\$567,076	\$772,208	\$1,008,229	\$3,496,041
Planning and Infrastructure	\$950,423	\$944,073	\$1,036,077	\$986,185	\$1,283,554	\$5,200,312
Marketing and Public Affairs	\$343,556	\$412,742	\$376,835	\$555,685	\$386,879	\$2,075,697
Program Support Services	\$442,189	\$432,959	\$540,428	\$398,019	\$473,919	\$2,287,514
Economic Development	\$445,746	\$539,187	\$555,621	\$388,847	\$233,562	\$2,162,963
GCP	\$68,853	\$55,870	\$54,821	\$34,311	\$37,862	\$251,717
Total	\$2,842,136	\$2,941,990	\$3,130,858	\$3,135,255	\$3,424,005	

Figure 5



Greenspoint Area Revitalization Plan 2017-2018 Action Plan

Based upon the preceding analysis, an Action Plan for 2017-2018 has been developed. Each year, as progress has been made against the overall goals and objectives of the Concerted Revitalization Plan, the plan will be updated.

Focus	Activity	Partner(s)	Estimated Investment	Result
Infrastructure	Improve Stormwater Infrastructure per LAN 2016 Study	TGLO, City of Houston, Texas Water Development Board, HCFCFCD	\$15,000,000	Reduced risk of flooding as seen in 2016 Tax Day Flood
	Flood Mitigation Buyouts	TGLO, HCFCFCD, City of Houston, Texas Water Development Board, TCEQ	\$300,000	Buyout tracts along Greens Bayou to remove people from harm and improve flood mitigation; Goal: 2 units bought out
	Improve Sidewalk Network per 2016 TEI Study	METRO, HGAC, City of Houston, Harris County	\$500,000	Overall improved pedestrian safety and mobility via buildout of missing segments and other improvements; Goal: 2 miles of new sidewalks
Public Safety	Harris County Sheriff's Office Task Force	Harris County Sheriff's Office	\$363,000	Reduced incidence and perception of crime
	Houston Police Department Off-Duty Officer Program	Houston Police Department	\$30,000	Reduced incidence and perception of crime
	NHD Security Services - Private Security	Greater Greenspoint Redevelopment Authority	\$50,000	Reduced incidence and perception of crime
	Hoops and Heroes, Neighborhood Night Out	HPD, HFD, HCSO	\$2,000	Improved public safety / community relations
	Apartment Complexes - Best Management Practices	Apartment Owners, HPD, HCSO	\$2,000	Reduced incidence and perception of crime; Enhanced sense of public safety
Housing	Multi-family Housing	City of Houston, Harris County, TDHCA, Non-Profit/Private Sectors	\$7,500,000	Increased affordable housing opportunities; Goal: 250 units rehabilitated
	Single-family Rental	City of Houston, Harris County, TDHCA, Non-Profit/Private Sector	\$8,750,000	Increased affordable housing opportunities; Goal: 50 new homes for rent
	Improved Energy Efficiency in Low/Moderate Housing	PACE Authority, Building Owners, CPE	\$125,000	Increased affordable housing opportunities through lower energy costs; Goal: 250 units improved
Quality of Life	Jack Drake Park Construction	Greens Bayou Coalition	\$260,000	Sixth park added to NHD service area
	Parks and Trails Maintenance	TxDOT, HCFCFCD, City of Houston, Houston Parks Board	\$292,500	Quality park availability to area residents
	Wussow Park Improvements	Aldine-Greenspoint YMCA	\$75,000	Improved facilities for Y programs
	De-littering, Enhanced Landscaping, Maintenance	North Houston District	\$140,000	High quality, attractive public spaces
Economic Development	Business Recruitment and Development	North Houston Center for Economic Development (NHCED), Greater Houston Partnership	\$8,750	A growing and vibrant economic environment
	Commercial Real Estate Information Services	NHCED	\$1,750	A growing and vibrant economic environment

III. Public Input: Process and Analysis

To gather public input for the revitalization plan, the District developed a survey and performed survey intercepts in the community. The survey instrument (**see Appendix B**) contained 24 questions and gathered information on basic demographics, living arrangements and tenancy, language preferences, employment status of both respondent and household members, household income and expenditures, perceptions of public safety, schooling status and perceptions, park and recreation usage and what they consider to be the neighborhood's greatest challenge.

Demographic data largely tracked information available from commercial and census sources, indicating the survey reached a reasonable cross section of the area's population. Interestingly, survey data indicated that English was spoken in more households than would be expected based upon the results of the ethnicity question, indicating the presence of second or later Hispanic generations. Roughly one-third of the households reported a preference for a language other than English.

Despite the general assumptions regarding the transitory nature of multi-family residents, a majority of the respondents (71%) reported being in their apartments for two or more years with 53% reporting being in their apartments three or more years. As expected from other data sources, respondents reported numerous people in their units with 70% reporting three or more people in the unit and 35% reporting four or more.

As reflected in the census data, the majority of the population is working class. Fifty-three percent (53%) of respondents reported being employed themselves. Of those responding they were not employed, nearly 100% reported someone else in the household being employed. Incomes were as expected, with roughly 70% of respondents reporting annual household incomes of between \$10,000 and \$30,000, and roughly 30% greater than \$30,000. With regards to transportation to work, approximately 60% reported taking a car and 40% public transportation.

The survey included several questions regarding public safety. Approximately two-thirds of respondents reported feeling safe where they currently live. Recognizing that recent personal experiences can influence perceptions of crime, the survey asked the respondent about recent experiences with crime. No respondents reported being the victim of a crime in

the last 6 months, and less than one-third reported a household member being the victim of a crime. Jumping ahead to the final question of the survey, respondents were asked what they felt was the biggest problem in the neighborhood. Two-thirds of respondents reported crime as the biggest problem. It appears that while there may be limited experience with crime by respondents and that they feel safe in their own complexes, the perception of crime in the neighborhood still exists.

In addition to the living arrangements and tenancy questions analyzed previously, respondents were asked about expenditures on housing. Approximately 64% of respondents reported spending roughly one-half or more of their monthly income on rent and utilities. This fits with general reports on housing costs in the Houston area. This would indicate most residents spend well above the national average on housing. When asked if they liked where they lived, a majority reported they did and that the size of their unit was satisfactory. When asked if they would like to move to a house, just over 80% reported they would.

The survey also provides data on the household of school-aged children. Fifty-three percent (53%) of respondents reported having school-aged children. Of those, all reported liking the school they attended. The survey also asked about the use of area parks and trails. Eighty-one percent (81%) of respondents reported visiting an area park or trail in the last month. It should be noted, however, that a portion of the survey intercepts were conducted in a park, likely skewing this figure. The data does fit with anecdotal evidence on strong usage of area parks and trails as observed by the District staff and others.

Analysis of Survey Data

Perhaps one of the greatest challenges facing the area was evident in the survey results. Crime data relative to other similarly situated areas in Houston indicates that Greenspoint has an average to below average level of crime. This seems to be in line with survey respondent's personal sense of safety in their current housing units. It also fits with survey responses relative to own and household members experience with crime in the last 6 months. However, there is still a perception of crime as indicated by the respondent's answers to the question regarding the biggest challenge facing the area. The District's strategy of investing in both actual crime reduction and messaging relative to the perception of crime appears appropriate. The District is also pursuing community engagement and public awareness to increase the community's sense of safety. The District hopes that by engaging stakeholders and helping to build a greater sense of community that over time the perception of crime will decrease.

Relative to housing, the District's goal of improving housing options is well-targeted. The District hopes to attract both single-family for sale and single-family rental products. Two of the latter project types are currently in the area and are very successful. The District is actively promoting a third in the revitalization area. This project, if successful, will likely utilize government housing tax credits to make it affordable for area residents.

As for housing costs, the District supports expanded restricted affordable housing. Very little of the housing in the revitalization area is government subsidized and is subject to rising rents that are occurring in the Houston Area. By increasing the stock of restricted units in the area, the cost burden on area residents should be reduced.

Executive Summary

The North Houston District (NHD) contracted with Lockwood, Andrews & Newnam, Inc. (LAN) to evaluate the performance of the local and regional drainage systems stressed by the recent April 17-18, 2016 (Tax Day) storm event. The primary goal of the study was to determine the root cause(s) of the severe flooding during the event including: overland/overflow, collection system and out of bank Greens Bayou floodplain. In addition to analyzing existing conditions, LAN was tasked to determine the effect of the future Kuykendahl and Glen Forest basins on the study area. Following the development of an existing conditions and post basins models of the region, LAN was also charged with recommending potential improvement measures that NHD can pursue to provide flood relief for the area.

The Greens Bayou watershed in North Houston District (formerly known as the Greenspoint District) is approximately 6.14 square miles and generally bounded by Rankin Road to the North, Beltway 8 to the South, I-45 to the West, and Hardy Road to the East (Exhibit 3). Greens Bayou runs through the center of the area and functions as a major drainage outfall channel. This region was evaluated using a high-level 2D InfoWorks ICM model within the study area in order to understand the regional flooding sources and overland sheet flow patterns.

Existing Conditions:

The Tax Day storm event of April 17 - 18, 2016, a storm with an annual exceedance probability (AEP) of approximately 2% (50-year), was simulated and validated using the hydrodynamic 2D InfoWorks ICM model. Actual storm event information in the form of monitored rainfall time series data and gaged Greens Bayou stages was used to simulate/model the event. The Tax Day event included two intense rain periods that were relatively close together.

Peak 1: During the first rain period (Peak 1) the area experienced significant ponding and flooding due to approximately 4.9-inches of rain fall in 1-hour. The primary cause of this flooding was the lack of local storm sewer capacity and insufficient overland sheet flow paths. During Peak 1, Greens Bayou remained within its banks and did not directly contribute to the localized flooding event. Generally, the ponding remained mostly within the streets and at a times was several feet deep in multiple locations along Imperial Valley and Greens Road. Greens Road was subject to overland sheet flow entering from Imperial Valley and continuing to flow downgrade where it was ultimately blocked by challenging topography. Overland flow travels from the north, with some limited flow exiting to Greens Bayou. The overall direction of flow can be seen in Exhibit 7 through velocity arrows.

The area south of Greens Road and north of Greens Bayou has multiple locations lower than the banks of Greens Bayou. This topographic restriction creates a large "bowled" area that water cascades via overland from north of Greens Road and then ultimately requires the storm sewer system in order to fully drain back to Greens Bayou. For instance, the intersection of Greens Road

North Houston District Drainage Evaluation Report, North Houston District

and Imperial Valley is lower than the elevations of Imperial Valley as it approaches Greens Bayou. The ponding and flooding extents resulting from Peak 1 can be seen in Exhibit 4.

Peak 2: During the second rain period (Peak 2) the area experienced additional ponding and flooding due to an additional 5.2-inches of rain fall in approximately 1.5-hours. Localized flooding was further impacted by high levels and overflows from Greens Bayou. It was during this second peak that Greens Bayou exceeded its banks approximately 900 feet north of the intersection of Greens Road and Greens Bayou. Upon leaving Greens Bayou, the flow cascades into Imperial Valley and Greens Road and flowing to the south and east. This additional overland flow exacerbated the flooding condition that resulted from Peak 1 creating areas with significant ponding and structural flooding, matching observations and flooding reports. Given the magnitude of the event (50-year) it is not surprising that Greens Bayou exceeded its banks. A significant portion of the study area is within the FEMA effective 100-year floodway and floodplain for Greens Bayou.

The simulation of the Tax Day event confirmed that the study area has two primary flood risk sources including localized overland flow and collection system deficiencies and out of bank riverine flooding from Greens Bayou.

Post-Basin Conditions:

A second analysis was performed that simulated a post basin condition and included the two future upstream detention basins - Kuykendahl (HCFC Unit No. P545-01-00) Detention Basin and Glen Forest (HCFC Unit No. P500-08-00) Detention Basin. The basins are part of a regional watershed improvement designed to target a 10-year level of protection.

It was determined that the two future detention basins will have a clear benefit to the Greens Bayou watershed in NHD, but will not completely solve the majority of the flooding issues within the watershed. This is expected as the basins only represent a portion of the regional project and do not include the future/planned Greens Bayou channel improvements. Exhibit 14 documents the benefits of the basins on the study area.

Post-Basin with Berm Conditions:

Given that the out of bank flooding from Greens Bayou in the vicinity of the Glen Forest (HCFC Unit No. P500-08-00) Detention Basin is a significant contributor to flooding in the district, NHD requested that LAN evaluate the impacts of constructing a berm to the south and east of Glen Forest Detention Basin between the basin and Greens Bayou. To accomplish this, a simplistic evaluation of a berm along the southern and eastern perimeters of the Glen Forest (HCFC Unit No. P500-08-00) Detention Basin was performed. An improvement such as this comes with significant challenges, starting with demonstrating no adverse impacts resulting from an obstruction in the floodplain.

In order to determine the potential positive and negative impacts of the basin, several storm events were simulated. The theoretical design storms for the 100-year and 10-year, 24-hour storm events

North Houston District Drainage Evaluation Report, North Houston District

were evaluated in order to determine potential impacts for severe events while evaluating potential benefits during high frequency storm events.

The result of the berm adjacent to the Glen Forest (HCFCD Unit No. P500-08-00) Detention Basin was overall a moderate benefit for the study area during the 10-year, 24-hour storm event. Marginal water surface reductions were seen within the areas south of Greens Road and north of Greens Bayou. Even with the benefits of the basin with an overland flow limiting berm, the localized flooding issues are not resolved. These localized flooding issues are due to insufficient storm sewer capacity and adverse overland sheet flow paths within the region.

It is important to note that the simulation indicated the placement of a berm adjacent to the Glen Forest (HCFCD Unit No. P500-08-00) Detention Basin resulted in the potential for adverse impacts during the 100-year event west and north of the basin. The berm adversely impacted the areas north of Greens Road, south of Resthaven Memorial Gardens, west of the berm, and east of I-45 as seen on Exhibit 16. A berm in the path of an established overbank flow path is potentially detrimental to overall floodplain conveyance and reduces the overall capacity of the area resulting in potential upstream water surface impacts. Due to the adverse impacts within the region, the berm is not recommended without significant additional analysis and engineering.

The preliminary findings in the simulation are useful to understand the existing flood patterns and the potential localized benefits from the two future detention basins as well as the impact from the potential berm.

Recommendations and considerations going forward:

1. Address localized conveyance issues - Conveyance improvements on Greens Road and Imperial Valley Drive should be considered to assist in providing additional conveyance capacity for the extreme storm event. This will assist in addressing local intense rain events and reduce overall ponding depths and durations within the area. It will also help to protect the area during the extreme regional events following the completion of the Greens Bayou Regional Flood Control projects. A primary challenge will be mitigating the improvements to prevent downstream impacts on Greens Bayou. This can be accomplished with localized detention within the NHD or within the project corridors.
2. Buyouts – the NHD’s current buyout plan is justified and warranted given the significant and frequent flooding with the region. Many of the recently and frequently flooded properties are repetitive loss and severe repetitive losses properties which mean they have filed multiple flood insurance claims. The most severe flooding is located in the lowest point of the area south of Greens Road adjacent to Greens Bayou. We recommend continuing the pursuit of the buyouts of repetitive and severe repetitive loss properties.
3. Localized Detention – If buyouts are actively pursued, the cleared buyout property could be repurposed for a multiuse park and localized detention facility. Detention local to the NHD

North Houston District Drainage Evaluation Report, North Houston District

can assist with mitigating the future localized conveyance improvements described in recommendation 1. If the buyout properties are large enough, it may be possible to provide additional sub-regional flood reduction.

4. Grants - A variety of grants exist to assist the NHD with flood risk mitigation projects and studies. Each grant available has varying application timelines, reimbursement procedures, cost sharing breakdowns, and overall project type restrictions. A small sampling of the grants potentially available to the NHD include the following: Flood Protection Planning Grant through the Texas Water Development Board (TWDB), Flood Mitigation Assistance through the TWDB and FEMA, Severe Repetitive Loss through the TWDB and FEMA, Hazard Mitigation Grant Program through the Texas Division of Emergency Management and FEMA, Housing and Urban Development (HUD) through the General Land Office (GLO), and Disaster Recovery through FEMA. It is recommended that these grant opportunities be fully vetted for potential funding options for the NHD.

5. Detailed Feasibility Analysis – A detailed feasibility analysis of the above described solutions is recommended in order to better refine the overall improvement concepts and challenges associated with each recommendation. This detailed feasibility analysis would incorporate a more detailed modeling approach and preliminary engineering to identify key design elements. Key design elements to be evaluated should include major utility conflict analysis, topographic evaluations, preliminary conveyance sizing, alignment determinations, construction cost estimates, and cost/benefit ratios of structures removed from flooding. A detailed feasibility analysis would also assist the NHD in grant preparation and potential federal support through a detailed project understanding.

APPENDIX B

North Houston District - Survey of Residents		DATE:	TIME:	LOCATION:	
Background/Basics					
1	Do you live in an apartment or a house?	Apartment	House		
2	Do you rent or own where you live?	Rent	Own		
3	How long have you lived where you currently are?	Less than 1 year	1-2 years	2-3 years	More than 3 years
4	How many people are currently living where you live?	1	2	3	4 or more
5	Is English the language most spoken in your house?	Yes	No		
6	Ethnicity	Hispanic	Non-Hispanic		
7	Race	White	African Am.	Asian	Other
Work/Employment					
1	Do you currently have a job?	Yes	No		
2	Is the job full-time or part-time?	Full-time	Part-time	N/A	
3	If part-time, would you want to work full-time?	Yes	No	N/A	
4	How much would you estimate you/household earn in a year?	Less than \$10,000	\$10,000 - \$20,000	\$20,000-\$30,000	More than \$30,000
5	Does anybody else where you live work?	Yes	No		
6	How do you get to work (if applicable)?	Car	Bus	Walk/Bike	N/A
Public Safety					
1	With respect to crime, do you feel safe where you currently live?	Yes	No		
2	Have you been the victim of a crime in the last 6 months?	Yes	No		
3	Has anybody you live with been a victim of a crime in the last 6 months?	Yes	No		
Housing					
How much of your monthly income would you estimate your household spends					
1	on rent plus utilities?	One-third or less	Roughly One-Half	More than one-half	N/A
2	Do you like where you currently live?	Yes	No		
3	If you live in an apartment, would you like to move to a bigger apartment?	Yes	No	N/A	
4	If you live in an apartment, would you like to move to a house?	Yes	No	N/A	
Community					
1	Have you been to a park or the hike and bike trails in the last month?	Yes	No		
2	Are there school aged kids in your household?	Yes	No		
3	If yes, do you like the school they are going to?	Yes	No	N/A	
4	What do you think is the biggest problem in the neighborhood?	Crime	Housing	Poverty/work	Other