MULTI-FACTORIAL ANALYSIS OF PRIME NEIGHBORHOODS IN THE HOUSTON-GALVESTON AREA

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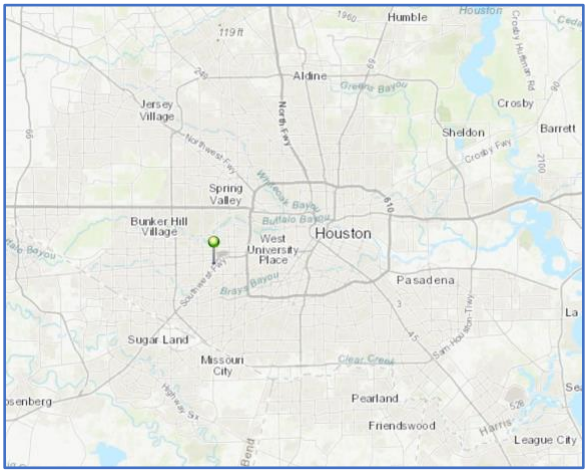
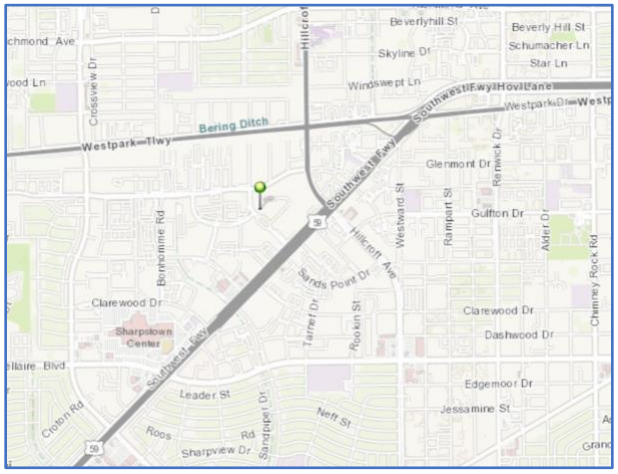
Introduction

The purpose of this project is to determine ideal neighborhoods of interest in Houston, Texas for a client that has recently received a job offer in the area. Ideal areas would include good schools for her two children which are of elementary and middle school age, within 30 minutes of work, low crime, and has good environmental quality.

The product of this project will be a least cost raster indicating areas which meet the client's needs and the identification of neighborhoods within those areas. The criteria for site selection include:

Away from airport noise
Away from air pollution
Away from ground pollution
Away from superfund and brownfield sites
Away from flood areas
Within 30 minutes to and from work.
Close to a good school and within the school's district
Close to emergency services such as hospitals, fire stations, and police stations
Away from crime zones
Close to leisure parks
Walkable (walk paths)
Away from road noise
Close to Public Transportation





(Left) Pin map of client's workplace in Houston, Texas. Location is in the western side of Houston near Hwy 59 / Southwest Freeway and Westpark Tollway. The address is 6001 Savoy Drive #110, Houston, TX 77036 , a storm water compliance firm called RSB Environmental. (Right) The same work location at a smaller scale to see exact area reference.

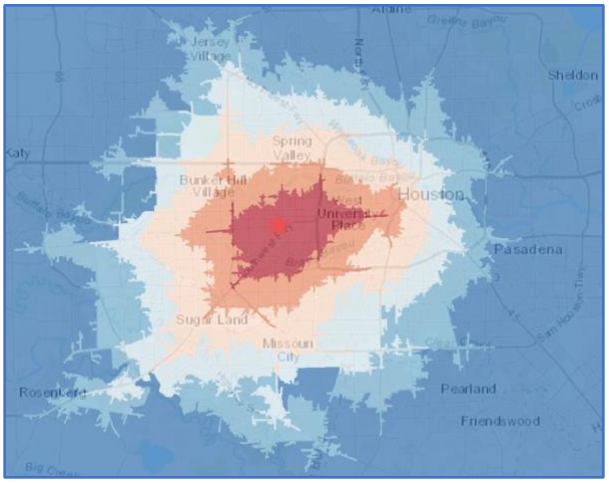
Methods

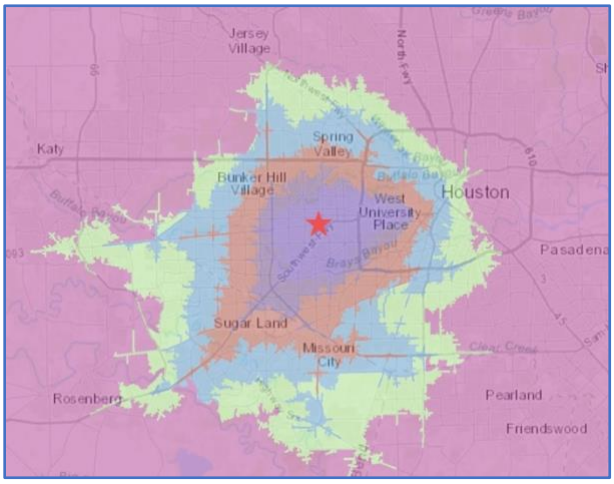
This model is fairly straightforward and will include only the Houston-Galveston Areas. The commute aspect accounts for the most temporal, limiting factor as the client wishes to limit distance to only that which can be driven within 30 minutes. The overall scale is fairly localized to only the south central part of Texas. Houston is a very large area there are many possibilities, as such it is important to reduce possible living areas as much as possible. The client would ideally intend to move soon so that the data remains current and relevant.

Each set of factors will have an output raster which can be reclassified into appropriate ranks. The ranking system will be based on the concept of least resistance, where more negative values are considered favorable. Some factors will not contain negative values (i.e. pollution) because these factors are inherently bad, the least possible rank value would be (0) zero.

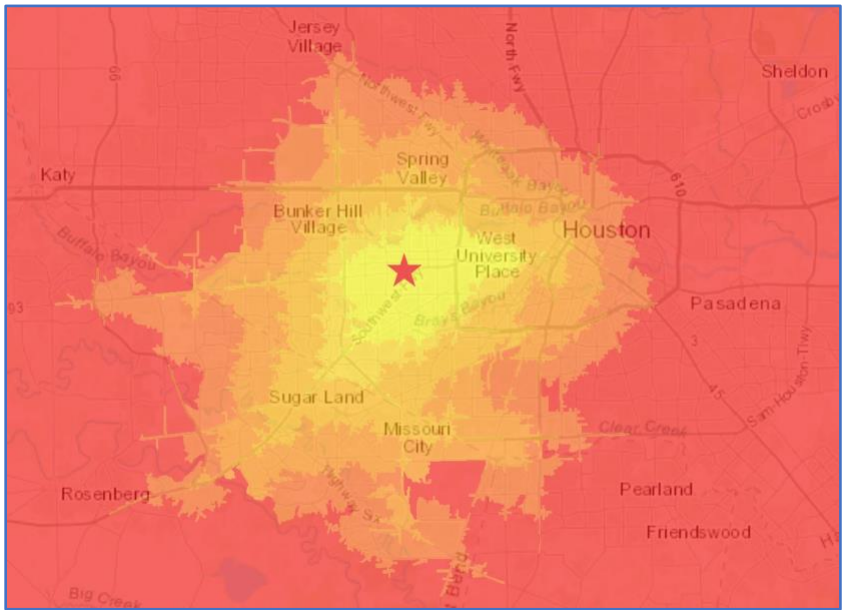
Commute

Arguably the most important factor is commute. The client has already found a job in Houston, as such it would be crucial to find a new home with a short commute. The following intermediate maps show commute drive time areas based on 10,15, 20, 25, and 30 minute drive times both driving toward and away from the client's work location indicated by a star. Houston's dense population creates highly variable drive times, dependent on the time of day and the type of road whether it be farm roads, avenues, or highways. The two main variables in computing drive time areas are the time of day as well as the type of street. Assuming work begins at 8:00 am CT and finishes at 5 p.m. CT, approximate leave times would be at about 7:30 am CT from a home location, and 5 p.m. from work to home. The drive time areas were created using the **calculate drive time areas tool** from ESRI online services. Areas closer to the work site are given a more negative rank value than areas further way. Throughout this project, negative values are favorable while more positive values are unfavorable conditions. For these maps ranks ranged from -5 to -1 for calculated areas, with all else areas within the area of interest (GHAC) as (0) zero.

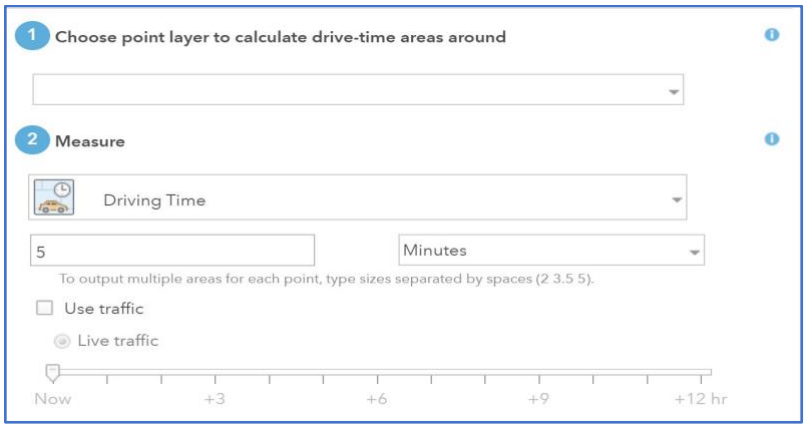




(Left) Drive times on a Monday at 7:30a.m. going toward the work site. (Right) Drive times on Monday at 5:00p.m. going away from work.



The map above is a combined map of the *drive to work* and *drive away from work* maps. Areas with a combined (-10) value are found closest to the star indicating the job site. Notice the lines which extend the farthest follow highways and avenues rather than regular small roads.

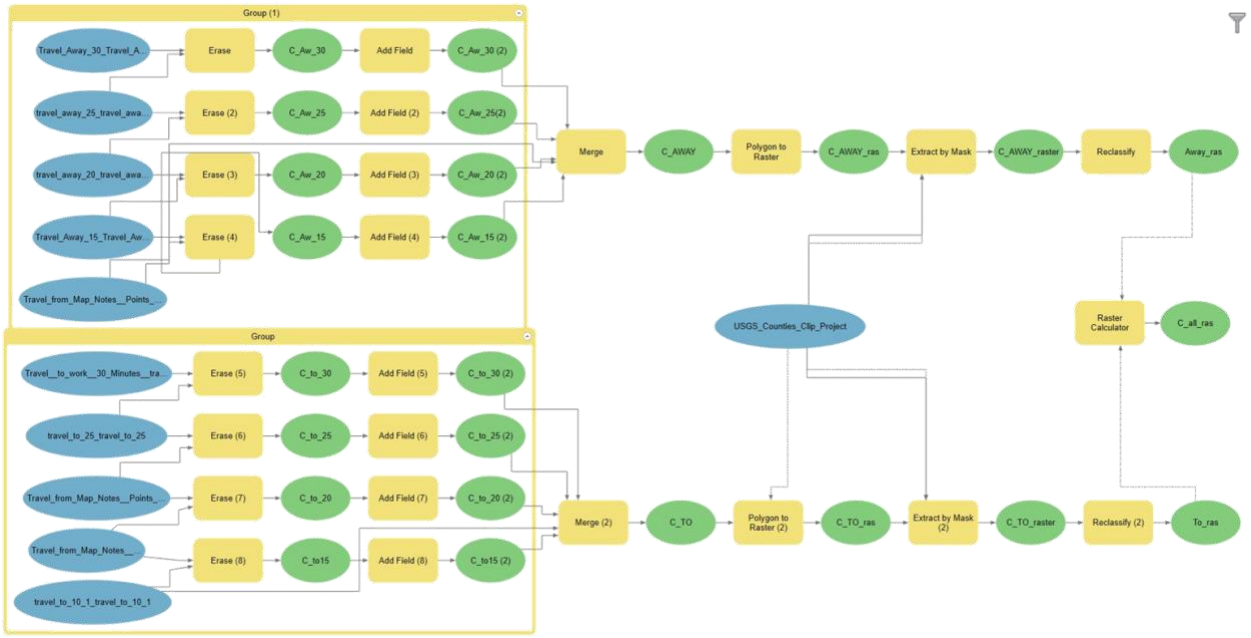


(Above) Drive-Time Tool Example.

To create the above maps, the Create Drive Time Areas Tool from ESRI Online was used. The image above is a screenshot of what the tool looks like. The process for finding the tool is: Login to ESRI Online through your registered organization -> go to **Maps** tab -> go to **Analysis** button

-> select **Use Proximity** from the options list -> and select **Create Drive-Time Areas.** To use the tool, a starting point is created using the Add -> Map Points -> Place a stickpin at the point location (work). This starting point is necessary to create areas around the point. At this point the Create Drive-Time Areas tool is opened and the point location for work is used as the point layer -> Measures should use Driving Time (other options available including Walk Time, etc.) -> Type in the amount of driving time (i.e. 5 minutes, 10 minutes, etc) -> Check the box for **Use Traffic** -> and select **traffic based on a specific leave time** -> select leave time for either going to work or go away from work - > select moving toward point or moving away from point options -> name the file and run. This tool has some caveats. The above image shows a small note beneath the driving time selection that says to type multiple numbers for multiple outputs at once. This would have been very efficient if it had worked. Instead, each drive time had to be computed separately. As such, outputs may have been simple buffer rings, or they may have been area individual layers.

Because the tool did not allow for multiple areas at once, each drive-time was a separate output layer. With drive-times of 10, 15, 20, 25, and 30 minutes, multiplied by (2) two commutes, (10) ten outputs were created. The following ArcGIS model shows what was done with these layers to make them useful.



(Above) Commute Model using Model-Builder using files generated from ESRI Online Drive-Time Areas Outputs.

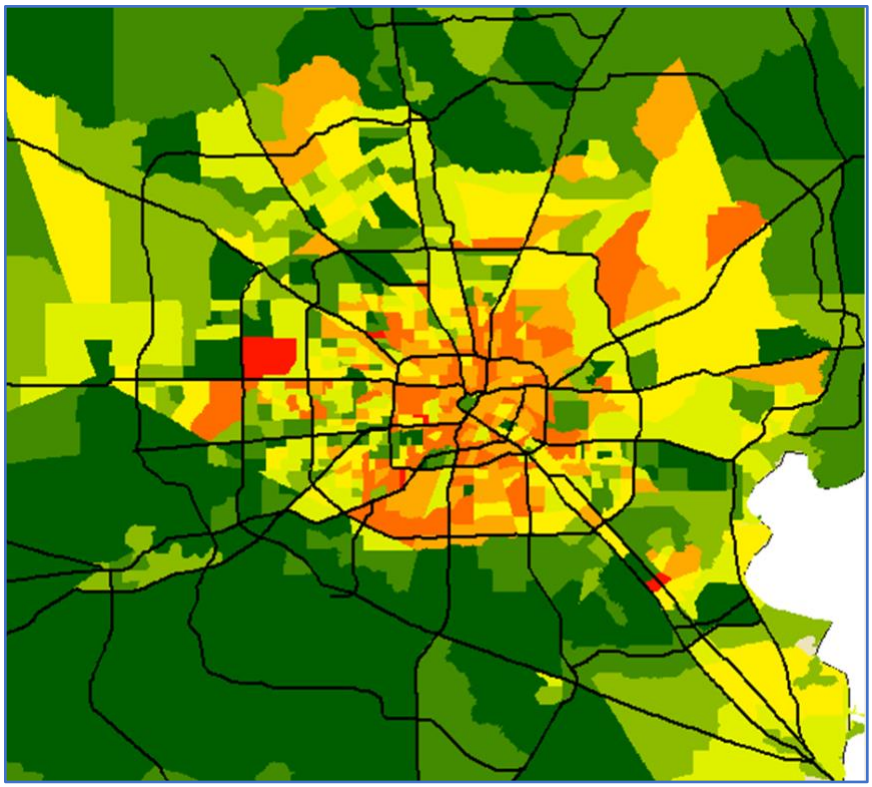
The (10) ten output layers needed to be reduced to essentially buffer rings. To do this, the largest area layer (30) thirty minutes had the next largest area,(25) minutes, erased from it so as to create polygons which represented only the (30) thirty minute proximate drive areas. This was done for the 25, 20, and15 minute drive-area layers as well, but not to the 10 minute area as it is the smallest. Each output was added a new field named “Rank”, short number, and merged. At this point, each rank was manually typed with values from -1 to -5, longest drive time to shortest

time. The *drive to* and *drive away* layers were kept separate. These outputs were converted to rasters using a mask of the HGAC area (USGS_Counties_Clip_Project layer). These two rasters were then reclassified using the Rank field so as to include NO DATA as a new value of 0. The two rasters were than added using (raster_1 + raster_2) formula to produce an output showing areas with the shortest commutes both going to and from work. Areas beyond the 30 minute approximate drive time are equally bad for the client as they would result in not getting to work on time.

Crime Rate

One of the most important factors in choosing a neighborhood is the crime rate in that particular area. To address this, The Federal Bureau of Investigations (FBI) Crime Risk Report data was used. This data compares the local average crime level to the nation as a whole, with an index value of 100 being average. It incorporates all types of crimes and provides a useful measure of the overall crime rate in a given area. The data was already broken down to US Census tracts by Applied Geographic Solutions, Inc.. This made its incorporation into the neighborhood selection data very simple with only minor preprocessing needed.
The following method was used: Crime Risk Polygon layer was clipped to the areas of interest (HGAC) -> add new field named “Rank”, short numerical -> Calculate Field (Rank = Crime Rate)-> Reclassify (See Below)-> polygon to raster.

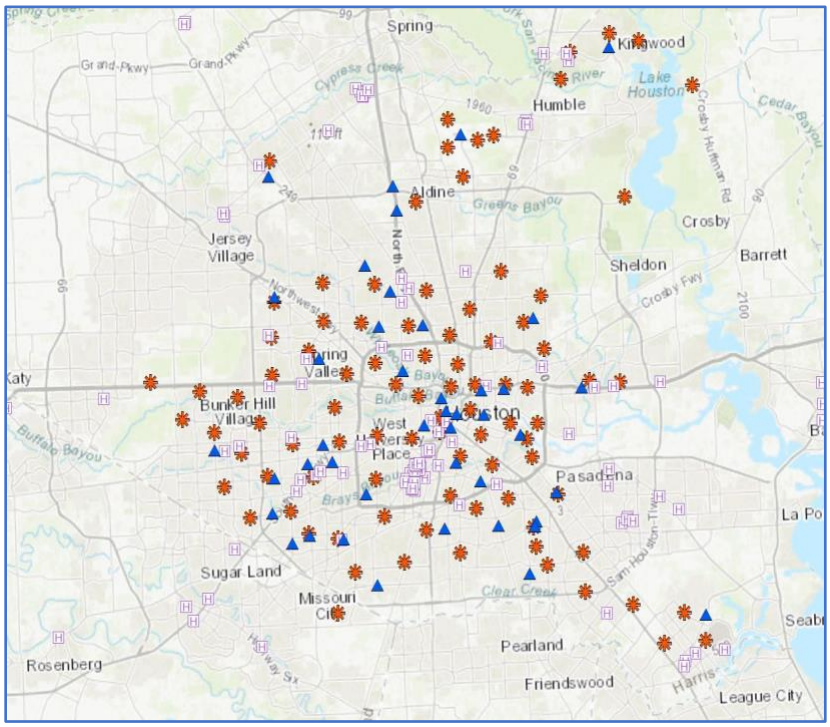
Reclassification Table	
Range (Natural Breaks(Jenks))	**New Value**
9 - 52	1
52.1 - 83	2
83.1 - 122	3
122.1 - 175	4
175.1 - 246	5
246.1 - 337	6
337.1 - 480	7
480.1 - 610	8



(Above) Raster output of crime rates in Houston -Galveston Area. Dark green areas have a lower crime rate than red areas.

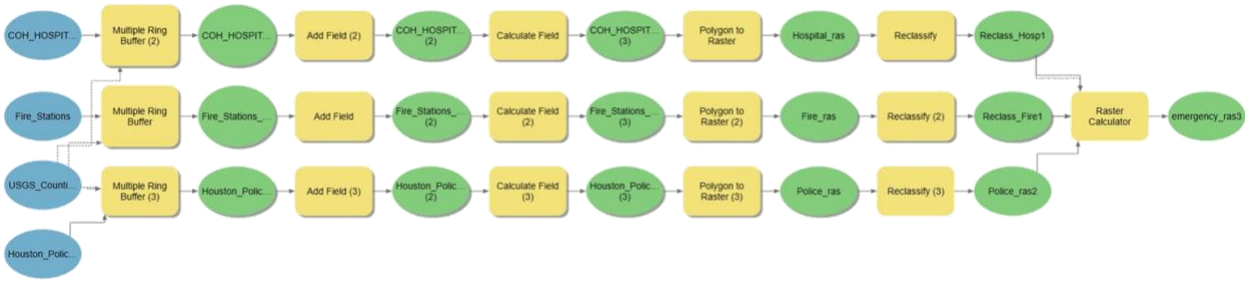
Emergency Services

Proximity to emergency services is crucial in crisis situations, especially in a city where traffic is a major complicating factor. With the risk of car crashes high, remaining near a hospital can be the difference between life and death. The same falls true with fire services where response times can prevent fires from spreading and the loss of property. As such, insurance costs may also be reduced with increasing proximity to such services. Locations for hospitals, fire stations, and police stations as point data were retrieved from the Houston-Galveston Area Council (HGAC) site. Below is an image of the point data.



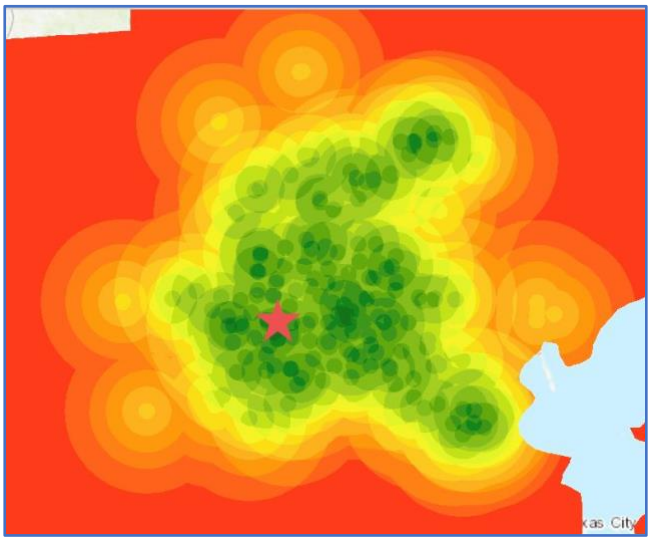
Above: Raw point data. H - Hospitals, Red Asterisk - Fire Stations, Blue Triangle - Police Stations

Each service point was given 5 buffers (1 mile, 2,3,4,5 miles) using the Multi Ring Buffer tool. A new field was added to each attribute table and named “Rank”, short numeric. The field was then calculated as Rank = !distance!. Each layer was then converted into rasters and reclassified from -5 to 0 using the chart below and to account for areas without data.. Then the raster calculator was used to produce an intermediate “emergency services” map using the formula (Hospitals +Fire Stations + Police Stations).



Above: Model of the "emergency services" workflow.

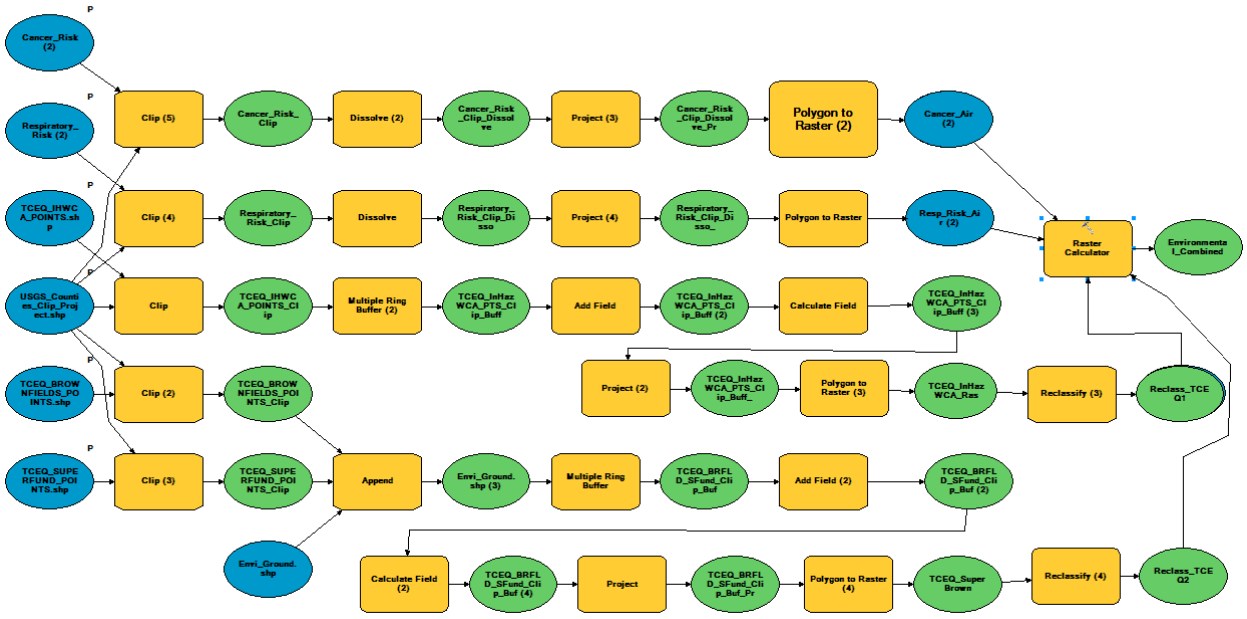
Reclassification for All Services		
Buffer	**Rank**	**New Value**
1 mile	-5	-5
2	-4	-4
3	-3	-3
4	-2	-2
5 miles	-1	-1
	NO DATA	0



(Right) Emergency Services Raster Map where green areas are closest to an emergency service.

Environmental Factors

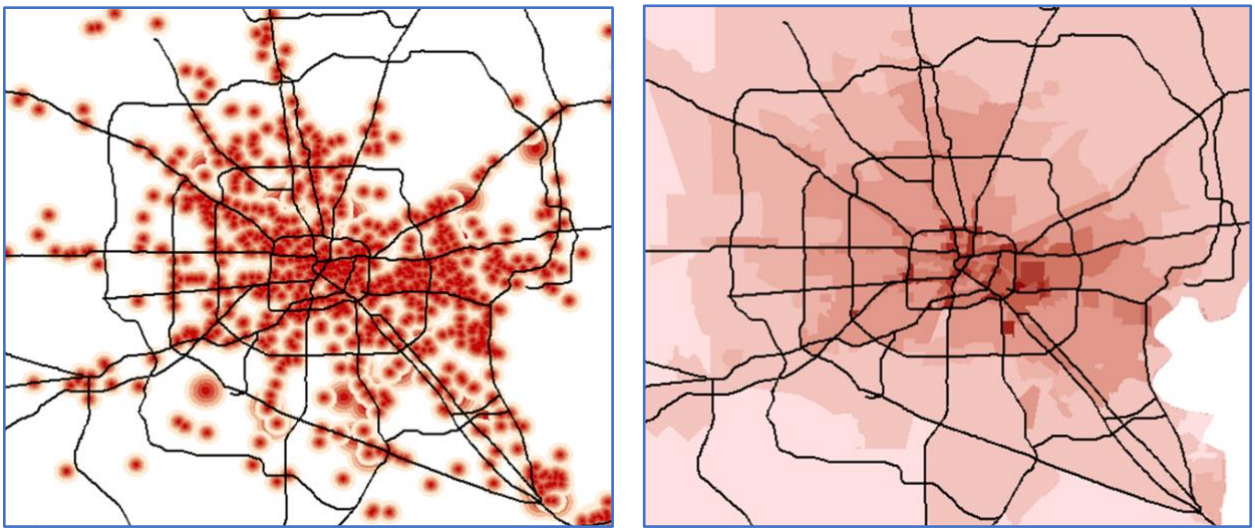
The environmental component of the model was comprised of four datasets, covering both ground and air pollution, from either the United States Environmental Protection Agency (US EPA) or the Texas Commission on Environmental Quality (TCEQ). Ranks were assigned to buffers rings created for the point files and then they were converted into weighted rasters. Later in the process they will be combined with another two rasters created from the two air-pollution polygon files using addition so that the final environmental raster will contain cumulative values for each cell based on all of the factors considered.



Above: Data workflow model for the Environmental components

Ground pollution was evaluated by combining the Industrial Hazard Waste Corrective Action (IHWCA) data with a data set produced by combining both Brownfields and Superfund Sites to produce a point file that was buffered at ¼ mile increments for the IHWCA and ½ mile increments for the Brownfield-Superfund layer. A greater distance was assigned to the Brownfield-Superfund data due to known risk in soil and groundwater around these contaminated sites. Industrial Hazardous Waste Corrective Action conversely was lower due to the size and that remediation is actively employed to minimize the environmental damage. Both data sets were given five buffer rings and a new field was added called “rank”. Each ring was ranked from 1 - 5 with the highest value closest to the point location. A final reclassification accounted for NO DATA areas present in the out rasters.

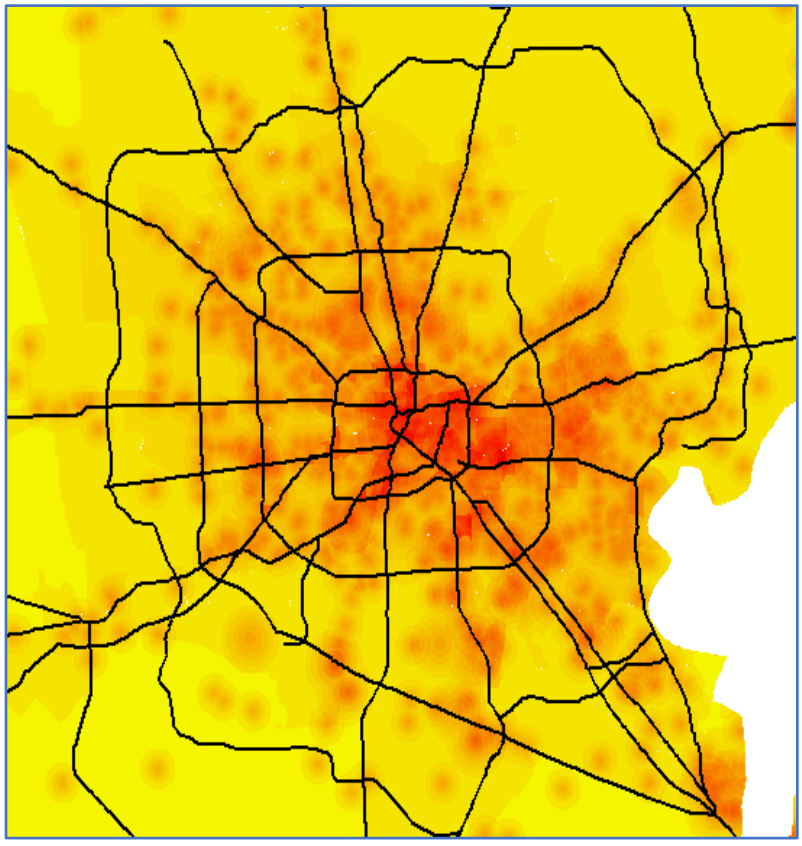
Reclassification of IHWCA			Reclassification of Brownfield-Superfund Sites		
Buffer	**Rank**	**New Value**	**Buffer**	**Rank**	**New Value**
0.25 mi	5	5	0.5 mi	5	5
0.5 mi	4	4	1.0 mi	4	4
0.75 mi	3	3	1.5 mi	3	3
1.0 mi	2	2	2.0 mi	2	2
1.25 mi	1	1	2.5 mi	1	1
	NO DATA	0		NO DATA	0



(Left) Combined Ground Pollution data. (Right) Combined Air Pollution data.

Rating Air Pollution was performed by combining two datasets provided by the US EPA Cancer Risk and Respiratory Risk. These came as polygon files divided by US Census Tracts and each was assigned an estimated index value based on established index models (Hazard Index and Core Based Statistical Areas with an estimated lifetime cancer risk greater than 100 in a million.) While some caution should be exercised interpreting them due to their limitations and uncertainties of the assessment that may vary from location to location as well as from pollutant to pollutant, they do provide a good baseline estimate of airborne risks in the Houston Metro area. Hazard values of 0 - 5, were already assigned by the EPA for Respiratory and 0 - 4 for Cancer Risk data sets and were left unchanged.

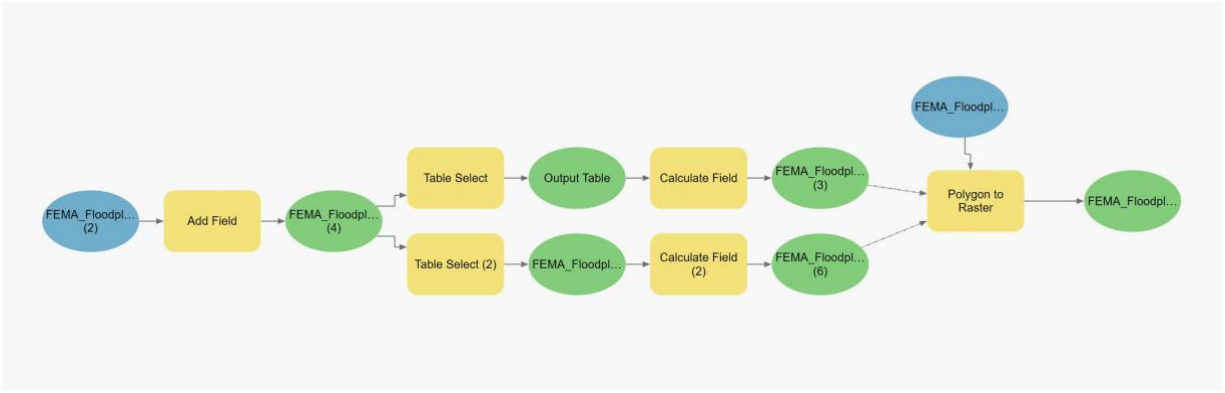
EPA Respiratory Risk (Hazard Index)		EPA Cancer Risk (per 1 million people)	
Range	**Rank**	**Range**	**Rank**
0 - 1	0	1 - 25	0
1 - 5	1	25 - 50	1
5 - 10	2	50 - 75	2
10 - 15	3	75 - 100	3
15 - 20	4	> 100	4
> 20	5		



(Above)The Environmental Heat Map produced where red areas have high danger/risk factors than yellow or green areas. .

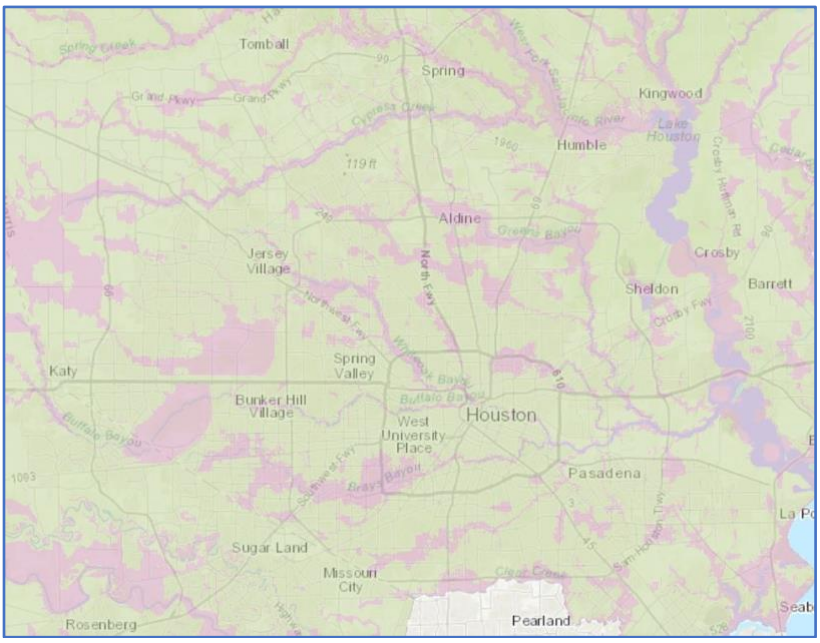
FEMA Floodplains

Houston is well known for its disastrous flooding issues, especially during hurricanes and flash storms. This is due to the draining of wetlands in and around Houston for the purpose of urban expansion and development. To avoid areas with high chances of flooding, the FEMA flood map for the Houston-Galveston Area was used. Ideally areas labeled as zone C, less than 0.02% chance of flooding (500 year floodplain), would be selected; however, the attribute table did not have any areas designated as zone C. Instead, zone X, also known as the 500 year floodplain was selected and assigned a rank of (0) zero. All other areas were labeled as the 100 year floodplain or areas with higher chances of flooding due to special circumstances, as such a rank of (10,000) ten thousand was assigned. Reasons to assign such a high rank to areas with a high chance of flooding include: major traffic issues which could add hours onto a typical 30 minute drive, damage to property, health issues with the rise of mosquitoes during wet seasons, dangerous flash floods, additional insurance costs, and the disruption to personal routines.



(Above) FEMA submap model.

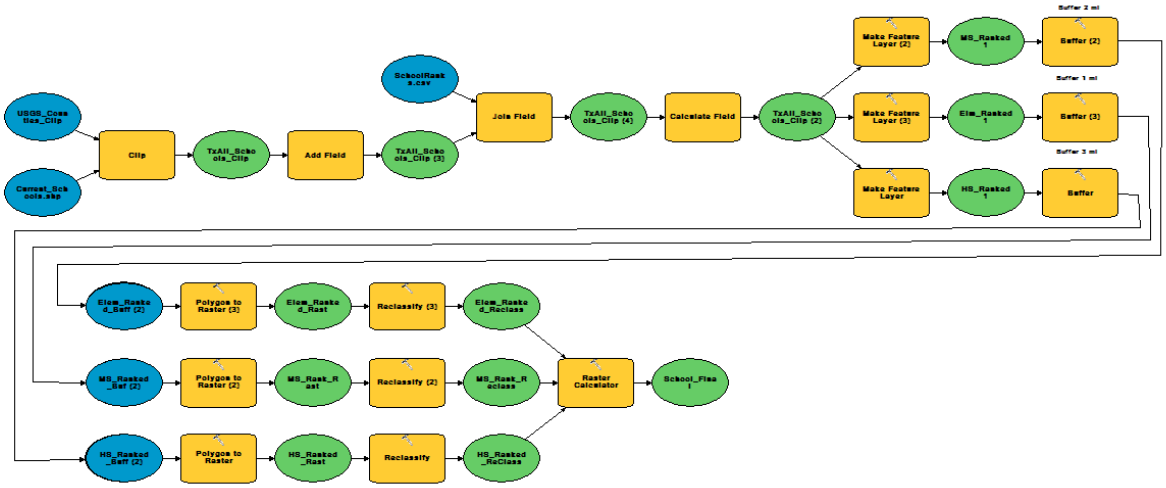
The downloaded FEMA shapefile map was added a new field named “Rank”. Areas labeled as zone X were selected and a field calculation for Rank was given a value of 0 for selected areas. Another selection for all areas except zone X, and a field calculation for Rank was given a value of 10,000 for selected areas. The polygons were then transformed to rasters.



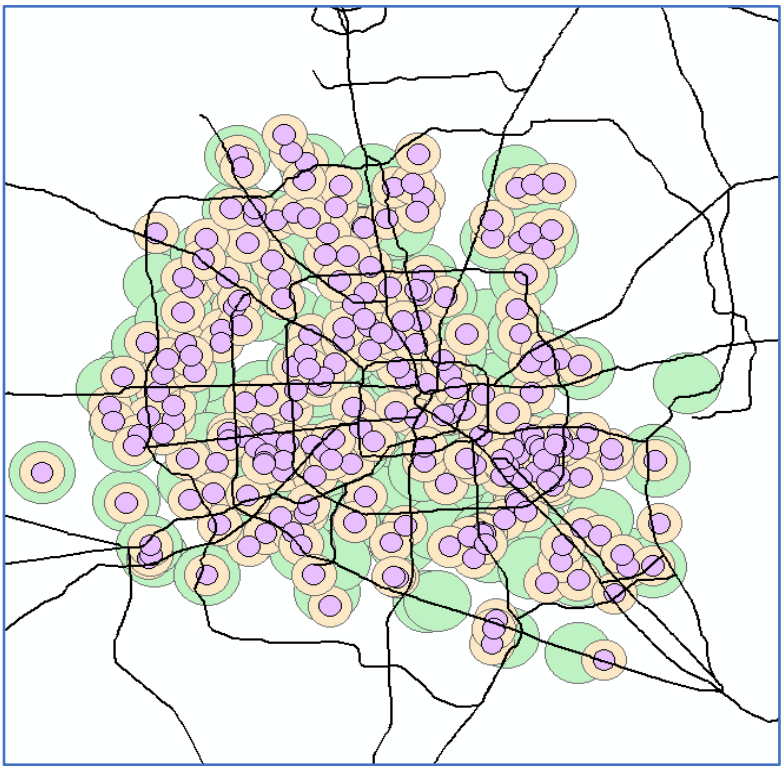
FEMA floodplains raster map output. Green areas are zone X with rank of 0, and purple areas are flood zones with a rank of 10,000.

Education/Schools

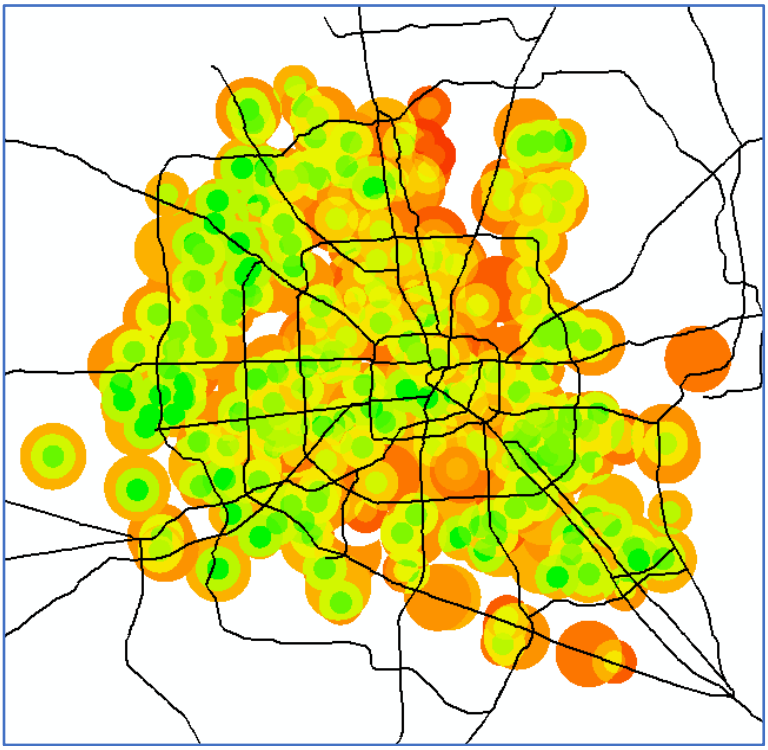
Schools are a major determining factor when choosing a neighborhood as home values are often directly affected by a school's performance in addition to the quality of education a school produces. The Texas Education Agency (TEA) provides data for every school in Texas and also provides their Accountability ratings free to the public. From this information, our schools variable was produced with a fair amount of processing involved to get the data into a usable format.



The Texas schools point file contained the location of every school in Texas and was very impractical for looking at just the Houston Metro area. It was clipped to the Houston-Galveston Area Council 13 county region to make it more manageable initially. A table join with the Accountability rating was then performed in order to have each location ranked. The TEA ranks schools A-F based on testing. Text is incompatible with our ranking system so a field was added and recalculated converting A-F into -5 through -1, respectively (based on our lower resistance model concept). Once new values were added, the shapefile was divided into three grade ranges (K-5, 6-8, 9-12) to separate the Elementary, Middle School and High Schools from each other. These shapefiles were then buffered at the estimated attendance zones: 3 miles for High Schools, 2 miles for Middle Schools and 1 mile for Elementary Schools. The buffers were then converted into Rasters maintaining the rank of each individual school the buffer represents. The final steps of the schools data preparation were to reclass the rasters and recombine them using the raster calculator addition process and the formula (Elementary + Middle School + High School).



Above School Buffers displayed as follows: Green- High School, Beige- Middle School, Purple- Elementary Schools.



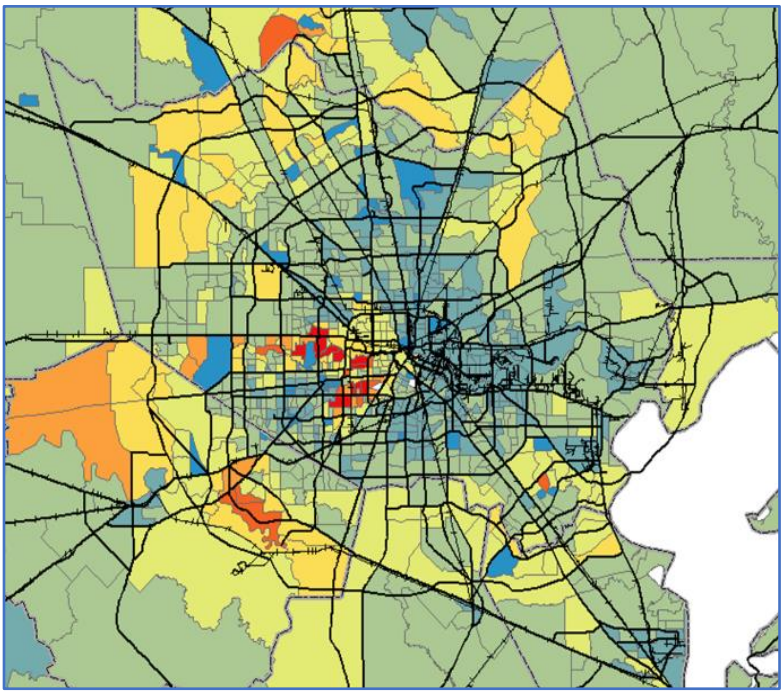
Above: The Final output Raster produced of the Schools Ranking data. Green areas are preferable as they have TEA rating of “A”, while red areas have TEA rating of “F”.

Monthly Housing Cost

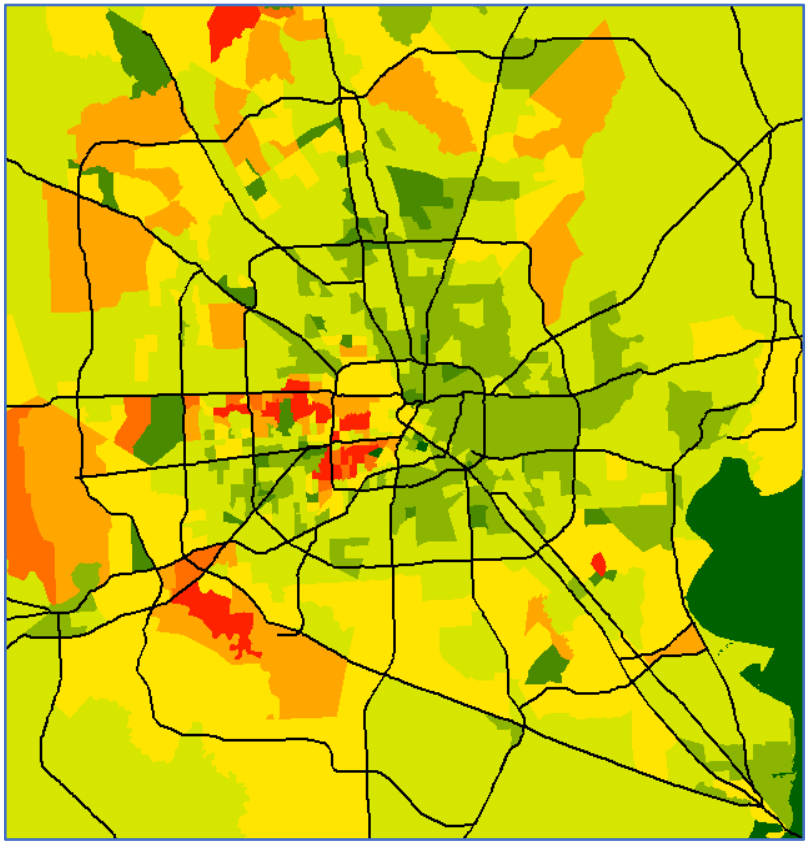
Housing cost if often the deciding factor in choosing a neighborhood. In order to address this factor the Housing and Urban Development (HUD) Affordability Index was employed. HUD takes US Census demographic data and extracts information such as average housing cost, average housing cost for owners and renters separated, commute time and cost, number of vehicles per household and their cost etc. The data is gathered by census tract making processing almost painless after choosing how to break it down. The average housing cost was broken into eight positive increments of $500 ranging from $500 to $4000 per month. After which it was converted into a raster and reclassified in preparation for the final raster calculator process step. While Housing cost is not a negative thing like Crime or Environmental pollution it does have a negative effect on one's bank account. Therefore it was decided to remain a positive integer since it is a resistance factor.

(Above) Workflow model for processing the HUD Affordability Index Data

Reclassification Table`	
Range	**New Value**
$500 - 1000	1
$1000 - 1500	2
$1500 - 2000	3
$2000 - 2500	4
$2500 - 3000	5
$3000 - 3500	6
$3500 - 4000	7



(Above) Affordability polygon data before processing, where blue is most affordable and red is least affordable. (Below) Affordability Data after processing. Where dark green is most affordable and red is least affordable.



Noise

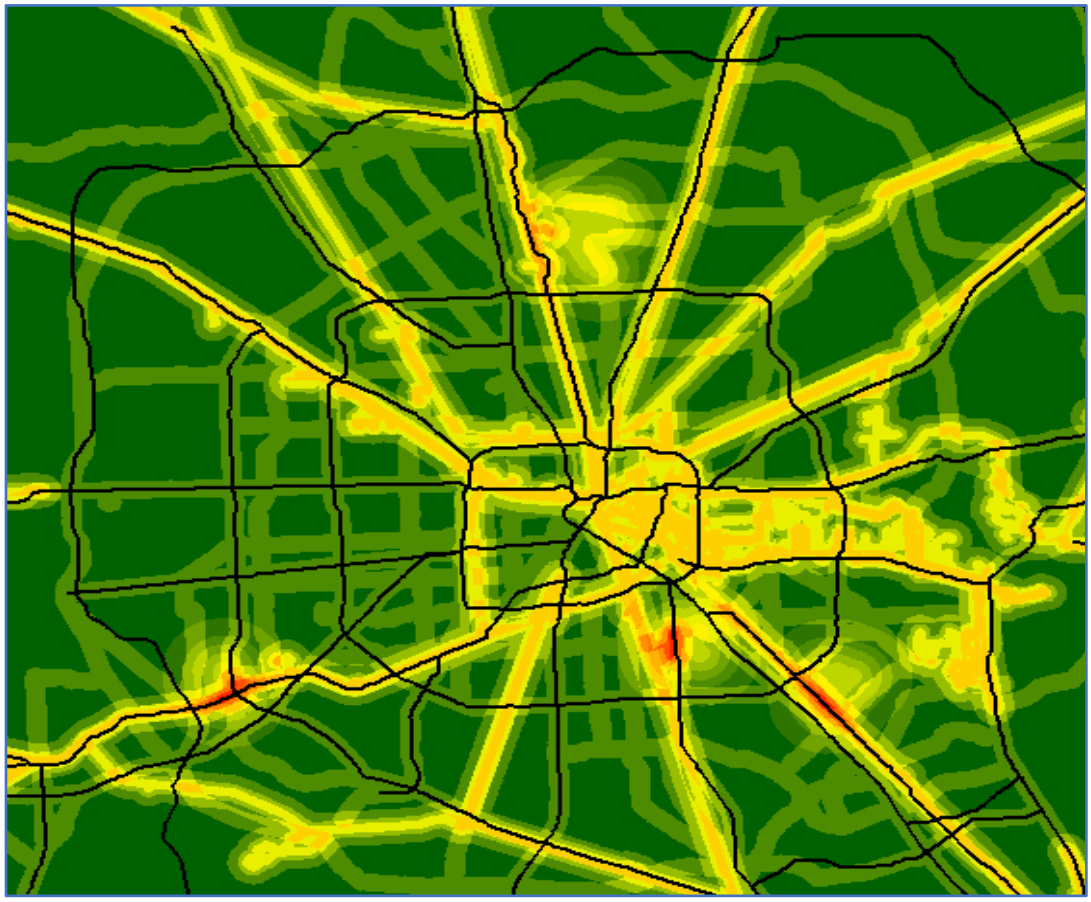
The amount of background noise can adversely affect one's quality of life. To avoid high noise areas three known culprits were taken into consideration: Airports, Railroads and Highways. All three datasets were found at the Houston-Galveston Area Council and required a small amount of geoprocessing.

Airports were the largest concern as engine noise comes not only from aircraft at the airport but in the air as well. Taking this into account 5 buffers were added at: 0.5, 1, 1.5, 2, and 3 miles around each one then given a positive rank from 1 to 5 respectively. Once the buffers and ranks were established the data was then converted into a raster, reclassified and combined with the other two (Airports + Railroads + Highways).

Reclassification for Airports		
Buffer	**Rank**	**New Value**
0.5	5	5
1	4	4
1.5	3	3
2	2	2
3	1	1
	NO DATA	0

Major roads and Railroads can also be large producers of noise, Highways during Houston's rush 3 hours and Railroads when a long train goes by. Highways were given a single buffer of ½ mile, (with a weight of 2) while Railroads received three, one at ¼, ½ and 1 mile (with weights of 2, 4, 6). This was due to highways also being needed for transportation and to avoid a Railroad being in the vicinity. The rest of the process was the same as above with converting to raster format followed by reclassification and the combining of all three rasters.

Reclassification of Highways			Reclassification of Railroads		
Buffers	**Rank**	**New Value**	**Buffers**	**Rank**	**New Value**
0.5 miles	2	2	0.25 miles	6	6
	NO DATA	0	0.5 miles	4	4
			1.0 mile	2	2
				NO DATA	0

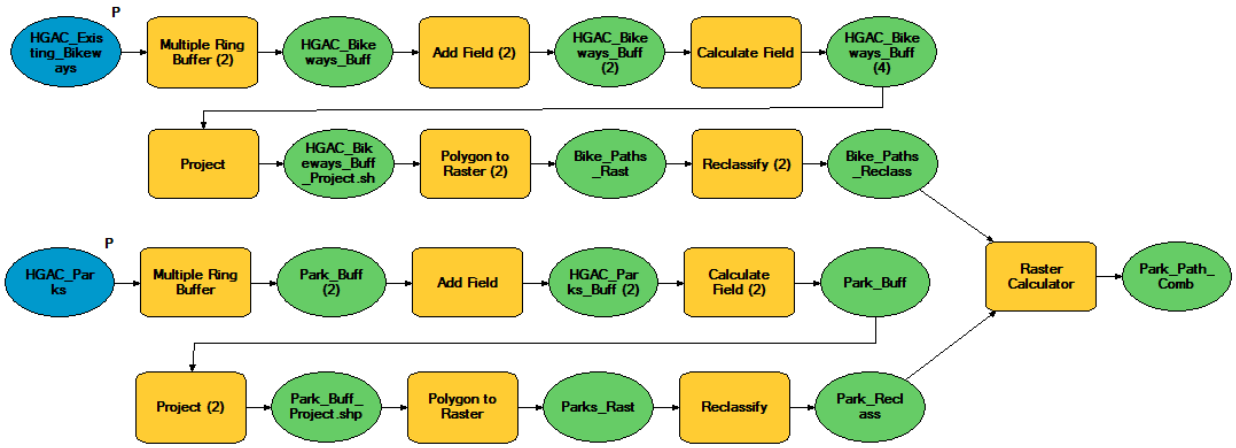


Above: Final composite Noise raster produced. Note the emphasis on avoiding Railroads. Green areas have a lower risk of noise issues while yellow and red areas have higher risk of noise pollution.

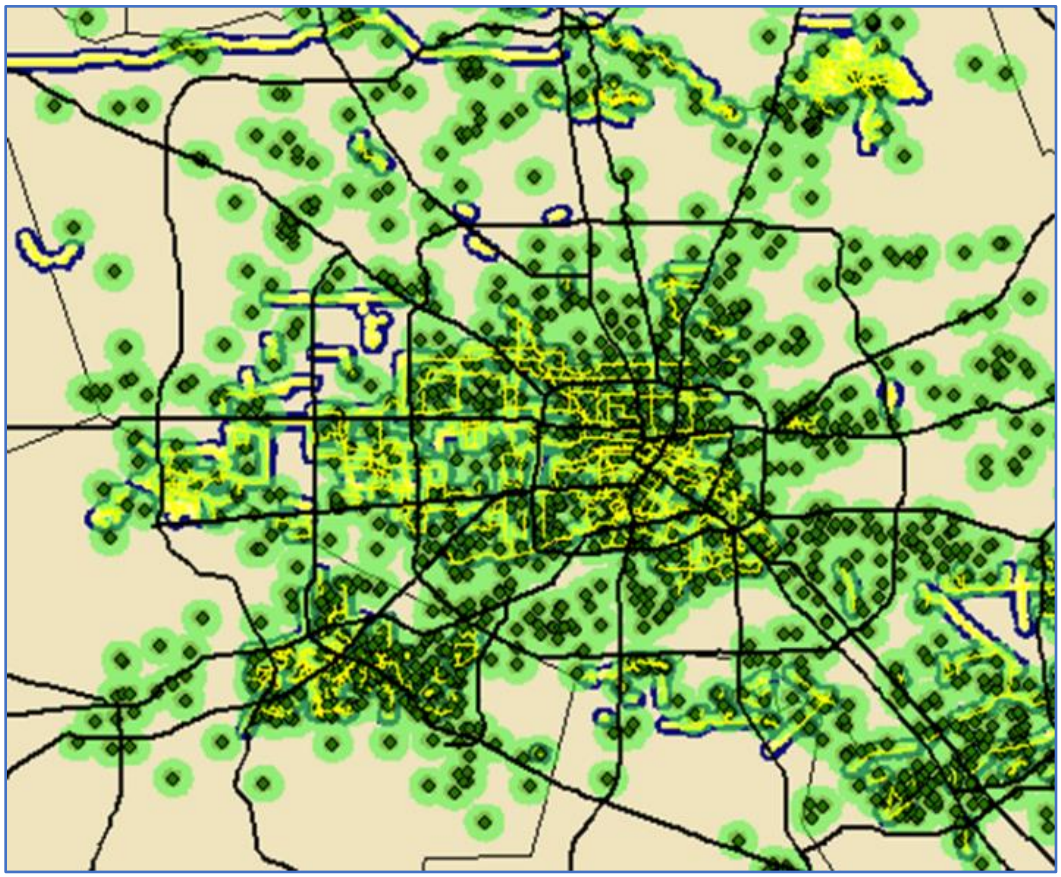
Parks and Paths

A neighborhood's appeal is based on many things, one of them is green space. The availability of both open green space and walking/biking paths greatly improves an areas appeal. Two factors were added in to try to measure this, the proximity to **parks** and the proximity to **bicycle paths** in an area. Two data sets were found at the Houston-Galveston Area Council (HGAC) that provides this information. These files were buffered at distances of 1 mile for parks and given a value of -3, and Paths were assigned 2 buffers at ¼, and ½ miles which were assigned values of -2 and -3. The logic behind the distance was on the grounds of people sometimes drive to parks but are more often going to be walking or riding a bicycle to a long path. Once these values were assigned the rest of the data preparation was fairly linear in nature consisting of projecting the data into State Plane Texas South Central Coordinate system, converting to a raster, reclassification and combining the two in preparation for the final raster addition process.

Reclassification for Parks			**Reclassification for Bicycle Paths**		
Buffer	**Rank**	**New Value**	**Buffer**	**Rank**	**New Value**
1 mile	-3	-3	0.25 miles	-3	-3
	NO DATA	0	0.50 miles	-2	-2
				NO DATA	0



Above: Data workflow processing model used to combine the Parks and Bicycle paths shapefiles provided by the HGAC.

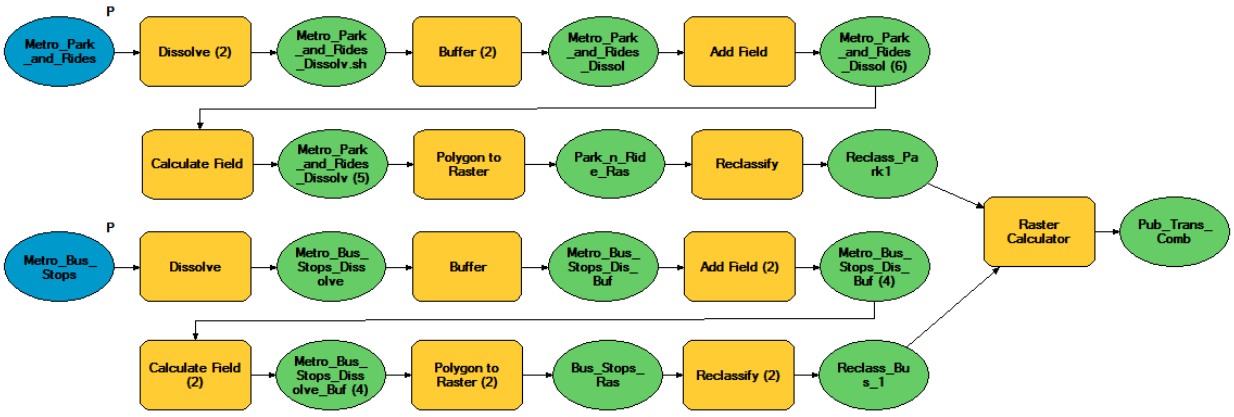


Above: The final combined output with the bicycle paths polyline file overlaid for clarity.

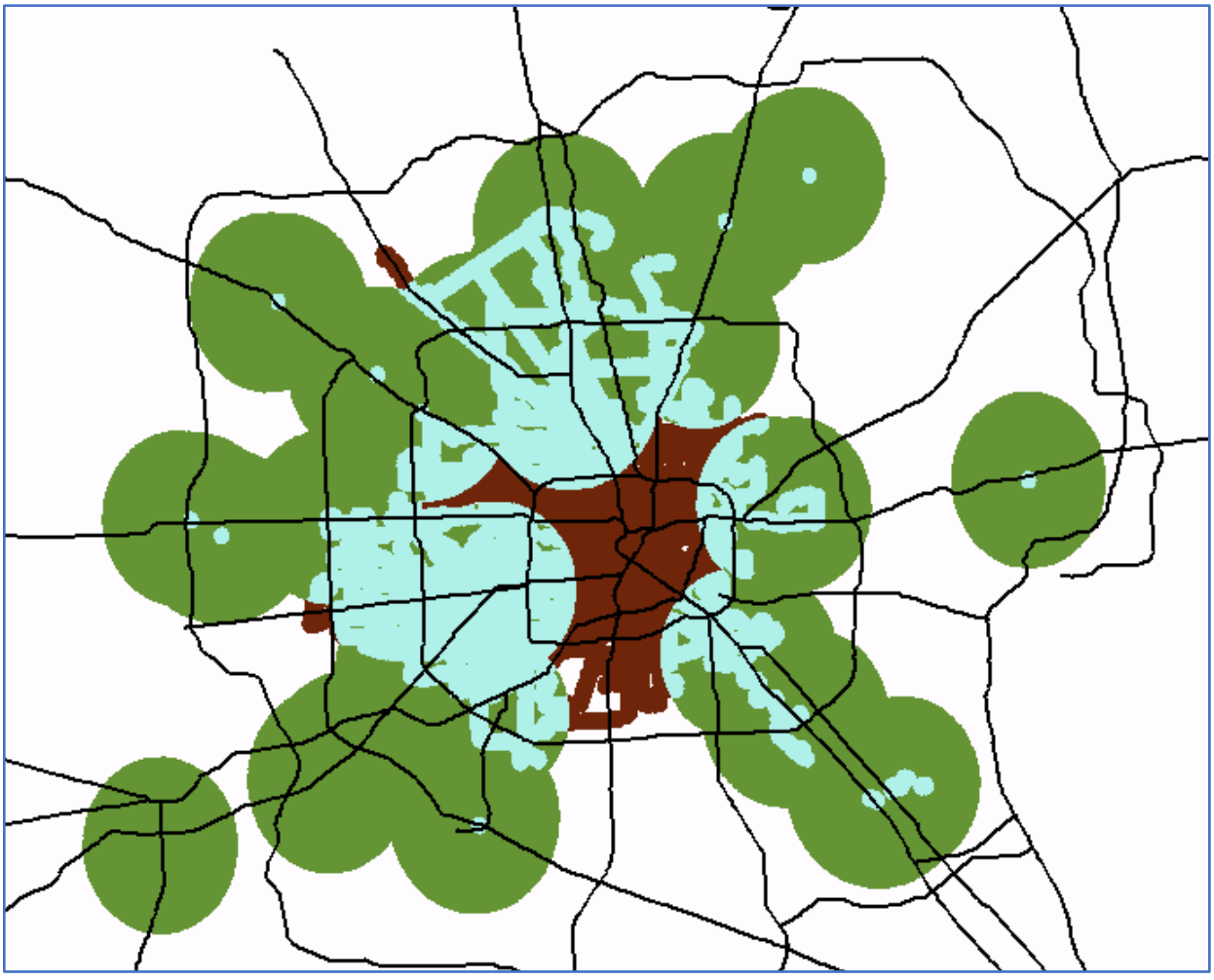
Public Transportation

The availability of Public Transportation is a factor some consider to be important when living and working in Houston as driving at times can be both costly and detrimental to one's mental health. To help in this site location assessment the availability of bus stops and Park-n-Ride locations were taken into consideration as factors on the model. Afterall, if one does not wish to commute an hour or more downtown each day or their car is in need of maintenance what options do they have open to them? The Light rail only serves the Eastern portion of the Metro area in neighborhoods of both high crime and pollution causing its elimination as a contributing factor. Bus routes were initially considered but deemed of little value since a bus driving past is not as important as to where it stops. The Houston-Galveston Area Council has several data sets available on public transportation. Of those files the Metro area bus stops and Park-n-Ride point files were chosen. The Park-n-Ride was found to be missing two stops in Fort Bend County which had to be added to it manually. Both shapefiles needed to have their data dissolved into fewer records in order to facilitate future geoprocessing. Of the two files, Park-n-Ride was deemed of higher importance and weighted accordingly. Both files were buffered with Metro Bus stops receiving a ½ mile radius and Park-n-Ride receiving a 5-mile radius. There were chosen based on a reasonable walking distance and a short drive time to a Park-n-Ride facility. Weighted values of -2 and -4 were employed as this this would decrease the resistance to moving into a neighborhood with Park-n-Rides facilities having a larger affect due to its higher importance. After those variables were set the rest of the processing was a simple matter of converting to a raster, reclassifying and combining using map algebra addition.

Bus Stops Reclassification			**Park-n-Ride Reclassification**		
Buffer	**Rank**	**New Value**	**Buffer**	**Rank**	**New Value**
0.5 miles	-2	-4	5 miles	-4	-4
	NO DATA	0		NO DATA	0



Above: Data Flow Model employed in processing the Public Transportation information.



Above: The combined raster image of Park-n-Rides and Metro bus stops. Note that most of the inner city is within ½ a mile of a bus stop location while the surrounding suburbs, especially of the North and West side of Houston) are mostly within 5 miles of a Park-n-Ride facility site.

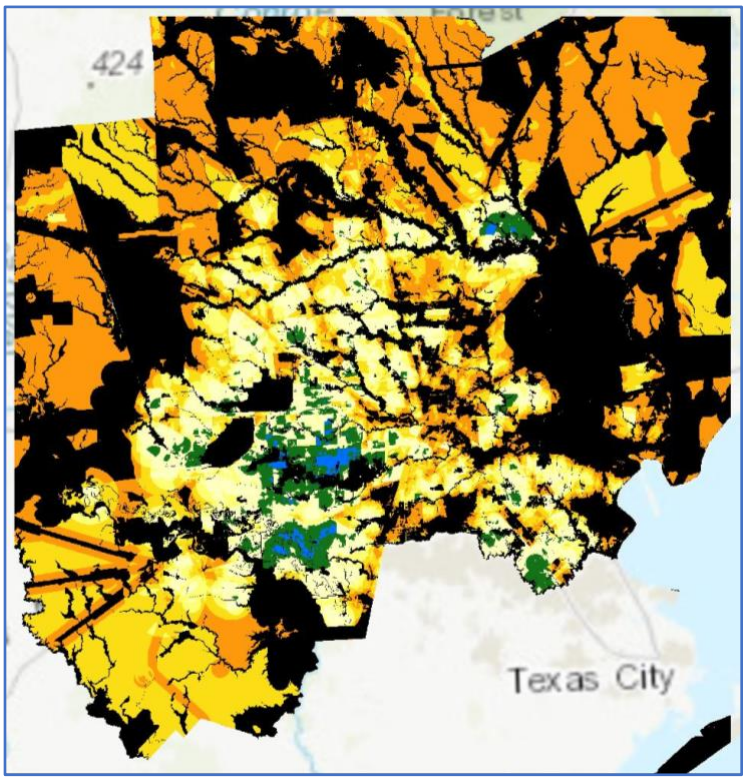
Final Map and Site Selections

The final map was created by combining the previous intermediate rasters. This produces a heat map which includes all of the previously mentioned factors and indicates prime areas in which to live. The formula used in Raster Calculator is as follows:

> Commute + (Crime *3)+ Emergency Services + Environmental Factors + FEMA + (Monthly Housing Costs *2) + Noise + Parks and Paths + Public Transport + Schools

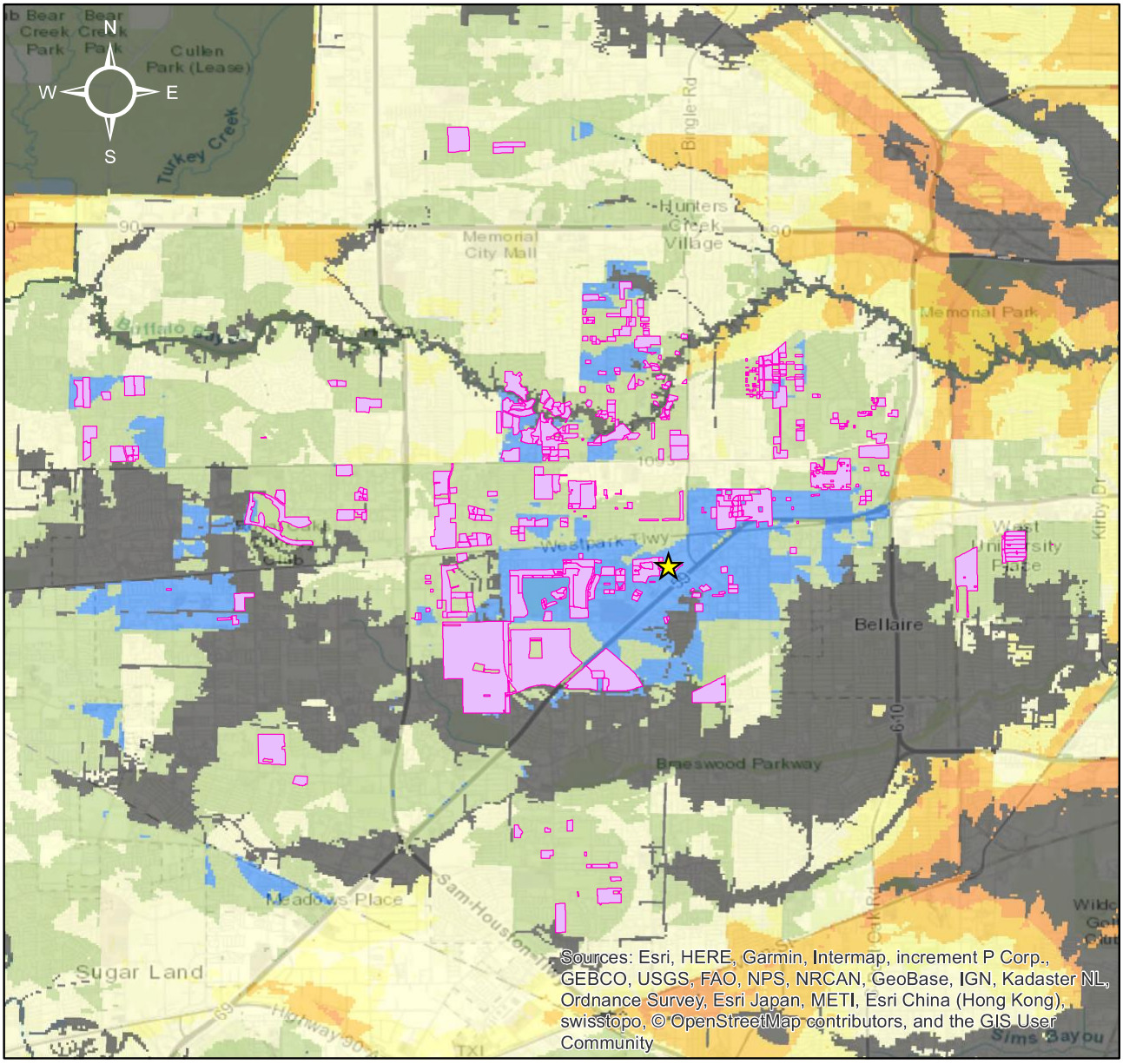
A greater emphasis was placed on crime and monthly housing costs as some areas of Houston are considered very dangerous, but may have low monthly housing costs. And clients may not be able to pay large monthly fees to reside in safe, but expensive neighborhoods.

The State Plane Texas South Central Projected coordinate system was chosen because projected coordinate systems have constant lengths, angles, and areas across the two dimensions and Texas South Central was designed for the area of interest. By maintaining length, distance and area, projected coordinate systems are ideal for geoprocessing where spatial accuracy is needed. At the county scale and smaller projected coordinate systems are a must as geographic coordinate systems will lose accuracy at lower scales.



(Above) is the heat map of the Houston-Galveston Area where blue areas are most desirable, green areas are somewhat desirable, yellow – orange areas are not very desirable, and black areas are within the FEMA high risk flood zone.

Recommended Residential Areas Near Houston, TX



Legend

- Work Location
- Prime Residential Areas

Total Rank Values

-35 - -20	5 - 10
-20 - -10	10 - 15
-10 - 0	15 - 10,044
0 - 5	

0 2 4 8
Miles

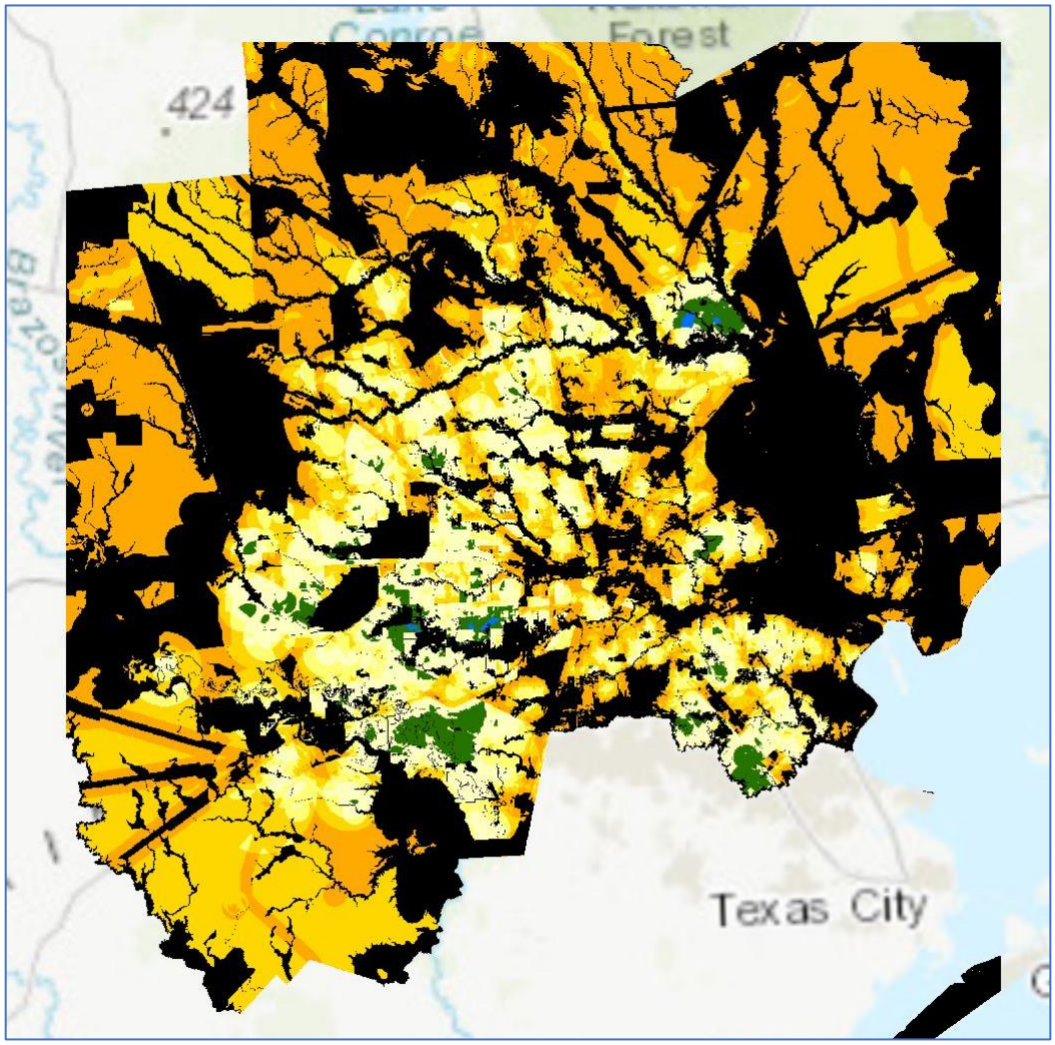
Note: Negative values imply more favorable conditions

Produced By: Richard Bielby & Marie Payne
Date: October 15, 2019
Texas A&M University Geosciences
Projection: NAD_1983_StatePlane_Texas_South_Central
Sources:
Houston-Galveston Area Council GIS Datasets
Texas Comission on Environmental Quality Datasets
United States Census Bureau
FEMA Flood Map Service Center
Applied Geographic Solutions, ESRI

Desirable neighborhoods were selected by overlaying a polygon map of Houston neighborhoods and buildings. Areas were hand selected according to their overlap with blue (very desirable) areas, their proximity to undesirable areas, and the possibility of flood zones blocking transitions into and out of the prime areas. From the initial selected list, only those with names conveying residential zones were selected. The following criteria were used:

Sub-Name contains: APARTMENTS, APT , T/H, TOWNHOMES, GARDENS, TERRACE, CONDO, CONDOS, ESTATES, ACRES, HOMES, ESTATE, VILLAGE, R/P

As such, the final map layout above shows only those areas which meet these criterion. A complete list of neighborhoods will be included as an appendix. Another map was also created which may be used generally as a reference and does not include the commute factor as this is very client specific. The map below uses the same color scale as the map above, many of the same areas are similarly highlighted, although some areas are now less desirable as the commute factor (negatively valued attributes) are removed from consideration.



Discussion

This project contained many factors from various sources. We feel air and ground pollution, noise, crime, and average housing cost were adequately represented as they were based off of known locations or statistical values collected from reliable sources.

Some data as not as extensive and limited in representation. Schools would be better shown as attendance zones (i.e. area from which students may attend). It is certainly possible to find fantastic housing opportunities only to find it is within the attendance zone of a poorly rated school. We chose to represent each school via circular buffers, but this would not be accurate. Drive time areas are also, at best, an estimate. Drive times vary wildly with seasons and time of day, as well as with speed. Neighborhoods outside of the city of Houston were also not well represented and would limit any further applications for clients wishing to reside more rurally. Some files were sourced from the city of Houston website and are restricted to their city limits. The final map produces prime areas near south Sugarland (a suburb of Houston), but this area did not have neighborhood polygons available, so it was not included in the final recommendation. Finally, public transportation was only represented by bus stop locations due to the inability to factor in bus routes and times.

It would be interesting to follow-up with the client to produce a map of all available amenities and routes given chosen work, school, and home locations. With these additional points, we could produce efficiency maps for shopping, leisure, and transportation.

Sources and Data Description

HGAC:
"GIS Datasets." Datasets, Houston-Galveston Area Council, 2019, h-gac.com/gis-applications-and-data/datasets.aspx.
Applies to the following files:

- Airports_Runways : A graphic representation of airports present in the Houston Metro Area. The data is for mapping and planning purposes only.
- Major_Roads: USGS Major roads file for the Houston Metro Area.
- NTAD_Railines: USGS NTAD Rail lines data for the Houston Metro Area.
- Existing_Bikeways: This file shows the location of existing bikeways in the Houston-Galveston Area Council region.
- HGAC_Parks: Based on the Houston-Galveston Area Council (H-GAC) Land Use database, this dataset shows the parcel-based centroids of parks for the H-GAC 13-county region. Park centroids area based on the centroid of park boundaries defined in the Park Areas dataset. All parks are based on park location identified and cross referenced with county appraisal data.
- Metro_Bus_Stops: Locations of METRO bus stops.
- Metro_Park_and_Rides: Existing Park & Ride Locations. Locations are specific. Park & Ride locations have been updated to reflect all the new routes in METRO's New Bus Network.

TCEQ:
"Download TCEQ GIS Data." Download TCEQ GIS Data, Texas Commission on Environmental Quality, 2019, www.tceq.texas.gov/gis/download-tceq-gis-data.
Applies to the following files used:

- TCEQ_IHWCA_POINTS: The TCEQ IHW Corrective Action (IHWCA) layer is used to identify the geographic location of all "Active and Inactive IHW Corrective Action" sites within the State of Texas. This data layer can be used for a variety of purposes, including: the plotting of IHWCA sites on maps; utilization by field personnel; and performing spatial analysis on how the sites affect their surroundings. The purpose of the industrial and hazardous waste corrective action program is to oversee the cleanup of sites with soil and groundwater contamination from industrial and municipal hazardous and industrial non-hazardous wastes
- TCEQ_BROWNFIELDS_POINTS: The TCEQ Brownfields Site Assessment Program (BSA) layer is used to identify the geographic location of all "Active and Inactive BSA" sites within the State of Texas. This data layer can be used for a variety of purposes, including: the plotting of BSA sites on maps; utilization by field personnel; and performing spatial analysis on how the sites affect their surroundings.
- TCEQ_SUPERFUND_POINTS: The TCEQ Superfund Sites layer is used to identify the geographic location of Federal and State Superfund sites within the State of Texas. This data layer can be used for a variety of purposes, including: the plotting of Superfund sites

on maps; utilization by field personnel; and performing spatial analysis on how the sites affect their surroundings.

US Census:
US Census Bureau. "Housing Affordability." Census.gov, United States Census Bureau, 1 Nov. 2017, www.census.gov/topics/housing/housing-affordability.html.
Housing Affordability is a complex, multidimensional issue influenced primarily by the labor market, Federal monetary policy and therefore mortgage rates, and also the balance between housing supply and demand. At the individual household level, the balance between these economic characteristics is translates to the relationship between income and home values.

FEMA Flood Data:
"FEMA Flood Map Service Center." FEMA Flood Map Service Center | Search All Products, Federal Emergency Management Agency, 8 June 2018, msc.fema.gov/portal/advanceSearch#searchresultsanchor.
The Federal Emergency Management Agency Flood Map contains information about the flood hazards within the study area. These zones are used by the Federal Emergency Management Agency (FEMA) to designate the Special Flood Hazard Area (SFHA) and for insurance rating purposes.

Applied Geographic Solutions, Inc. (AGS):
"CrimeRisk." Applied Geographic Solutions, ESRI, 21 Aug. 2019, www.appliedgeographic.com/crimerisk/.
Based on the FBI Uniform Crime Report of the United States, this compares the average local crime level to that of the United States as a whole. An index of 100 is average. The total crime index for 2010 incorporates all crimes and provides a useful measure of the relative "overall" crime rate in an area. However, these are unweighted indexes, meaning that a murder is weighted no more heavily than a purse snatching in the computations.

US EPA:
"2005 NATA: Risk Maps." EPA, Environmental Protection Agency, 26 Dec. 2016, www.epa.gov/national-air-toxics-assessment/2005-nata-risk-maps#cancer-risk.
Applies to the following files:

- Respiratory Risk
- Cancer Risk

The map show the geographic patterns of estimated cancer and non-cancer risks in 2005 from inhalation of air toxics. These maps represent a snapshot of conditions in 2005 and are not reflective of current conditions. EPA developed these maps to inform both national and more localized efforts to collect air toxics information and characterize emissions (e.g., prioritize pollutants/geographic areas of interest for more refined data collection such as monitoring). These maps are for screening purposes only. EPA suggests caution in interpreting the information displayed, as limitations and uncertainties of the assessment will vary from location to location as well as from pollutant to pollutant. In many cases more localized assessments, including monitoring and modeling, may be needed to better characterize local-level risk.

Texas Education Agency:

"Current Schools" TEA, Texas Education Agency, 25 Apr. 2019, http://schoolsdata2-tea-texas.opendata.arcgis.com/datasets/059432fd0dcb4a208974c235e837c94f_0.
Point dataset of Texas regular, charter, and alternative schools, excluding disciplinary alternative ed. (DAEP), juvenile justice alternative ed. (JJAEP) institutions, and the Windham school district.

"2019 Accountability Rating System" TEA, Texas Education Agency, 2019, https://tea.texas.gov/Student_Testing_and_Accountability/Accountability/State_Accountability/Performance_Reporting/2019_Accountability_Rating_System .
This report accountability rating summaries and detailed reports for each district, campus, and open-enrollment charter school in the state of Texas.

APPENDIX

Recommended Neighborhoods/ Buildings

#	Location Name
1	TOWNHOMES ON THE PARK
2	FONDREN T/H
3	ALIEF FOREST R/P
4	HUA XIA CONDO
5	SUMMERSET LANDING CONDO
6	TANGLEWILDE T/H CONDO
7	CEDAR CREEK T/H
8	ELM GROVE T/H CONDO
9	UNITY PLACE T/H
10	TAMERRAND CONDO
11	MARK II CONDO
12	240 MCCUE CONDO
13	STERLING GARDEN RESIDENTIAL CONDO
14	TANGLEWOOD PLACE CONDO
15	NANTUCKET PLACE T/H
16	HAPPY VILLAGE GARDEN CONDO
17	POTOMAC PLACE CONDO
18	RIVERSTONE CONDO
19	RADNEY ESTATES
20	HARLEM HEIGHTS PAR R/P
21	SUGAR HILL HOMES
22	PINEMONT ESTATES
23	SILVERWOOD HOMES
24	THE SAINT JAMES CONDO
25	AUTUMN CHASE T/H
26	MEADOWRIDGE CONDO
27	SUNSTREAM VILLAS CONDO
28	WIND RIVER PARK T/H
29	IDLEWOOD CONDO
30	TOWNHOMES AT WESTCHASE
31	CHARTWELL ONE R/P
32	OAKS OF WOODLAKE & PAR R/P
33	WOODLAKE FOREST R/P
34	WOODLAKE T/H
35	HUDSON BEND PAR R/P
36	PINE STABLES PAR R/P
37	BLALOCK COUNTRY ESTATES
38	JERRY C BAUER R/P
39	DUNSINANE FOREST R/P
40	CLAYMORE ESTATES
41	PINEY POINT MEADOWS R/P
42	CLAYMORE OAKS R/P
43	GAINES L G R/P
44	GREEN PINES ESTATES
45	GREENBAY OAKS R/P
46	WILLIAMSBURG WEST PAR R/P
47	PINEY POINT WOODS R/P
48	PINEFIELD PLACE PAR R/P
49	BLOSSOM HEIGHTS R/P
50	BRIARMEADOW PAR R/P
51	LANCER T/H
52	ASHLEY ACRES
53	TIFFANY PLACE CONDO
54	WOODWAY T/H CONDO
55	BUFFALO BAYOU BEND T/H R/P
56	WOODWAY VILLAGE T/H CONDO
57	WESTHEIMER CROSSING & PAR R/P
58	BAXTER HOUSE CONDO
59	FARNHAM PARK PAR R/P
60	WILLOWICK R/P
61	CLAYMORE OAKS PAR R/P
62	FLEETWOOD PLAZA PAR R/P
63	1213 NANTUCKET T/H
64	1210 POTOMAC T/H
65	1206 POTOMAC T/H
66	5917 VALLEY FORGE T/H
67	1117 POTOMAC T/H
68	SAN FELIPE PATIO T/H U/R
69	1608-10-12 POTOMAC T/H
70	1418 NANTUCKET T/H
71	1526 POTOMAC T/H
72	1601-05 NANTUCKET T/H U/R
73	WOODWAY PLACE T/H
74	THE TANGLEWOOD CONDO
75	CHALET ROYALE T/H CONDO
76	BERINGTON PLACE II T/H
77	SUGAR HILL T/H RESOLUTION
78	THE PARK REGENCY CONDO
79	WOODWAY POINT CONDO
80	LEXINGTON CONDO
81	LA CASA CONDO
82	DEL MONTE CONDO
83	SAGEMONT TERRACE APTS CONDO
84	ANDERSON PARK T/H
85	REGENCY ATRIUM CONDO
86	REGENCY COURT T/H CONDO
87	FRENCH QUARTER T/H
88	THE SUSSEX CONDO (WEST)
89	FONDREN BEND CONDO
90	SANDSPOINT T/H

91 SANDSPOINT CONDO
92 DE MOSS CONDO
93 HIGHLAND GREEN CONDO

94 SHARPSTOWN COUNTRY CLUB ESTATES
95 HARBORGREEN CONDO

96 SHARPSTOWN GREEN GARDEN HOMES
97 SHARPSTOWN GREEN CONDO
98 RANDOLPH PARK T/H
99 HAMILTON COURT CONDO
100 HAPPY VILLAGE CONDO

101 FONDREN SW BELLFORT SQUARE T/H
102 FONDREN SW SOUTHMEADOW PATIO HOMES
103 1430 NANTUCKET T/H
104 NANTUCKET PLACE ESTATES
105 LEAWOOD CONDO
106 SUNSET TERRACE
107 UNITED SPRING MILL CONDO
108 HBU STUDENT HOUSING 2ND R/P
109 PINEY POINT CIRCLE R/P
110 SOUTH BAY CLUB APTS R/P
111 THREE OAKS CONDO
112 BAUER R/P
113 THOMPSON ESTATES
114 RADNEY OAKS ESTATES R/P
115 TRAILS OF WOODLAKE CONDO
116 SUNMOLA ESTATES
117 1614 NANTUCKET T/H
118 POTOMAC COURT CONDO
119 QUAIL HOLLOW LANE ESTATES R/P
120 1425 NANTUCKET T/H
121 STERLING HOMES
122 LAKE VARGO T/H
123 BEVERLY VILLAGE T/H CONDO
124 BEVERLY PLACE CONDO
125 AITKEN MANOR R/P
126 HARWIN CHOICE PLAZA CONDO
127 SAGE PAR R/P
128 DURRETT PLACE VILLAS

129 TRIANON PLACE T/H
130 WOODBRIDGE CROSSING CONDO

131 WESTBRIAR R/P
132 SHENOY STONE PAR R/P
133 FARNHAM PARK PAR R/P
134 ELKINS ESTATES
135 WILLOWICK ESTATES R/P

136 AMES PLACE R/P

137 GREENCOVE R/P
138 GREENBAY CIRCLE R/P
139 WOODS EDGE PAR R/P
140 WILLOWICK ESTATE SECTION R/P
141 WOODS EDGE R/P LOT 9 BLK1
142 ARBUOR T/H
143 THE GROVEWOOD CONDO
144 1011-1017 NANTUCKET T/H
145 BEVERLY HILLS T/H
146 SAGE 5TH PAR R/P
147 WESTCHASE PAR R/P
148 THE OAKS OF BRITTANY CONDO
149 7000 REGENCY SQUARE CONDO
150 TANGLEWILDE SOUTH CONDO
151 DICKENS COURT T/H
152 LOUISVILLE COURT CONDO
153 CARVER CREST R/P
154 ONE ORLEANS PLACE CONDO
155 DOLIVER POINT T/H
156 NUWAY R/P
157 RADNEY RIDGE ESTATES
158 CAMELLA POINTE 4TH R/P
159 LAKE VARGO T/H PAR R/P
160 PINEY POINT ESTATES R/P

161 CLUSTER OAKS T/H
162 RADNEY OAKS ESTATES
163 PINEY POINT VILLAGE R/P
164 MEMORIAL POINT PAR R/P
165 OLSON R/P
166 OAKS OF WOODLAKE CONDO
167 POST OAK CENTRE R/P
168 THE SUSSEX CONDO (EAST) CONDO
169 GLENHAVEN ESTATES R/P
170 CREEKBEND T/H
171 SHADY OAKS LANE LOT 3 R/P NO 1
172 ARROWWOOD PLACE R/P

173 SHARPSTOWN COUNTRY CLUB TERRACE
174 MEMORIAL TERRACE
175 STAYTON ESTATES
176 MERRITT PLACE R/P
177 CHAPELWOOD ESTATES
178 PINEY OAKS ESTATES
179 COUNTRY SQUIRE ESTATES
180 SAN FELIPE ESTATES
181 DILSTON HOUSE CONDO
182 WESTCHASE FOREST T/H
183 DOMA CHASE CONDO
184 KIRKWOOD TERRACE
185 WOODWAY CROSSING CONDO
186 1218 POTOMAC T/H
187 AUGUSTA VALLEY CONDO
188 WESTHAVEN ESTATES

189 1115-1123 NANTUCKET T/H U/R
190 TANGLEGROVE T/H
191 TANGLEOAKS CONDO

192 AUGUSTA SQUARE CONDO
193 2001 BERING DRIVE CONDO
194 WESTMONT R/P
195 SUNRIDGE VILLAS T/H
196 SUNRIDGE VILLAS 2 CONDO
197 5107 DEL MONTE T/H CONDO
198 DEL MONTE HOMES CONDO
199 SAN FELIPE GREEN PAR R/P
200 POTOMAC COURT T/H
201 6103 VALLEY FORGE T/H
202 TOWNPLACE R/P
203 TANGLEBROOK R/P

204 TANGLEBROOK CONDO
205 POST OAK ESTATES
206 STONEY BROOK T/H CONDO
207 WOODWAY ESTATES
208 WILLOWWICK R/P
209 WILLOWICK ESTATE PAR R/P
210 RIVERBEND R/P
211 DEERWOOD GARDENS CONDO
212 PINEY POINT ESTATES PAR R/P NO 3
213 HUDSON ON BAYOU T/H
214 ARIAN HOMES
215 ARIAN HOMES 2

216 RAINTREE CIRCLE ESTATES
217 ASCOT PLACE 2ND R/P
218 PINEY POINT CIRCLE 2ND R/P
219 R B BLOOMFIELD R/P
220 SMITHDALE ESTATES
221 WOODHAVEN ESTATES
222 TIGOWONA TERRACE
223 QUAIL HOLLOW LANE ESTATES R/P OF R/P
224 FONDREN SW WEST BELLFORT PATIO HOMES
225 21 SEVILLE T/H - FONDREN SW
226 WESTBRAE COURT R/P
227 DEL MONTE TERRACE
228 1770 SOUTH POST OAK LANE CONDO
229 VENETIAN LUXURY HOMES
230 WESTBRAE PARK PLACE CONDO
231 R/P
UNIVERSITY PLACE RETIREMENT CENTER PAR
232 R/P
233 SHARPSTOWN R/P AND EXTN
234 KIRKWOOD COUNTRY R/P
LAKES OF FONDREN SOUTHWEST CLUSTER
235 HOMES R/P
236 STONEHENGE R/P U/R
237 LAKESIDE ENCLAVE R/P
238 PARKWAY TERRACE
239 CRESCENT AT PARKWAY PAR R/P
240 ENCLAVE AT REFLECTIONS APTS R/P
241 SUFFOLK CHASE PATIO HOMES
242 WALNUT BEND R/P
243 DASHWOOD T/H
244 WESTCHASE GARDENS CONDO
245 WALNUT BEND APTS PAR R/P
246 RIVERSTONE 2 CONDO PHASE 2
247

248 AUTUMN CHASE T/H U/R
249 HEATHERSHIRE PATIO HOMES
250 AUTUMN CHASE T/H R/P
251 ROYAL OAKS COUNTRY CLUB R/P
252 ROYAL OAKS COURTYARD VILLAS
253 WESTCHASE R/P
254 WOODCHASE VILLAGE CONDO
255 WESTCHASE R/P 2 AND PAR R/P
256 BELTWAY R/P
257 WOODLAKE PAR R/P
258 HAMLET OF CHERBOURG CONDO
259 VERMA ESTATES
260 PINEY POINT ESTATES PAR R/P
261 TANGLEWILDE T/H COND
262 BRANDY CREEK CONDO
263 SHARPSTOWN COUNTRY CLUB ESTATES PAR R/P
264 SILVERFIELD CONDO PH 1
265 SILVERFIELD CONDO
266 BELLERIVE CONDO
267 GALLERIA DIPLOMAT T/H
268 SHARPSTOWN R/P
269 HIGHLAND GREEN R/P
270 REGENCY SQUARE OFFICE PARK R/P

271 OFFICE CONDO RESIDENCE AT SAVOY
272 LAGOON AT WINDWATER VILLAGE PAR R/P
273 CEDAR MILL CONDO
274 WESTHEIMER MANOR R/P
275 SKYLINE COURT R/P
276 WEST GREENRIDGE CIRCLE CONDO
277 GLENHAVEN ESTATES PAR R/P

278 HISD PILGRIM ELEMENTARY SCHOOL R/P
279 WESTHEIMER GARDENS PAR R/P
280 WESTWARD PLACE CONDO
281 ATRIUM CELLINI CONDO
282 MCDC BUSINESS CENTER CONDO
283 SISTERS OF CHARITY R/P AND EXTN
284 COURTLAND PARK T/H

285 LIVE OAK HILLS COURTHOMES CONDO
286 ROYAL OAKS PAR R/P
287 HIDALGO CONDOS
288 NANTUCKET PLACE R/P
289 1112 NANTUCKET T/H
290 PINEY POINT ESTATES

291 WOODWAY T/H APT R/P
292 SHARPSTOWN COUNTRY CLUB ESTATES R/P
293 GLENHAVEN ESTATES
294 AZALEA TERRACE
295 BOULEVARD PLACE PAR R/P
296 THE GALLERIA 2ND R/P
297 PHOENICIAN APTS R/P
298 FONDREN SW NORTHFIELD PAR R/P
299 SANDALWOOD R/P
300 WESTHAVEN ESTATES 7TH PAR R/P
301 HUDSON FOREST R/P
302 HUDSON GREEN 2ND R/P
303 WALDEMAR T/H
304 LAMAR TERRACE
305 FONDREN SW NORTHFIELD R/P

306 ESGAROTH ESTATES
307 BLALOCK LAKE ESTATES U/R
308 SEVEN OAKS T/H CONDO
309 SAN FELIPE SQUARE T/H EXTN
310 COLONIAL TERRACE
311 FLYNN WOODS R/P
312 OLD FARM CROSSING PAR R/P
313 CREEKSIDE APARTMENTS R/P

314 TAGHI ESTATES

315 MCGINTY ACRES SEC 1 R/P
316 JOHN DREAPER PLACE 2ND R/P AND EXTN
317 MCGINTY ACRES
318 BRIARMONT PAR R/P
319 COLONIAL OAKS R/P
320 COLONIAL OAKS PAR R/P

321 BRAEBURN TERRACE
322 5626 SAN FELIPE T/H U/R
323 5600 SAN FELIPE T/H