

KINGWOOD AREA MOBILITY STUDY



PREPARED FOR:



Lake Houston Redevelopment Authority
(TIRZ #10)

May 2015

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LAKE HOUSTON REDEVELOPMENT AUTHORITY



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EXECUTIVE SUMMARY

The Kingwood Area Mobility Study presents a determined yet realistic vision of providing mobility options for Kingwood area residents. This report focuses on the creation of a capital improvement plan (CIP), recognizing that significant changes to the physical infrastructure on various corridors must have minimal impact to the trees. It is planned that projects, while identified as recommended improvements, will require future design and engineering studies to finalize specific details. Some improvement options can be implemented almost immediately, while others are pending financial details at the time of this report.

A. STUDY PROCESS

The study process included collection and analysis of existing data, identification and analysis of corridor needs, and recommending improvements. To accomplish these tasks, Steering Committee meetings were conducted to gather technical guidance. Stakeholder (Public) Meetings were also conducted to identify specific needs in the area and to fine-tune the recommendations in a way that best serves the residents. Figure 4-1 illustrates the study process.

B. PUBLIC INVOLVEMENT

An important aspect of every mobility study is public involvement. Establishing a detailed plan from the beginning is crucial to the success of the study. The goal of the public involvement efforts was to create an open process that encourages idea exchange, allows for serious consideration of all suggestions, and provides an objective presentation of options. Throughout the study, various public involvement initiatives were undertaken to gather as much public input as possible. There were a total of five (5) Steering Committee meetings, which are open to public, and two (2) Stakeholder Meetings. A dedicated e-mail address and project website were created to gather input from residents and provide information for to review. In addition, the study team attended other meetings such as town hall meetings, and bizcom meetings to disseminate information about the study. An online survey was created for residents to provide their input and suggestions for the mobility study. Once the improvement alternatives were reviewed, the residents were given another opportunity to rank the alternatives.

C. SPECIFIC PROJECTS

The prioritized projects are planned with the aim to work together to achieve multiple goals, individually as well as collectively. These roadway projects are also intended to facilitate to improve traffic flow by reducing congestion and improving safety, thereby improving the quality of life for Kingwood area residents. The projects listed in the order of priority are:

- Priority # 1 Intersection Improvements
- Priority #2 Widening of Kingwood Drive to 6-Lanes from US 59 to Woodland Hills Drive
- Priority #3 Widening of Northpark Drive to 6-Lanes from US 59 to Woodland Hills Drive

- Priority #4 Extension of Woodland Hills Drive to Hamblen Road and Widening of Hamblen Road
- Priority #5 Grade Separation on Kingwood Drive at Loop 494/Rail Road Crossing
- Priority #6 Grade Separation on Northpark Drive at Loop 494/Rail Road Crossing

D. IMPLEMENTATION

Preliminary cost estimates for the projects outlined above total approximately \$150 Million. However, because these projects promote multiple important goals, many different potential funding sources can be utilized including:

- TIRZ#10 Funding
- City of Houston Capital Improvement Plan
- Federal Funding in the form of Transportation Improvement Program (TIP)
- Federal Highway Administration FHWA TIGER Grant
- FHWA Congestion Mitigation and Air Quality (CMAQ) Funding
- Developer Agreements from future developments
- Possible UPRR Funding

While implementation of the prioritized projects is complex, the benefits far outweigh the challenges. Through coordinated effort, effective partnerships, and thorough public involvement, these improvements can be implemented in a unified manner, creating benefits that will spread beyond the boundaries of the study area and benefit the entire region.

1. INTRODUCTION

A Mobility Study is a study to develop a strategy that addresses the transportation needs based on existing deficiencies and future growth to improve the overall quality of life for the residents.

This mobility study was commissioned by Lake Houston Redevelopment Authority, also referred to as Tax Increment Reinvestment Zone (TIRZ) #10, in association with the City of Houston. The study primarily focuses on identifying solutions to fix existing transportation mobility issues within the Kingwood area. Figure 1-1 shows an overview of the Houston region.

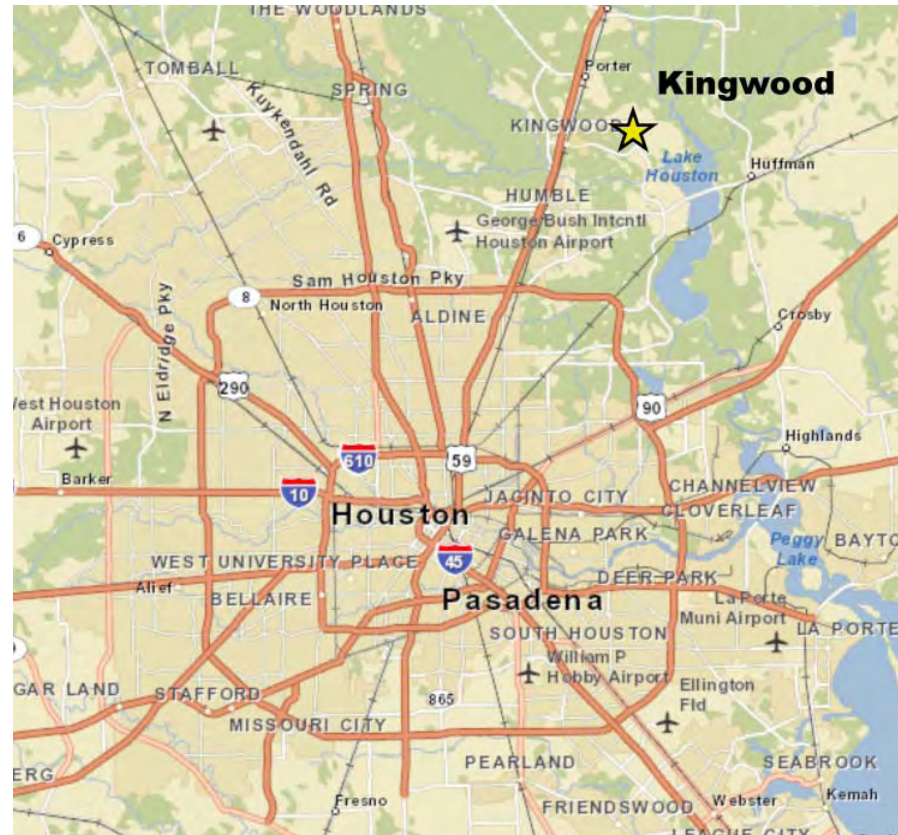


Figure 1-1 Overview Map

Kingwood is a 14,000 acre master-planned community located in northeast Houston, Texas. The majority of the community is located in Harris County with a small portion in Montgomery County. Known as the "Livable Forest," it is the largest master-planned community in Harris County. Historically, Kingwood experienced significant residential growth. The increase in the growth has contributed to increase in traffic volume and congestion along major thoroughfares in this area.

2. PURPOSE AND SCOPE

The purpose of this mobility study is to identify transportation measures that will improve traffic flow and safety, reduce vehicular delay, and improve the overall quality of life for Kingwood residents. The scope of this study is:

- To develop a strategy to address the transportation needs based on existing deficiencies and anticipated growth, and
- To improve the overall quality of life for the residents.

3. OVERVIEW OF STUDY AREA

The study area extends from Hamblen Road to the south to Northpark Drive to the north and Sorters Road to the west to Mills Branch Road to the east. The major thoroughfares in Kingwood Area are Kingwood Drive, Northpark Drive, Woodland Hills Drive, and West Lake Houston Parkway. The other major roadways in the area are Hamblen Road, Sorters Road, and Mills Branch Road.

- Of the four (4) major thoroughfares, Kingwood Drive and Northpark Drive are the most heavily traveled roadways and are of particular interest due to the presence of trees within the right-of-way.
- There are two (2) active railroad crossings at the entrance of Kingwood both on Kingwood Drive and Northpark Drive complicating access and cross-town connectivity.
- Existing land use pattern is generally residential with pockets of commercial developments.
- Pedestrian and bicycle accommodations, as well as transit facilities are mostly minimal or non-existent in the public right-of-way.
- Current conditions within the right-of-way and adjoining public and private properties allow for widening of Kingwood Drive and Northpark Drive with the exception of tree and bridge locations.

Figure 3-1 below shows the study area.

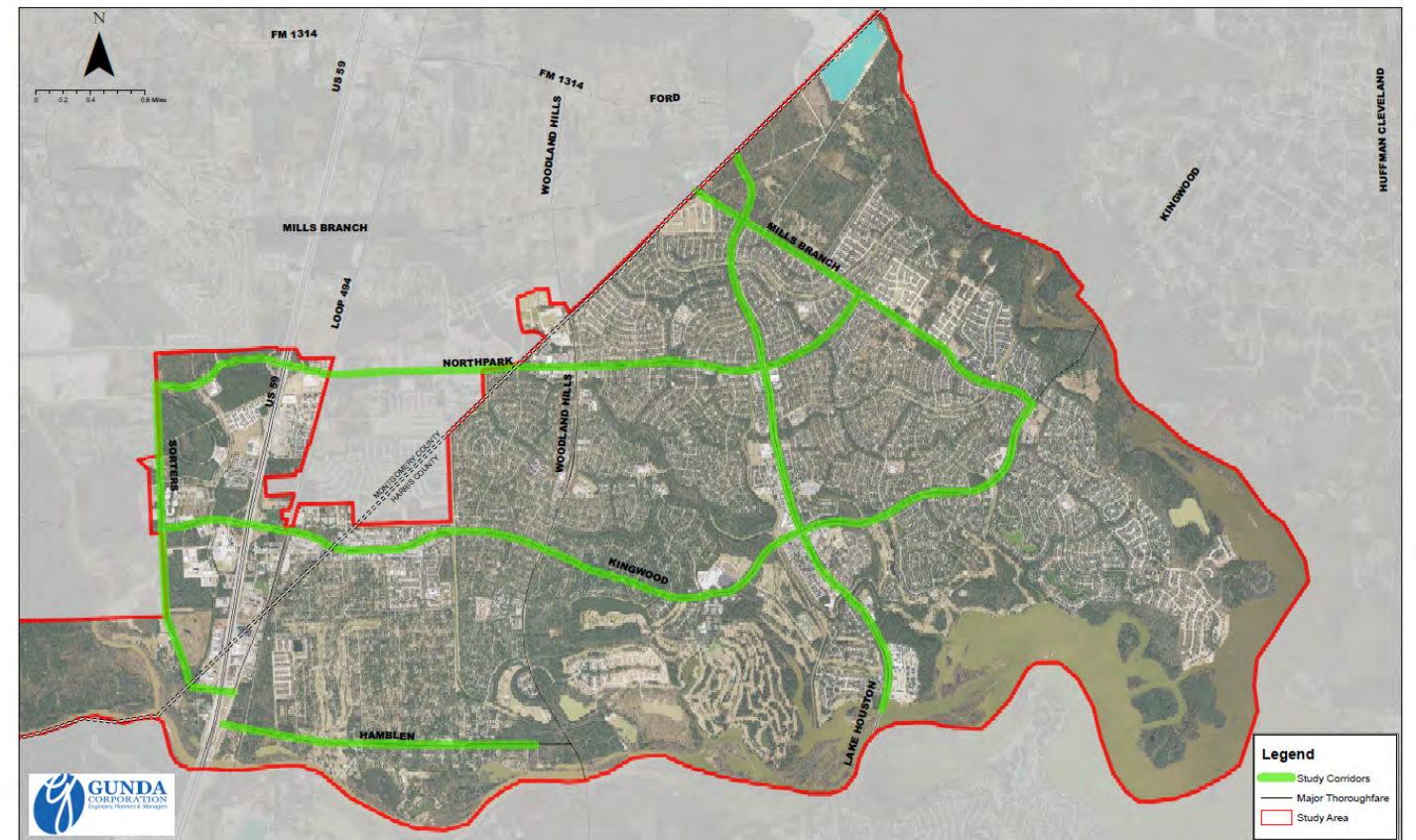


Figure 3-1 Study Area Map

4. STUDY PROCESS

The study process followed a standard planning approach in which the study team carried out extensive data collection efforts, base model development, data analysis, and final report preparation. Steering Committee meetings and Stakeholder meetings at appropriate times were conducted to refine the process and to obtain necessary guidance. The project Steering Committee played an important role in the preparation of this analysis and report by providing guidance and review of documents throughout the process. Figure 4-1 shows the study process flow chart.

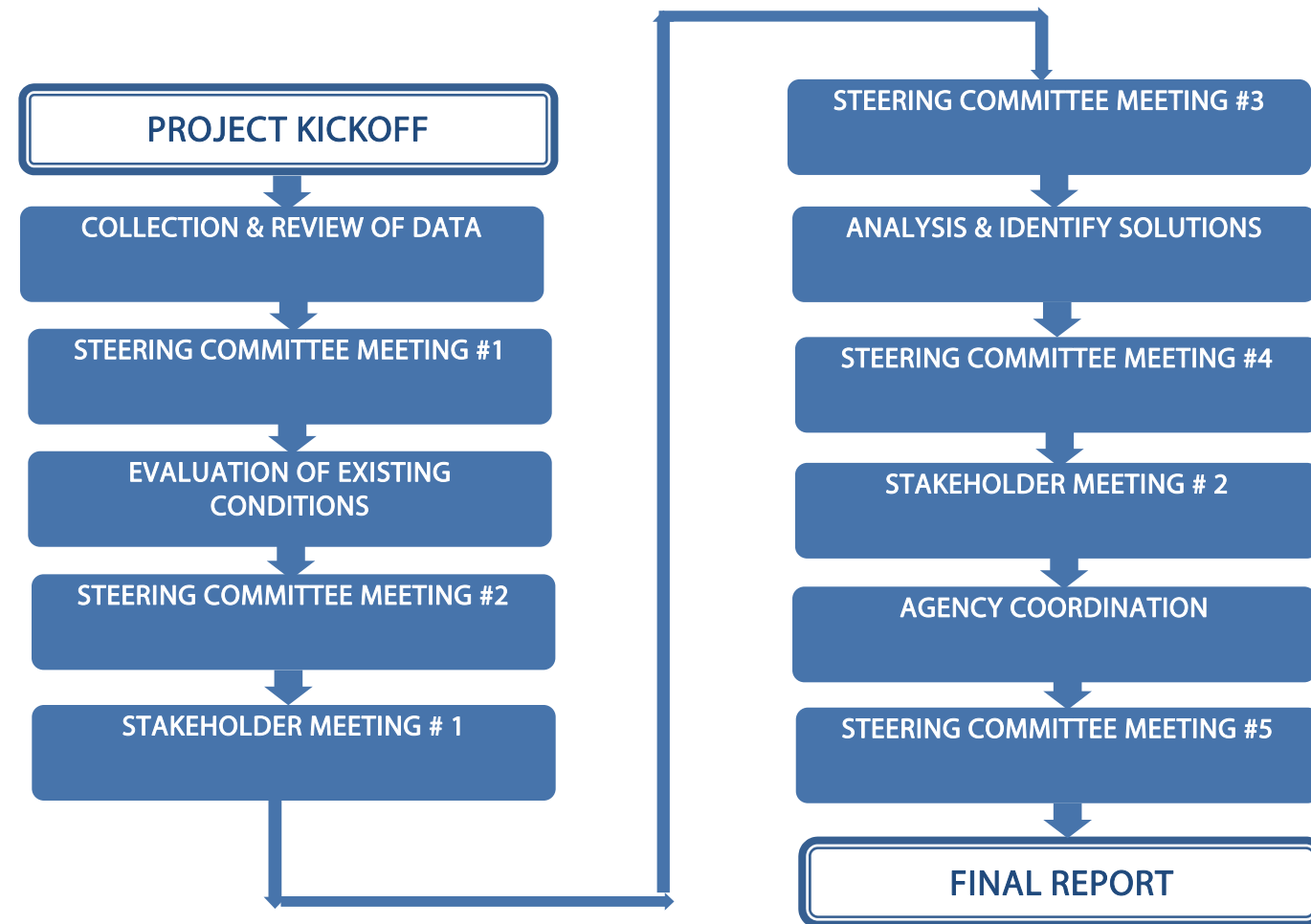


Figure 4-1 Study Process Flowchart

5. STUDY GOALS

Goals were developed for the study based on the experience of the study team members and the steering committee members. Feedback from the project steering committee was captured during the first steering committee meeting to understand what outcomes key stakeholders wanted to achieve through the course of the study. The previous Kingwood Area Mobility Study completed in 2004 was reviewed to capture some of the past concerns and important details. Goals identified the need for the study to:

- Obtain community input
- Improve mobility – short and long term
- Maintain same or better quality of life
- Identify funding sources
 - Educate public regarding funding sources
- Plan for future
- Improve Safety
- Look for possible transit solutions for aging population
- Provide pedestrian facilities as part of street improvements
- Consider public transportation
- Consider trolley system – not typical METRO bus
- Look for Quick fixes

6. MEASURES OF EFFECTIVENESS (MOE'S)

Once the goals were established each goal was reviewed to identify how it would be measured. Below are MOE's the study team and steering committee identified during the first steering committee meeting. Study recommendations would be measured for:

- Reduction in congestion
- Decrease delay/travel time
- Pedestrian safety/bicycle safety
- Vehicular safety
- Cost effectiveness
- Time to delivery-Schedule
- Regulatory impacts
- Environmental impacts including tree impacts

7. DEMOGRAPHIC INFORMATION

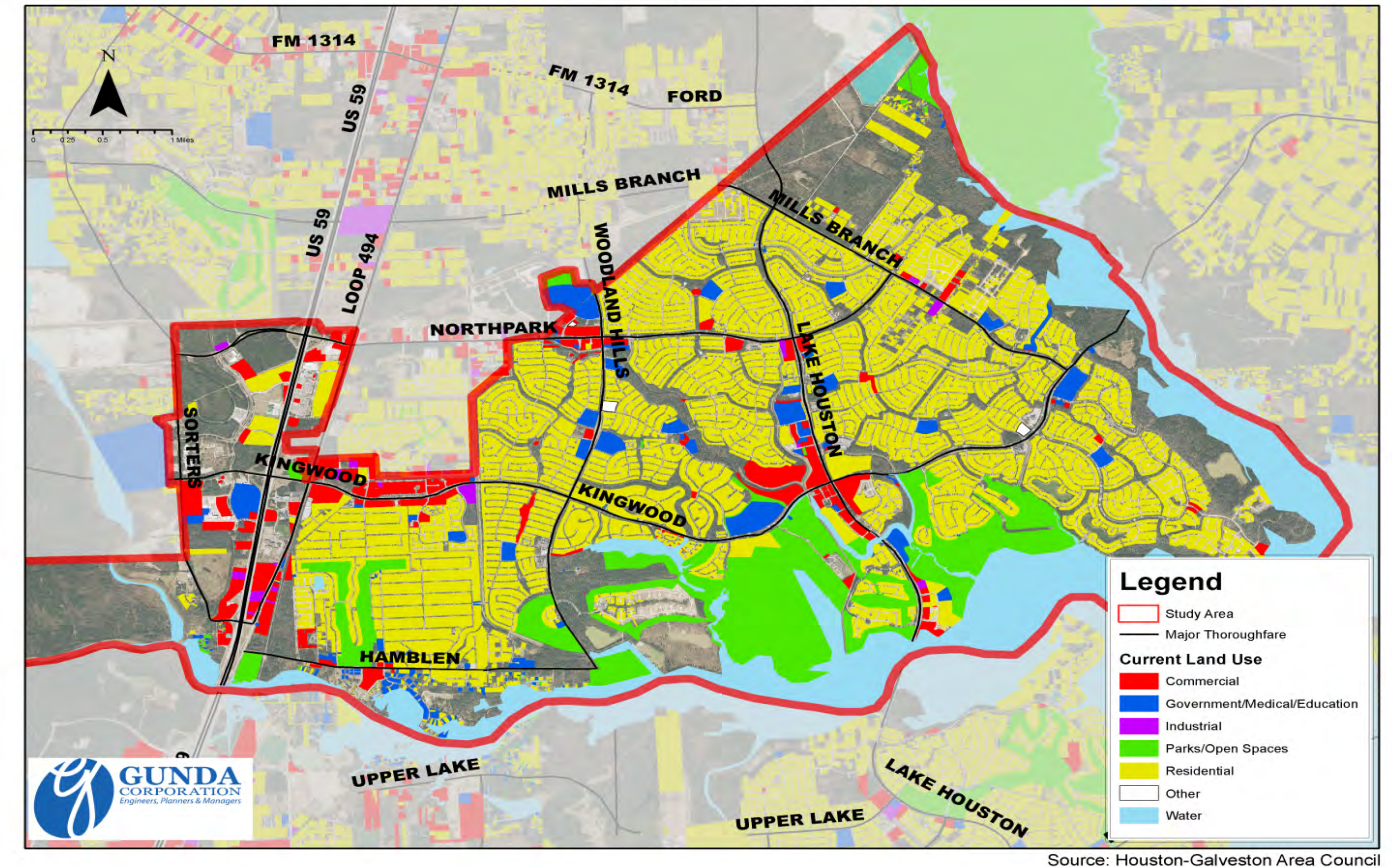
According to U.S. Census and information available from the Lake Houston Chamber of Commerce, the population of the study area was approximately 63,500 in the year 2010. The historical and future population data shows growth pattern as listed below:

- 2000 Census Data : 54,322
- 2010 Census Data: 63,653
- 2013 Projection: 66,626
- 2018 Projection: 74,051
- Average Household Size: 2.62

Figure 7-1 indicates the area for the Census data above and as shown by Lake Houston Chamber of Commerce. Figure 7-2 shows the land use map. The current land use map in the Kingwood area generally shows residential uses with pockets of commercial developments.



Figure 7-1 Population Map



Source: Houston-Galveston Area Council

Figure 7-2 Current Land Use

8. WHAT WE FOUND

8.1 DRAINAGE ISSUES

The City of Houston maintains a record of flooding problems reported by residents via the City of Houston 311 web site or telephone assistance. The information includes general flooding complaints, impassable street complaints, property and building flooding complaints within the City of Houston area. For the years 2002 through 2010, 55 complaints were reported from the study area. The 311 complaints are spread out in the study area as shown in Figure 8-1.

The FEMA repetitive loss properties include the properties that have purchased flood insurance, have flooded, and received the flood insurance payments. For the years 2001 through 2010, 55 FEMA repetitive losses were reported from the study area. Most of the FEMA repetitive loss properties are located near Hamblen Road. Figure 8-1 is the Flood Complaint Map.

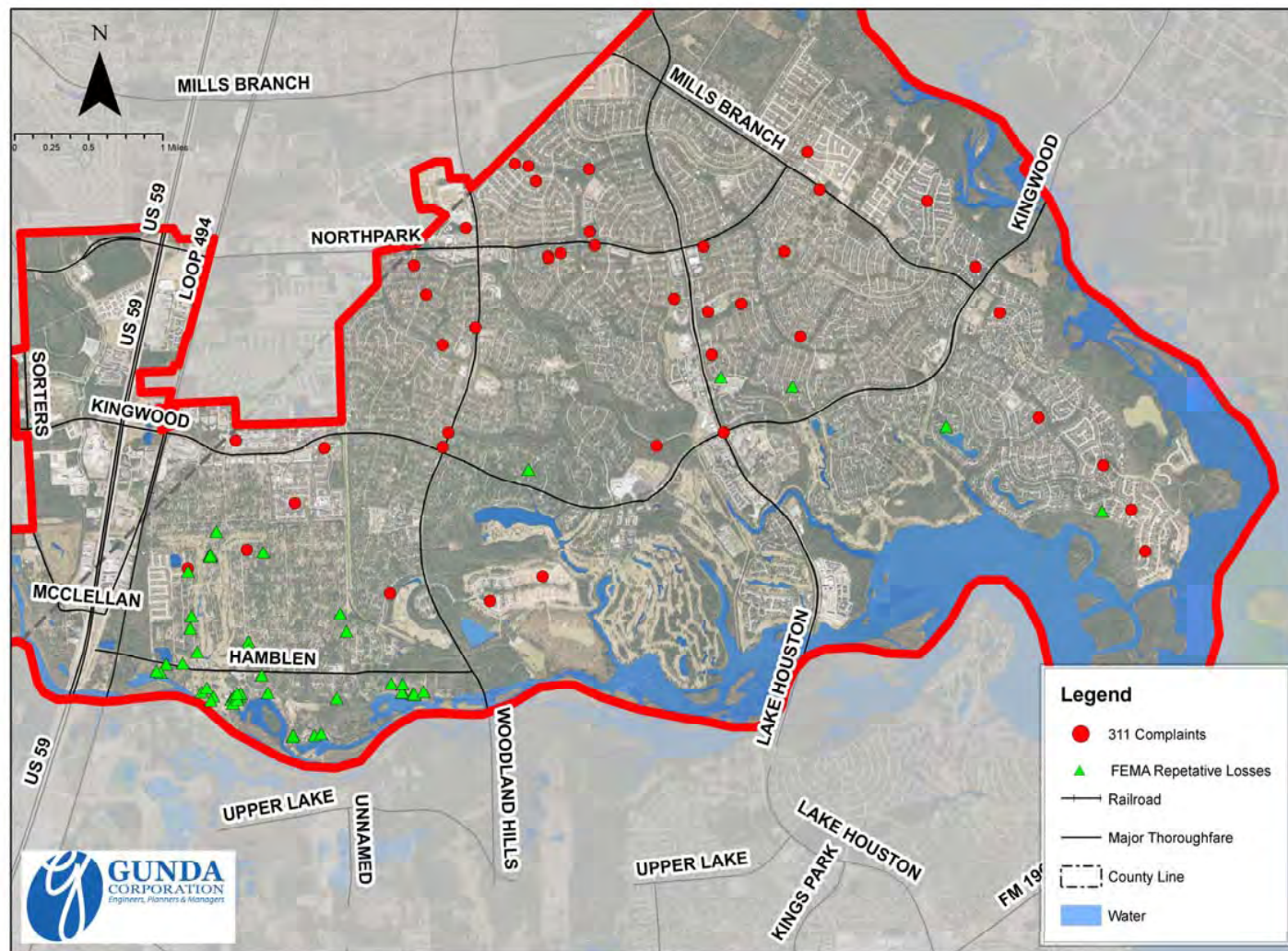


Figure 8-1 Flood Complaint Map

Table 8-1 Pavement Condition Rating (PCR) Scores

Street	PCR Scores
Northpark Drive	59-88
Kingwood Drive	51-80
Hamblen Road	57-89
Woodland Hills	53-83
Lake Houston Parkway	61-80
Mills Branch Drive	73-94

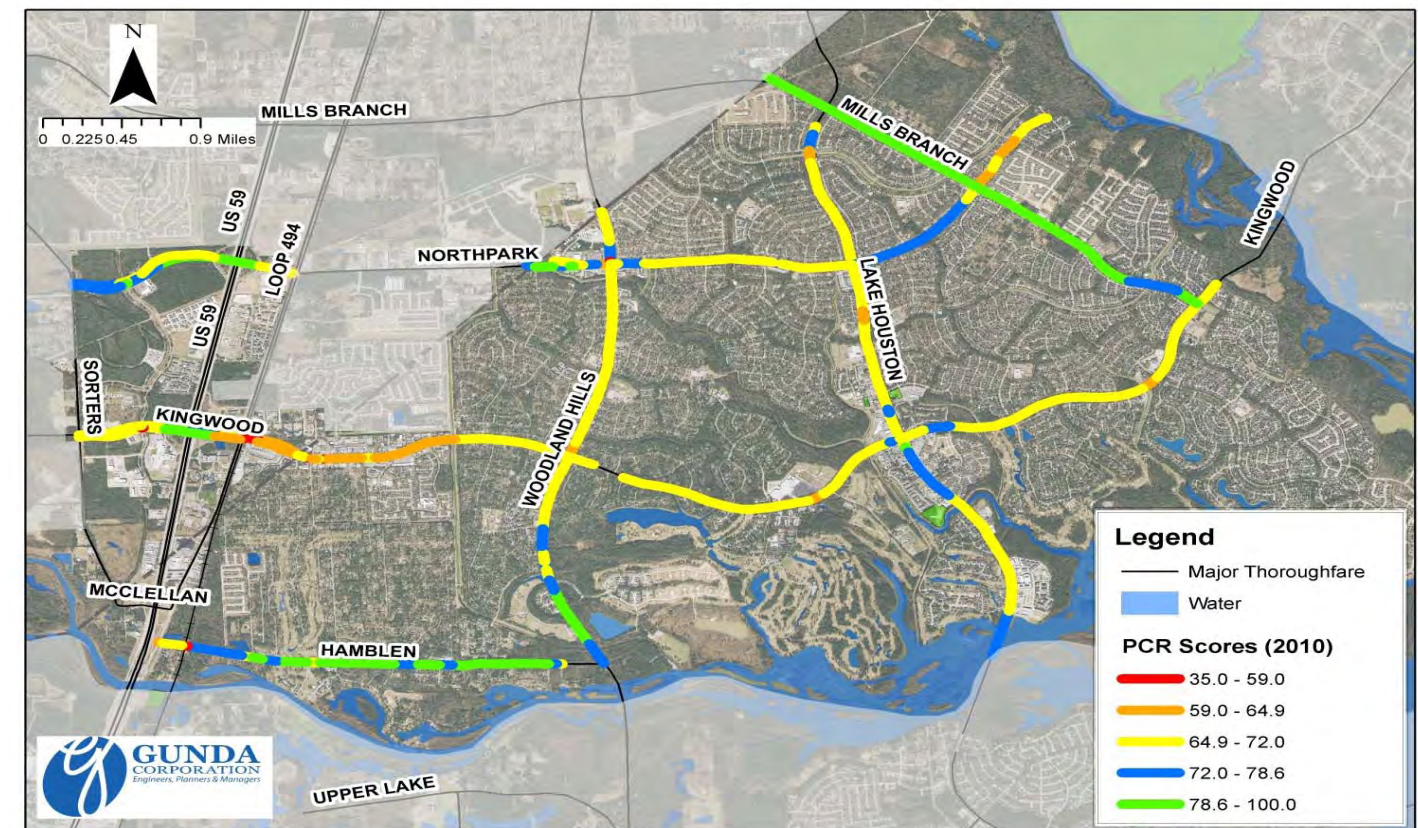


Figure 8-2 Pavement Condition Rating (PCR) Map

8.2 PAVEMENT CONDITION

Existing pavement conditions were determined based on field observations and Pavement Condition Rating (PCR) scores from the City of Houston database for year 2010. The PCR score is a rating system developed by the City of Houston to determine the existing pavement condition of the streets within the City of Houston limits. The City's Street Surface Assessment Vehicle (SSAV) measures cracks, smoothness, and settlement of pavement to assign a PCR score. The PCR scores have been classified into five categories: High (78.6-100), Medium-High (72-78.6), Medium (64.9-72), Medium-Low (59-64.9), and Low (35-59). The City of Houston has recommended that streets with PCR scores less than 65 (Low and Medium-low) were considered to be in poor condition. The PCR score for the study area streets are listed in the Table 8-1 and Figure 8-2 shows the PCR score Map.

8.3 CRASH DATA

Understanding roadway safety performance is critical in developing effective solutions that provide safety, mobility, and in maintaining quality of life. One of the key components in understanding safety performance is recognizing any pre-existing safety issues and concerns. To identify this, the study team obtained historical crash data from H-GAC for the study area for the past three (3) years. Using the historical crash data a crash rate was calculated for each roadway segment in the study area and was compared to a statewide average. Figure 8-3 below shows crash intensity map for various roadways within the study area for the year 2013.

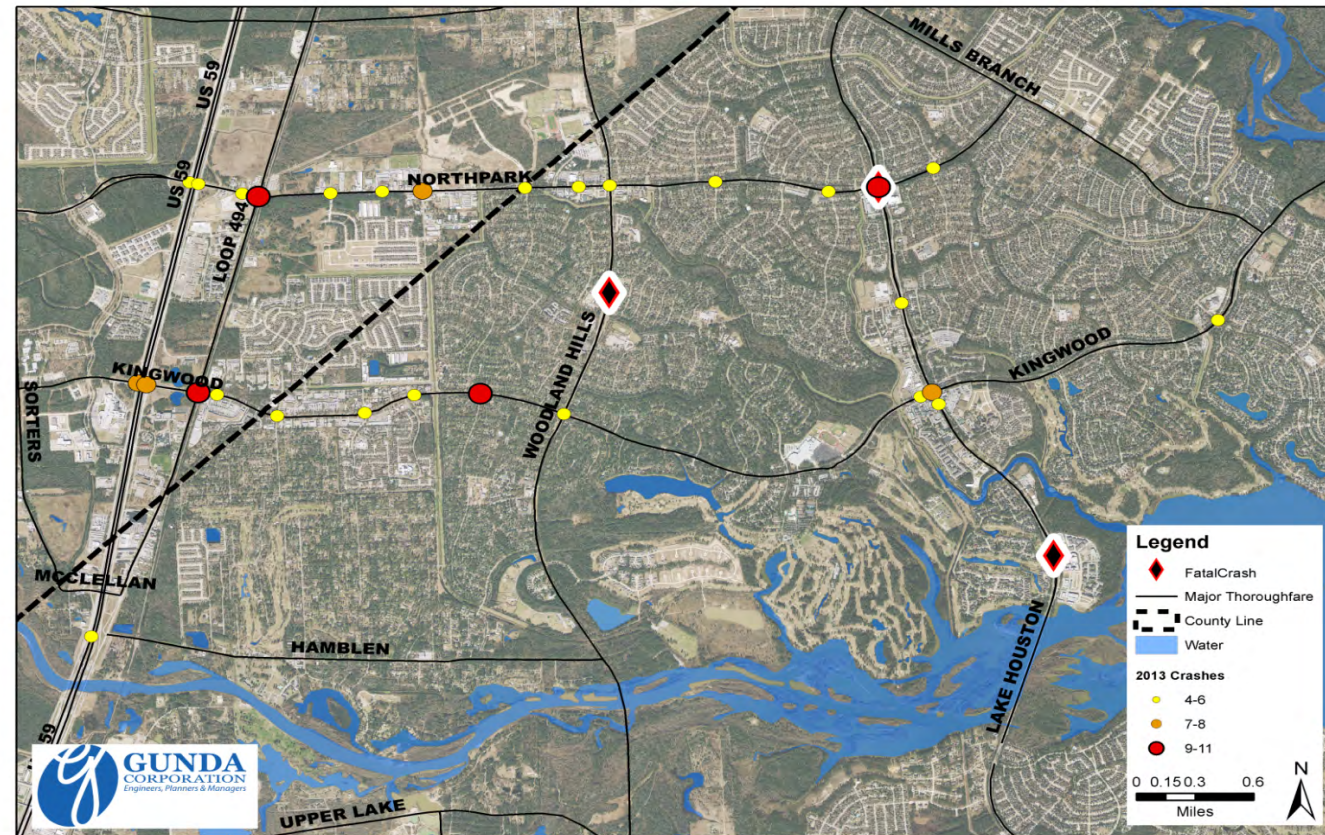


Figure 8-3 Crash Data Map

From the review of available crash data, three (3) fatalities were found to occur within the study area in the year 2013. The Crash Rate (R) is expressed as Million Vehicle Miles Traveled (MVMT) by the equation described below:

$$R = \frac{C \times 100,000,000}{V \times 365 \times N \times L}$$

Where,

- R = Roadway crash rate for the road segment expressed as crashes per 100 million vehicle-miles of travel
- C = Total number of roadway crashes in the study period
- V = Traffic volumes Average Annual Daily Traffic (AADT)
- N = Number of years of data
- L = Length of the roadway segment in miles

Table 8-2 below shows crash rate by segment within the study area. This table also indicated the statewide average for the two types of roadways being studied (four-lane and two-lane roadways). The statewide average for a two-lane facility is 193.07 crashes per 100 MVMT and for a four lane facility is 125.01 crashes per 100 MVMT

Table 8-2 Crash Rate Calculation

Roadway	Number of Crashes	Crash Rate per MVMT	Statewide Average
	C	R	
Kingwood Drive	200	249.73	125.01 (4-Lane Facility)
Northpark Drive	212	454.49	125.01 (4-Lane Facility)
West Lake Houston Parkway	82	578.63	125.01 (4-Lane Facility)
Woodland Hills Drive	49	690.01	125.01 (4-Lane Facility)
Mills Branch Road	50	662.78	193.07 (2-Lane Facility)
Hamblen Road	14	187.12	193.07(2-Lane Facility)

From the review of this historical crash data, the following roadways within study area were found to be experiencing more crashes than the statewide average during 2013.

- Kingwood Drive
- Northpark Drive
- West Lake Houston Parkway
- Woodland Hills Drive
- Mills Branch Road

Hamblen Road is the only roadway that is experiencing lower crash rate than the statewide average for a similar type of roadway.

8.4 TRAFFIC OPERATIONAL ISSUES

Traffic simulation analysis was conducted using SYNCHRO software for the AM and PM peak hours. Intersection performance is measured by a level of service. SYNCHRO is a traffic analysis software that uses Highway Capacity Manual procedures to estimate level of service. Level of service is represented from “A” to “F”. “A” being the best free-flowing condition and “F” being failing condition. Level of service “D” is considered as acceptable by most agencies. Figure 8-4 graphically illustrates the different level of service conditions. Field visits were conducted to gather the existing intersection lane configuration and traffic signals information. Existing traffic signal timing information was provided by City of Houston. The lane configuration, traffic signals information, and signal timing information along with the turning movement counts were coded in the SYNCHRO software to estimate signalized intersections level of

service. Both AM and PM peak hour level of service analysis was performed, however, PM peak hour was the worst case scenario and results for PM peak hour analysis are provided in Appendix C.

Based on the analysis of existing conditions several intersections within the study are operate a level of service (LOS) below the acceptable LOS standard D. Figure 8-5 shows 2014 Intersection Level of Service Map.

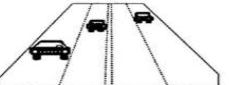
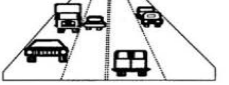




A		Excellent
B		Good
C		Average
D		Acceptable
E		Congested
F		Severely Congested

Figure 8-4 Level of Service

9. PLANNED DEVELOPMENTS AND INFRASTRUCTURE IMPROVEMENTS

Based on a review of Houston-Galveston Area Council (H-GAC) regional Transportation Improvements Program (TIP) and the City of Houston's Capital Improvement Plan (CIP) the following planned/scheduled/funded roadway improvements were identified within the study area and are shown in Figure 9-1:

- **Four Lane Widening of Kingwood Drive from Loop 494 to Woodland Hills Drive** – This improvement is funded by the City of Houston for FY 07/2016
- **Four Lane Widening of Loop 494 from North of Kingwood Drive to Harris County Line** - This improvement is funded by the TXDOT for FY 09/2016
- **Four Lane Widening of Loop 494 from North of Sorters to Montgomery County Line** - This improvement is funded by the TXDOT for FY 09/2016
- **Woodland Hills Drive Extension from Northpark Drive to Ford Road** - This improvement is planned by Montgomery County for FY 09/2019
- **Four Lane Widening of Sorters Road from FM 1314 to Northpark Drive** - This improvement is planned by Montgomery County for FY 09/2019,
- **Reconstruction of Ford Road from US 59 to West Lake Houston Parkway** - This improvement is planned by Montgomery County for FY 01/2022

Several developments are either currently under construction or planned for development. Known development activity include:

- **Watercrest Kingwood** – This development is 236 unit senior living villas/Apartments anticipated to be complete and operational in the summer of 2015.
- **Kings Creek Mixed Use Development** – This a mixed use development anticipated to start construction in the summer of 2015. This includes some high end restaurants, retail, and luxury residential units.
- **Kingwood Parc Mixed Use Development** – This mixed-use development is anticipated to start construction in 2015.
- **New Caney Middle School** – This a new middle school for 1,100 students which is currently in operation.
- **Royal Brook Residential Development** – This includes a 774 unit single family residential development anticipated to be opened by 2016.
- **Main Street Kingwood Mixed-Use Development** – This is mixed use retail development anticipated to be complete and operational in the year 2016.
- **Woodridge Forest** – This residential development has four sections completed as of February 2015 and three additional sections currently under development.

Figure 9-1 shows planned improvements and developments.

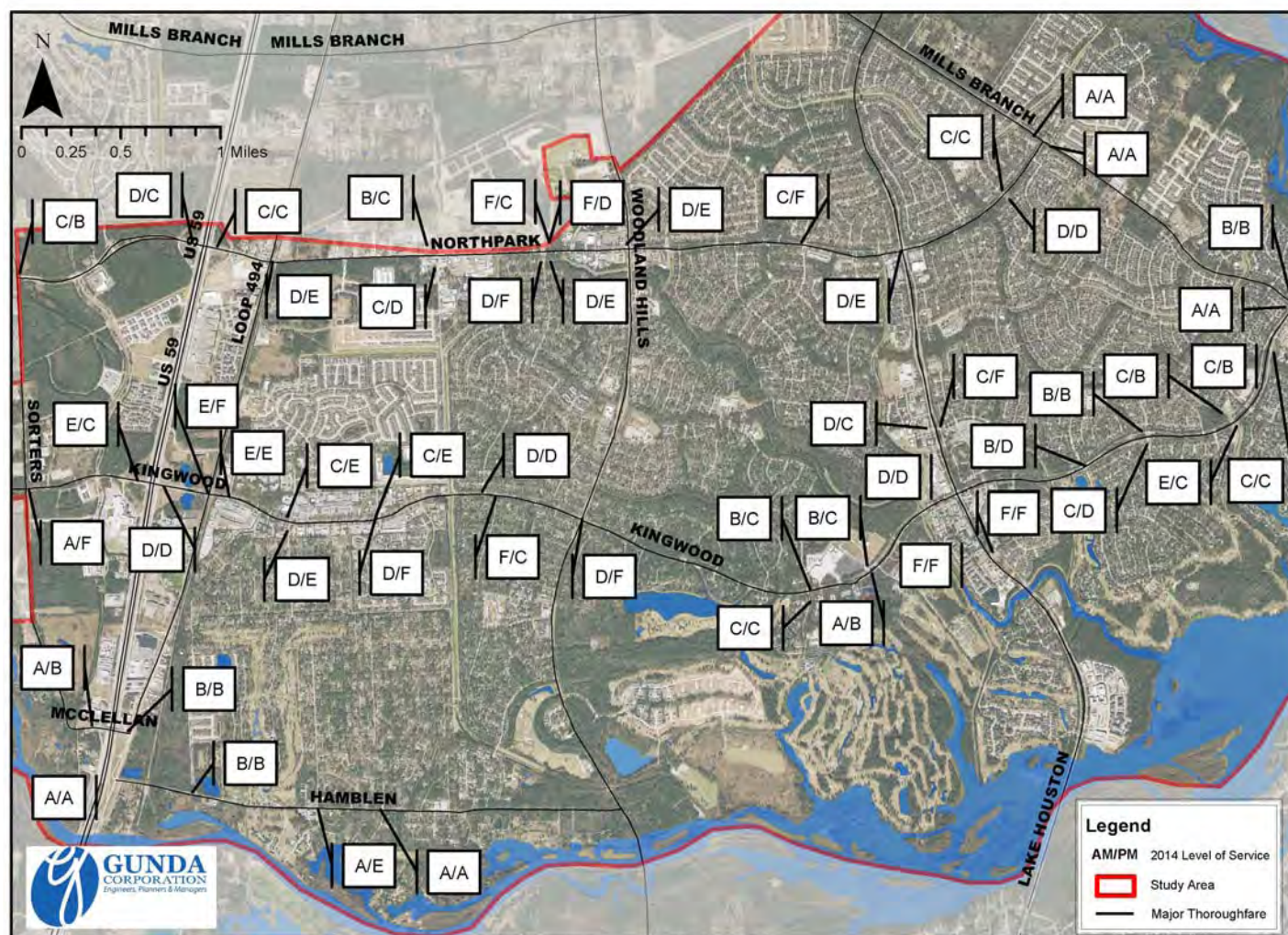


Figure 8-5 2014 Intersection Level of Service Map

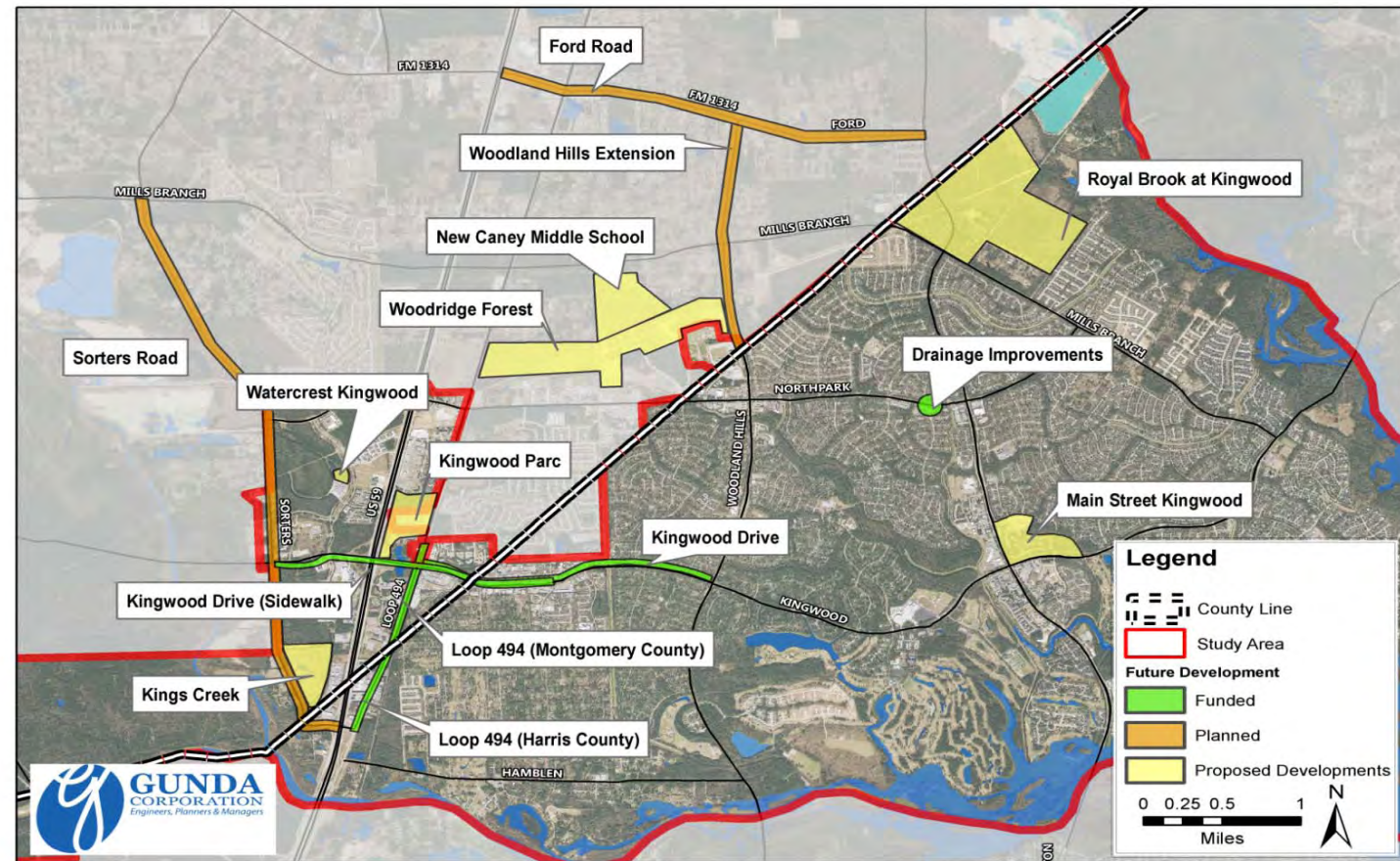


Figure 9-1 Planned Developments and Infrastructure Improvements

- Traffic signal timing synchronization (perceived issue by residents)
- There is too much cut-through traffic in the Forest Cove neighborhood
- Underbrush growth within the right-of-way causing and perceived sight distance issues

Opportunities include:

- There is enough right-of-way to provide turn lanes at major intersections
- There is space available in the median to add capacity on Kingwood Drive and Northpark Drive with minimal impacts to trees
- Coordination with Union Pacific Rail Road (UPRR) may yield a positive solutions at Loop 494/Rail Road crossings
- Woodland Hills Drive extension to Hamblen Road and widening of Hamblen Road can serve as an alternate entry/exit point for residents. This will also eliminate Forest Cove cut-through traffic concern to a certain extent

Constraints include:

- There are 3 locations on Kingwood Drive with very narrow median that may impact the widening of Kingwood Drive (Refer to Priority #2 Exhibit)
- On Northpark Drive there is a deep drainage ditch requiring storm sewer construction
- On Hamblen Road at the intersection of Loop 494, there is additional right-of-way needed
- Provision of grade separation at Kingwood Drive & Loop 494 will eliminate existing trees and may impact the existing traffic signal at the intersection of Kingwood Drive & Royal Forest Drive

10. ISSUES, OPPORTUNITIES, AND CONSTRAINTS

The Issues, Opportunities, and Constraints identified in this report are the result of a detailed inventory and analysis conducted by the project team, steering committee, and stakeholders. This report includes input gathered at two public meetings and five (5) steering committee meetings. Inventory and analysis activities included the following general physical elements of the study corridors area wide. The following list is an abbreviated summary of conclusions on the Issues, Opportunities, and Constraints.

Issues include:

- Intersections are operating below acceptable level of service as adopted by City Standard
- Traffic congestion problems along Kingwood Drive and Northpark Drive during the peak hours
- Safety concerns exist along major thoroughfares
- Recent development activity without proper planning
- Bottleneck issues on Kingwood Drive and Northpark Drive at Loop 494/Rail Road Crossings due to trains
- Traffic signals are closely spaced and there is lack of turn lanes at certain intersections

11. PUBLIC INVOLVEMENT

Public involvement is a key component of any comprehensive mobility study. For the Kingwood Area Mobility Study, the study team made every effort to maximize public participation during different stages of the study process.

Targeted Groups

Two (2) primary groups: Steering Committee and Stakeholders (General Public) were targeted as part of this plan, with each group providing unique perspectives in relation to the project. Following is a description of the role, activities, scheduled meetings and meeting purpose for each target group.

Steering Committee

A group of local technical and policy decision makers was identified for the Kingwood Area Mobility Study Steering Committee. The committee met at key milestones in the process to receive and assess reports on progress, comment on the schedule, coordinate with their respective agencies and provide oversight of major activities associated with the study. This group provided details on current and future plans, policies and standards to be used in the process. The committee extended technical guidance related to project goals, determining measures of effectiveness and

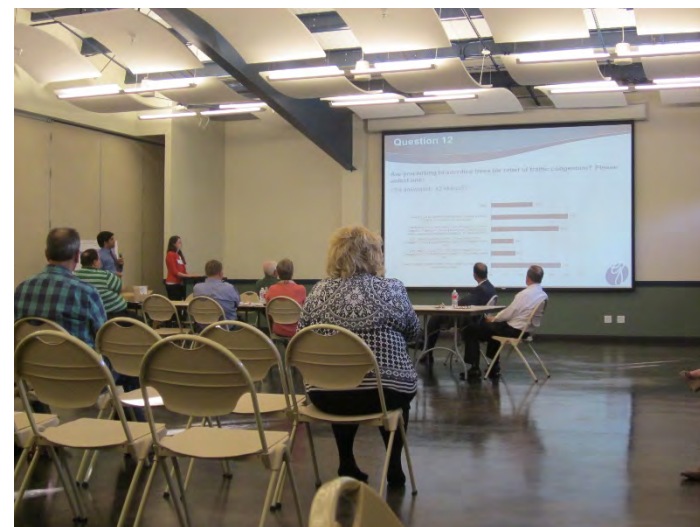
project tools to be employed. It was composed of representatives from Lake Houston Redevelopment Authority, Lake Houston Chamber of Commerce, Residents, and Lone Star College.

The Steering Committee meetings were open to the public and held at the Kingwood Community Center on the following dates:

- March 18, 2014
- April 22, 2014
- May 27, 2014
- September 23, 2014
- November 18, 2014



Steering Committee Meeting #2



Steering Committee Meeting #3



Steering Committee Meeting #4



Steering Committee Meeting #5

Stakeholder Meetings (Public Meetings)

The intent of public meetings was to promote honest, active, two-way communication with the public — actively listening to their concerns and keeping them informed about the study’s progress so that all community groups felt as if their concerns were being addressed and they had the opportunity to participate. It was important to reach out to members of the public that actively use the study area transportation facilities. Public meetings were a major component of this two-way communication effort and were scheduled during key stages of the project. The first public meeting relayed the purpose, process and progress of the study; engaged the public in providing specific input on study area and characteristics; and presented existing conditions analysis. A summary of public comments are

included in the Appendix D. Public meetings were held at Kingwood Community Center on May 13, 2014 and October 14, 2014.

In addition, study team has attended a local bizcom and a town hall meeting to discuss different aspects of this study. The study team also developed a dedicated website www.gundacorp.com/kingwood-mobility and an e-mail address kingwoodmobility@gundacorp.com to collect public input and comment.



Stakeholder Meeting #1



Stakeholder Meeting #2

Presentation materials

At steering committee, stakeholder and public meetings, presentation materials with clear, strong graphics were used to assist the public in understanding technical concepts. These include presentation boards, PowerPoint presentations, handouts and other communications tools. Materials also convey the technical results at each stage of the study. Team members knowledgeable of the project were available at meetings so that attendees could provide direct input regarding the project, or have questions answered.

Project maps

Another important technique in engaging the public to use detailed aerial maps to present study recommendations or to gather specific comments on the public's knowledge of the area (locations of developments, high crash locations, problem intersections, etc.) along with suggested improvements. These maps were documented as part of the public participation process.

Fact sheets

To help better communicate the process, fact sheets were created and distributed manually at stakeholder and public meetings. These sheets were also posted on the project website.

Online Survey

An online version of the questionnaire distributed at the first public meeting was posted and provided to attendees of the meeting. Approximately 1,300 people responded to the survey questionnaire and the results of the online survey are attached in Appendix D of this report.

Alternative Ranking Sheets

Once the alternatives were analyzed and presented at the second public meeting a ranking sheets was provided to the public so they could participate in the ranking or provide any additional comments. Results of rankings are attached in Appendix D of this report.

Comprehensive Meeting Notification

The study team in association with the Council Members Office provided meeting notifications using the following process:

- Post notices in Council Members monthly newsletters
- Send out Press Releases
- Local media was invited, attended, and made write ups after each meeting
- Announced at Neighborhood Meetings and all events attended in the area
- Posted Notice in Community Stores/Restaurants with Public Posting Boards like Starbucks, Alspaugh's, YMCA and more
- Announced at 6 different neighborhood National Night's Out on October 7th
- Visited both the Humble Intercontinental and Kingwood Rotary Clubs
- Posted information through social media
- Announced at Tax Reinvestment Zone #10 meetings
- Sent reminders on the days that meetings occurred
- Announced at Lake Houston Chamber of Commerce events like Bizcoms, Networking After Hours, Third Tuesday Luncheons and Chamber Community Events, and Included in St. Martha's Catholic Church Bulletin

12. ALTERNATIVES ANALYSIS

An analysis of future traffic conditions is important to determine improvements necessary to meet future needs. Existing and future traffic volumes from the H-GAC model and future development patterns were reviewed to estimate annual traffic volumes growth rate. Based on this review we determined a two percent annual traffic growth rate was appropriate for the study area. Existing intersection turning movement counts were then projected to year 2020 based on this estimated two percent annual growth rate. Using these projected volumes, a traffic simulation analysis was conducted for future year 2020. This traffic simulation analysis was first conducted for a No Build scenario to see how the intersections would operate without constructing any improvements and to identify intersections that would need improvement. Later, several alternatives were analyzed for intersections that would operate at an unacceptable level of service in the future years. Based on several trials, recommendations were made to improve the level of service. Appendix C provides future years No Build and Build scenarios level of service.

Based on the review and analysis of the data along with public input, the following improvement alternatives were analyzed:

1. Alternative A: Intersection Improvements
2. Alternative B: Left-Turn Prohibition in the Off-Peak Direction on Kingwood Drive
3. Alternative C: Widening of Kingwood Drive to 6-Lanes from US 59 to Woodland Hills Drive
4. Alternative D: Widening of Northpark Drive to 6-Lanes from US 59 to Woodland Hills Drive
5. Alternative E: Westbound Direct Connector from Kingwood Drive to US 59 Southbound
6. Alternative F: Westbound Direct Connector on Northpark Drive to US 59 Southbound
7. Alternative G: Alternative C + Alternative E
8. Alternative H: Alternative D + Alternative F
9. Alternative I: Alternative G + Alternative F
10. Alternative J: Extension of Woodland Hills Drive to Hamblen Road and Widening of Hamblen Road
11. Alternative K: Alternative C + Alternative D
12. Alternative L: Grade Separation on Kingwood Drive at Loop 494/Rail Road Crossing
13. Alternative M: Grade Separation on Northpark Drive at Loop 494/Rail Road Crossing
14. Alternative N: Alternative C + Alternative L
15. Alternative O: Alternative D + Alternative M

A detailed description of each alternative, along with cost and safety information, is illustrated in the attached exhibits.

13. COST EFFECTIVENESS

Alternatives were analyzed were reviewed for effectiveness not only from a cost perspective but also from schedule and time impacts. For example, Woodland Hills extension to FM 1960 and ultimately to Beltway 8 was reviewed. However, the crossing over the San Jacinto River has several wetland impacts causing environmental delays, so this alternative was not analyzed any further, but could be considered in the future. Also, the direct connector options from Kingwood Drive and Northpark Drive to US 59 are expensive alternatives and will provide least benefits for the cost associated with those improvements.

14. SCORING CRITERIA

Scoring criteria were established based on both the goals and measures of effectiveness agreed upon by the study team and the steering committee. The identified 15 alternatives were scored, and ranked appropriately. The following weighting factors were agreed upon and used to score each alternative:

- Community Input: 30
- Improve Mobility/Plan for Future/Quick Fixes: 30
- Maintain Same or Better Quality of Life: 25
- Identify Funding Sources: 5
- Safety: 30
- Transit: 5
- Pedestrian Facilities: 5

The measures of effectiveness for each alternative were identified as a number from 0 to 5 depending upon the criteria established for each alternative. Then the MOE for each goal was multiplied by the corresponding weighting factor. Finally, the score for each goal was added together for ranking purposes. Based on the final weighted score, the ranking for these alternatives was determined and is shown in Table 14-1:

Table 14-1 Alternatives Ranking

Alternative	Improvement	Rank
A	Intersection Improvements Only	1
B	Left-Turn Prohibition in the Off-Peak Direction	12
C	Widening of Kingwood Drive to 6-Lanes from US 59 to Woodland Hills Drive	3
D	Widening of Northpark Drive to 6-Lanes from US 59 to Woodland Hills Drive	6
E	Direct Connector from Kingwood Drive to US 59 SB	11
F	Direct Connector from Northpark Drive to US 59 SB	13
G	6-Laning of Kingwood Drive & Direct Connector from Kingwood Drive to US 59 SB	7
H	6-Laning of Northpark Drive & Direct Connector from Northpark Drive to US 59 SB	8
I	6-Lane Kingwood Drive, 6-Lane Northpark Drive, Direct Connector from Kingwood Drive, and Direct Connector from Northpark Drive	2
J	Extension of Woodland Hills Drive to Hamblen Road and Widening of Hamblen Road	4
K	6-Laning of Kingwood Drive and Northpark Drive	5
L	Grade Separation on Kingwood Drive at Loop 494/Rail Road Crossing	9
M	Grade Separation on Northpark Drive at Loop 494/Rail Road Crossing	10
N	Widening of Kingwood Drive & Grade Separation at Loop 494/Rail Road Crossing	14
O	Widening of Northpark Drive and Grade Separation at Loop 494/Rail Road Crossing	15

Once the ranking was established, these alternatives were further analyzed by the study team and steering committee members to identify the priorities and options needed for the Kingwood area to address existing deficiencies and also to accommodate future growth in the area. After receiving input from the public on the ranking, the study team and steering committee identified the improvement priority list as shown below. A list of the exhibits is attached with this report in the end. Based on further analysis a priority list was determined and is shown in Table 14-2:

Table 14-2 Priority List

Priority	Description
1	Intersection Improvements Only (Alternative A) – \$14.5 Million
2	Widening of Kingwood Drive to 6-Lanes from US 59 to Woodland Hills Drive (Alternative C) - \$29 Million
3	Widening of Northpark Drive to 6-Lanes from US 59 to Woodland Hills Drive (Alternative D) – \$28.5 Million
4	Extension of Woodland Hills Drive to Hamblen Road and Widening of Hamblen Road to US 59 (Alternative J) - \$25 Million + Right-of-Way Costs
5	Grade Separation on Kingwood Drive at Loop 494/Rail Road Crossing (Alternative L) - \$26 Million
6	Grade Separation on Northpark Drive at Loop 494/Rail Road Crossing (Alternative M) - \$26 Million

15. AGENCY COORDINATION

The study team, along with representatives from Council Member Martin’s office and the Steering Committee, met with the governmental agencies to discuss the list of prioritized improvements. The study team has met with the following agencies to obtain their input on the priorities identified and to discuss potential funding opportunities:

- Texas Department of Transportation
- City of Houston Public Works
- State of Texas Representative Dan Huberty
- State of Texas Representative Cecil Bell
- State of Texas Senator Brandon Creighton
- Houston Galveston Area Council (H-GAC)
- Union Pacific Rail Road
- Harris County Commissioner Jack Cagle
- Montgomery County Judge Craig Doyal and Commissioner Jim Clark

The representatives from the above agencies are in general agreement with the improvements and priorities identified.

16. CAPITAL IMPROVEMENT PLAN AND PHASING

Recommended improvements within the study area are primarily a plan for capital projects. Projects identified are conceptual in scope and will require further efforts in the coming years to be designed, funded, and ultimately implemented. Some are likely to be completed within a short period of time, while others are advanced later. This section provides rough cost estimated for capital components of the plan as prioritized by the Steering Committee and residents.

Projects should be thought of less as a set of sequential steps and more as clusters of related improvements that should be coordinated to maximize the aggregate benefits of the improvements. This section sets forth the capital plan and preliminary cost estimate. Detailed cost estimates for each of the prioritized improvements are attached in Appendix B for reference.

A detailed capital improvement plan will developed separately with the available information from TRIZ #10, and City of Houston based on the existing and future budgets and funding availability.

17. IMPLEMENTATION

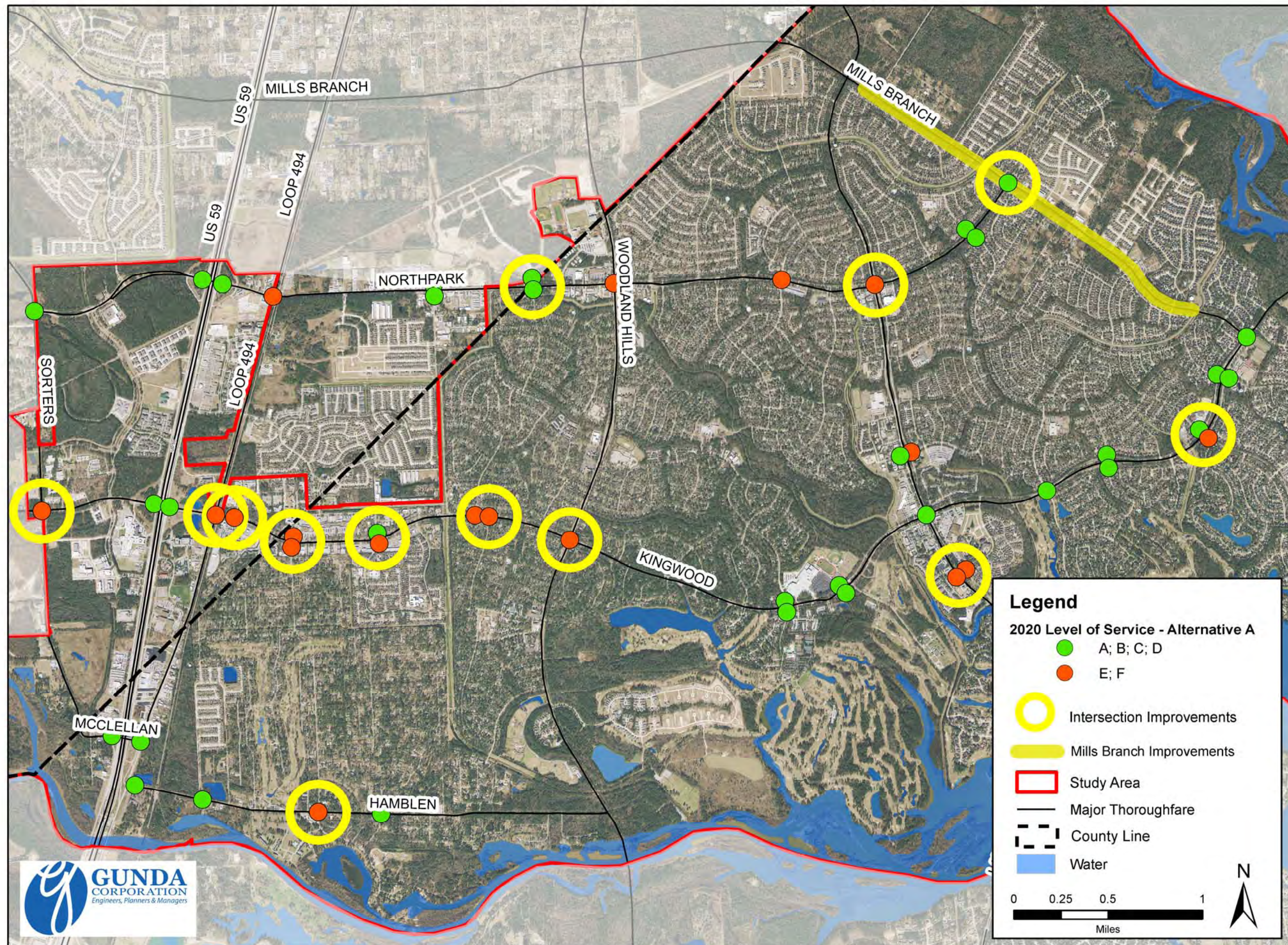
Once the CIP was developed and funding sources are identified for each of the prioritized improvements an implementation plan based on the priorities identified above will be required. This implementation plan serves as a road map to carry the identified improvements from planning level to design level and finally to the implementation stage. Preliminary cost estimates for the projects outlined above total approximately \$150 Million. However, because these projects promote multiple important goals, many different potential funding sources can be utilized including:

- TIRZ#10 Funding
- City of Houston Capital Improvement Plan
- Federal Funding in the form of Transportation Improvement Program (TIP)
- Federal Highway Administration FHWA TIGER Grant
- FHWA Congestion Mitigation and Air Quality (CMAQ) Funding
- Developer Agreements from future developments
- Possible UPRR Funding

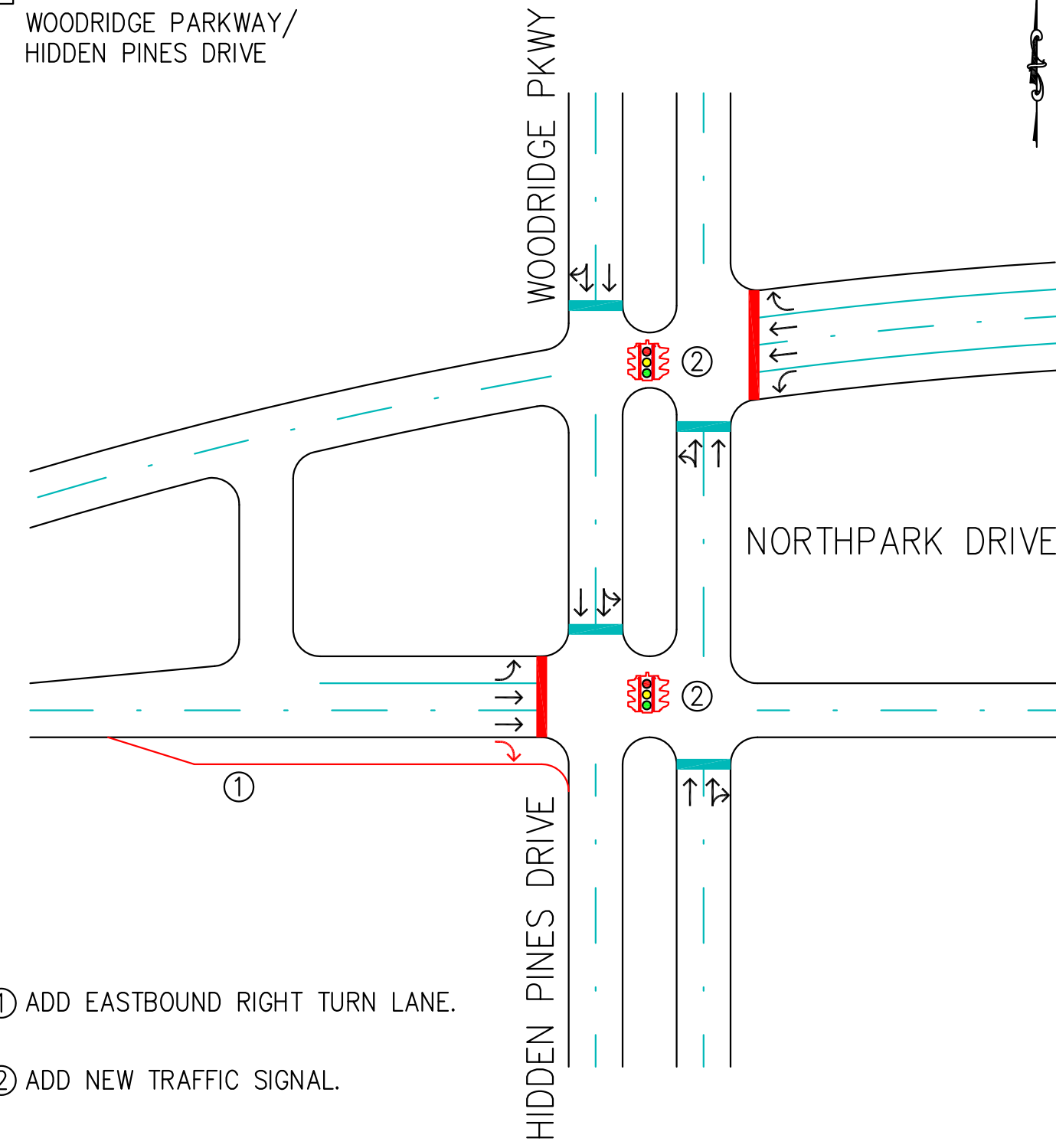
While implementation of the prioritized projects is complex, the benefits far outweigh the challenges. Through coordinated effort, effective partnerships, and thorough public involvement, these improvements can be implemented in a unified manner, creating benefits that will spread beyond the boundaries of the study area and benefit the entire region.

Lake Houston/Kingwood Area Mobility Study

Priority 1: Alternative A: Intersection Improvements

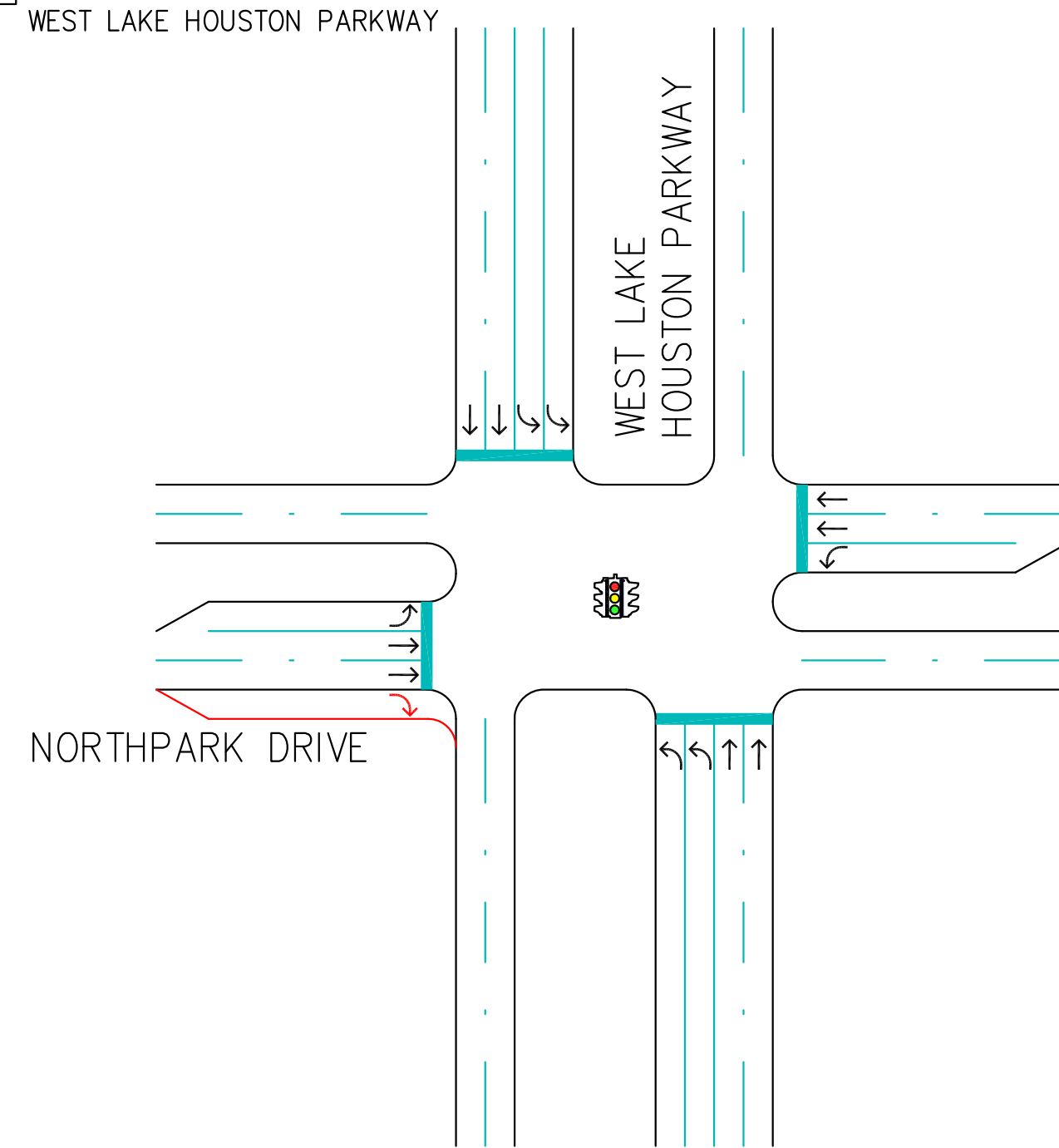


1 NORTH PARK DRIVE & WOODRIDGE PARKWAY/ HIDDEN PINES DRIVE



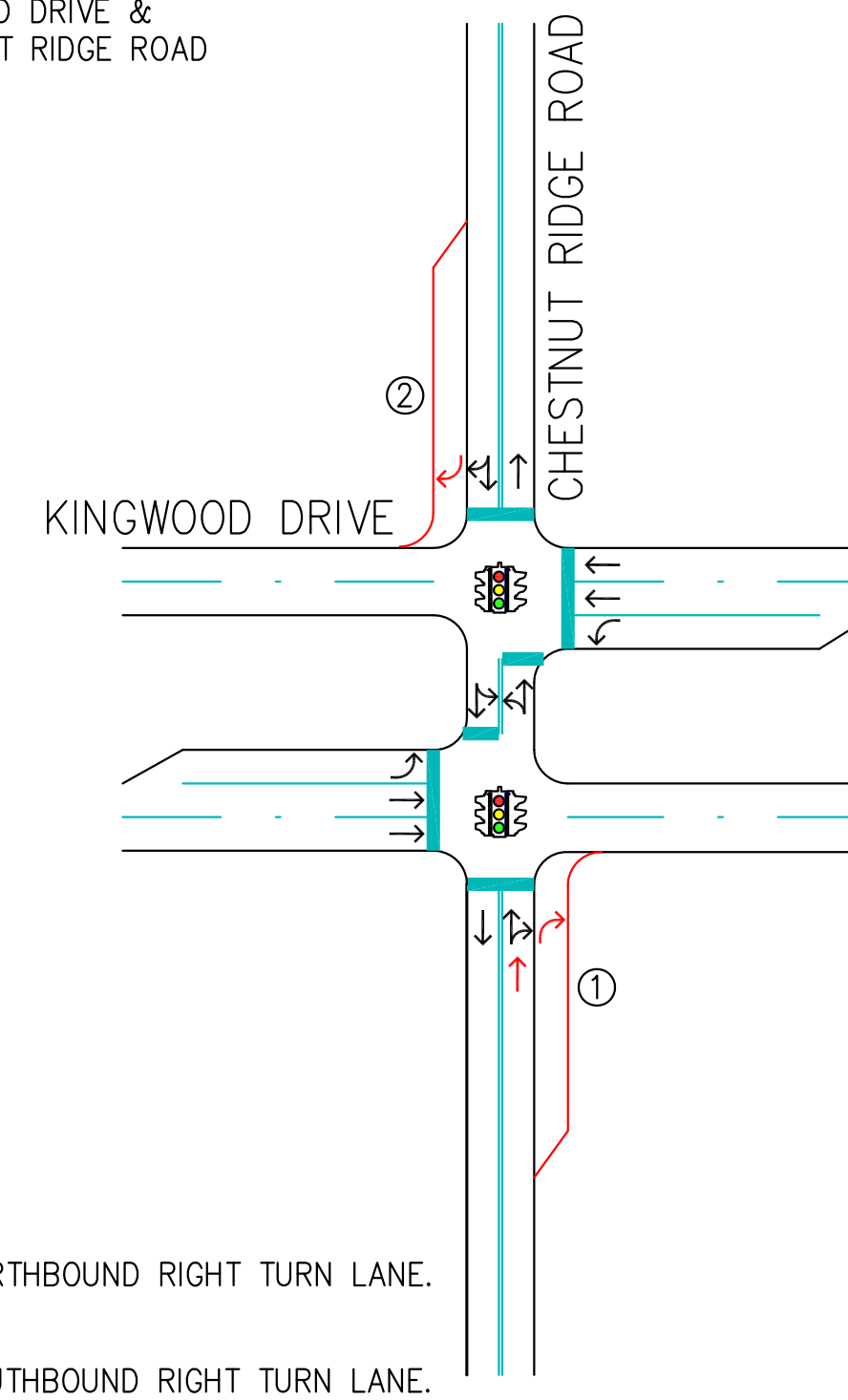
- ① ADD EASTBOUND RIGHT TURN LANE.
- ② ADD NEW TRAFFIC SIGNAL.

2 NORTH PARK DRIVE & WEST LAKE HOUSTON PARKWAY



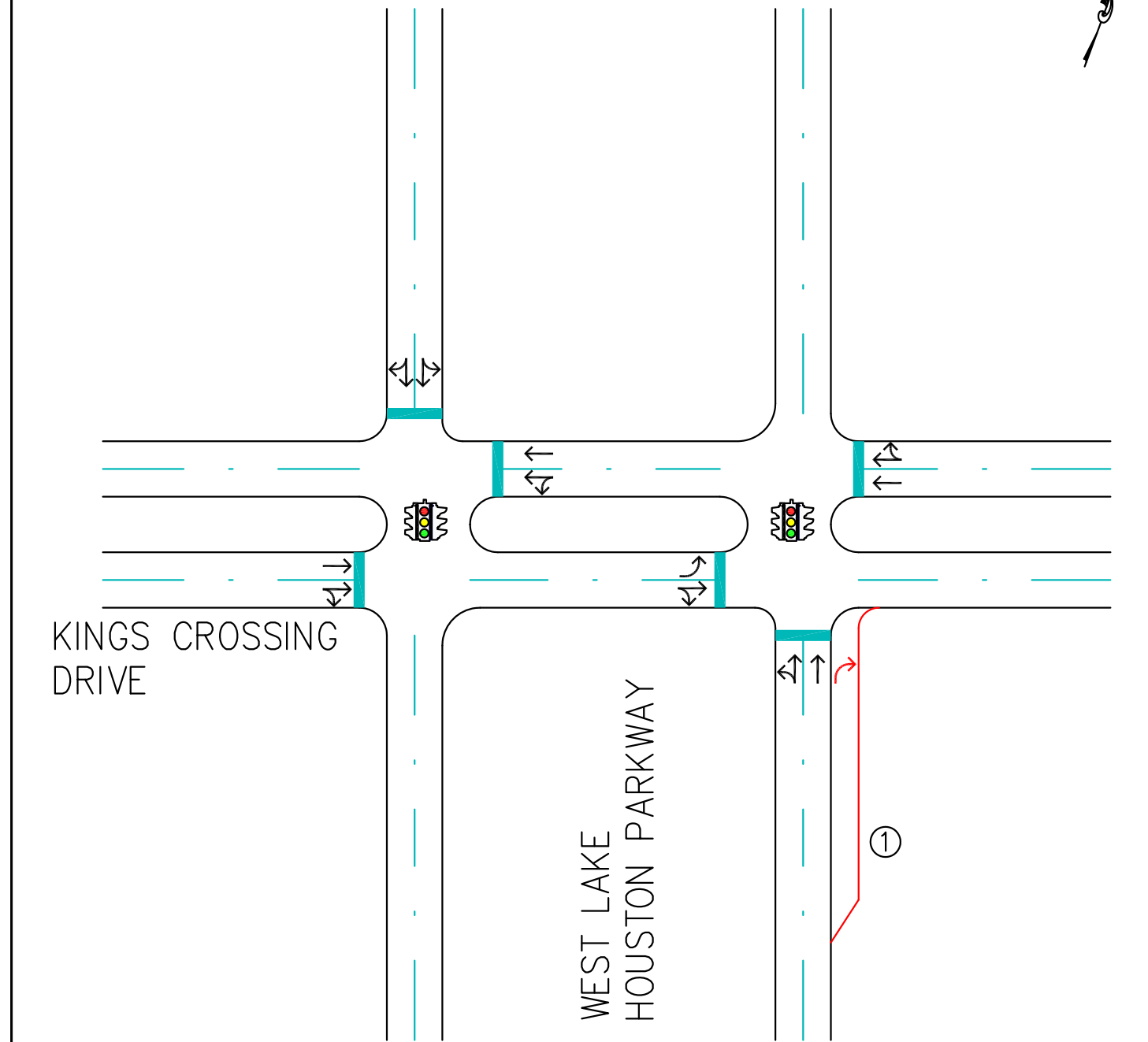
- ① ADD EASTBOUND RIGHT TURN LANE.

3 KINGWOOD DRIVE & CHESTNUT RIDGE ROAD



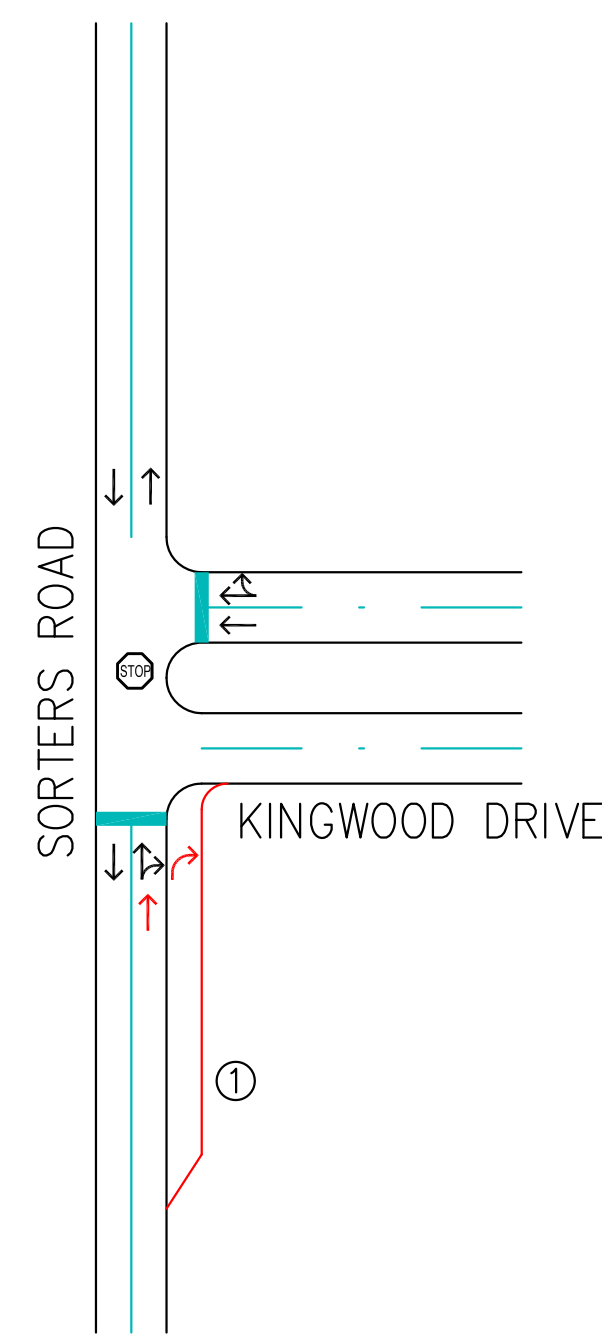
- ① ADD NORTHBOUND RIGHT TURN LANE.
- ② ADD SOUTHBOUND RIGHT TURN LANE.

4 WEST LAKE HOUSTON PARKWAY & KINGS CROSSING DRIVE



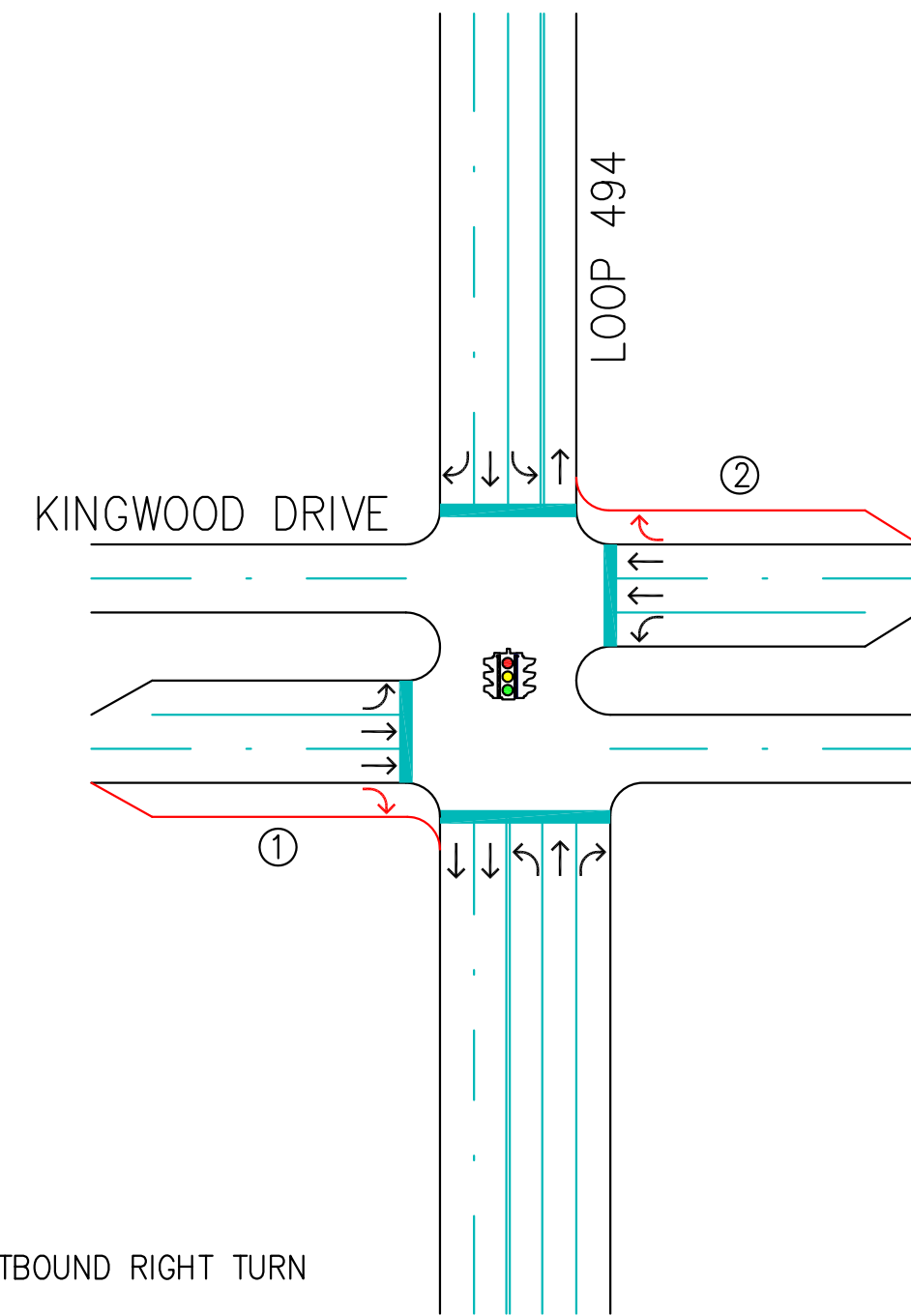
- ① ADD NORTHBOUND RIGHT TURN LANE.

5 KINGWOOD DRIVE & SORTERS ROAD



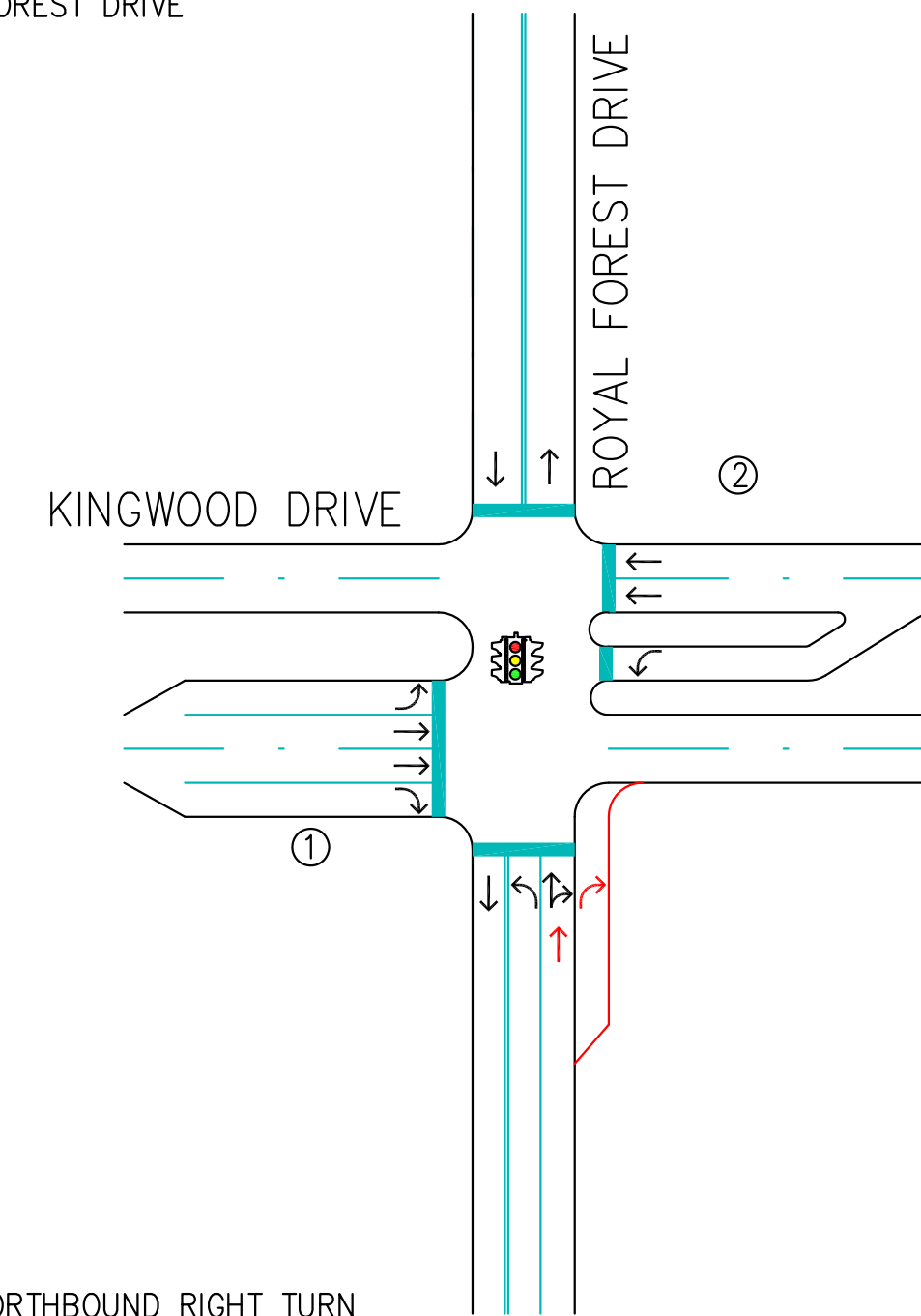
- ① ADD NORTHBOUND RIGHT TURN LANE TO KINGWOOD DRIVE.

6 KINGWOOD DRIVE & LOOP 494



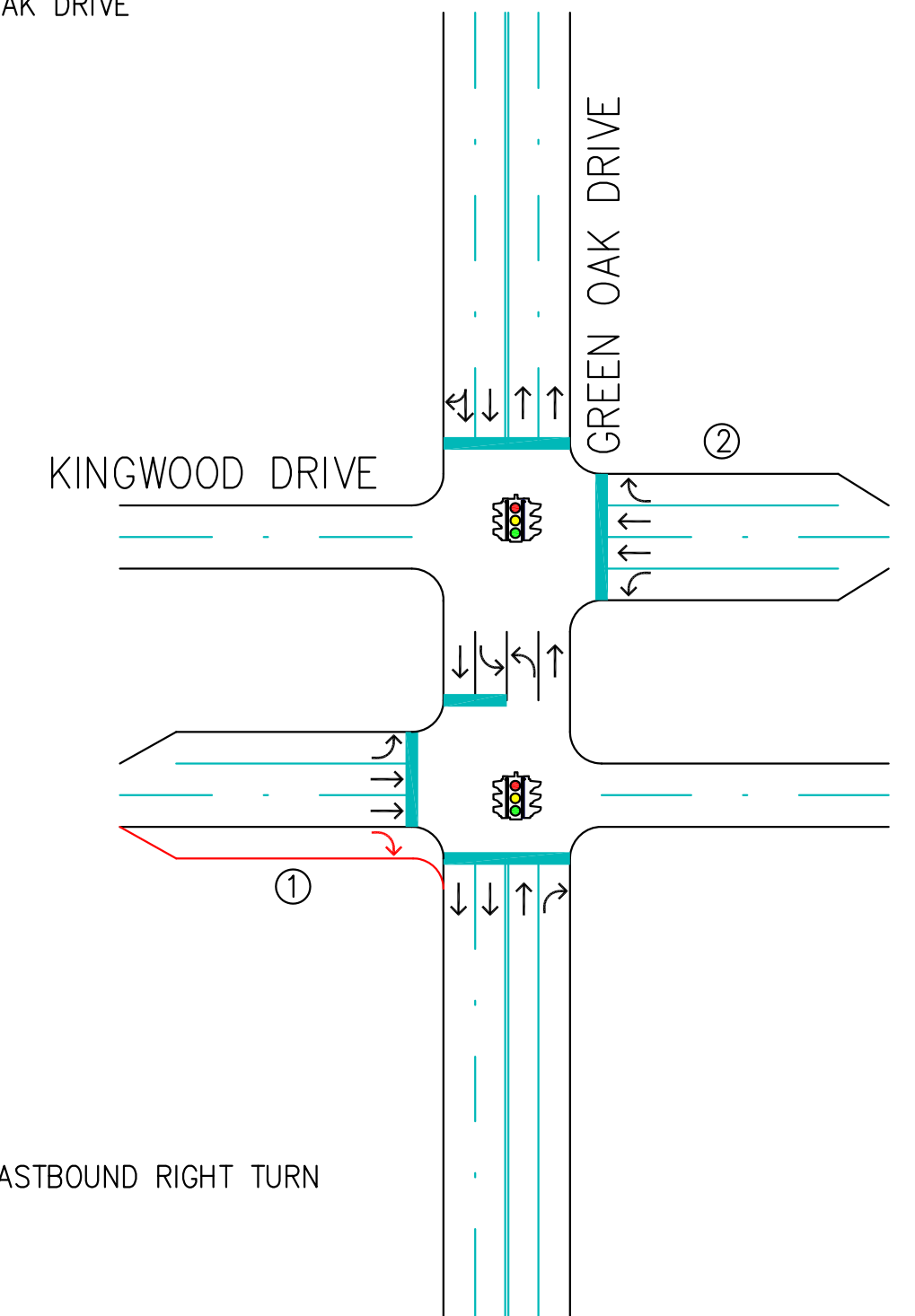
- ① ADD EASTBOUND RIGHT TURN LANE.
- ② ADD WESTBOUND RIGHT TURN LANE.

7 KINGWOOD DRIVE & ROYAL FOREST DRIVE



- ① ADD NORTHBOUND RIGHT TURN LANE.

8 KINGWOOD DRIVE & GREEN OAK DRIVE



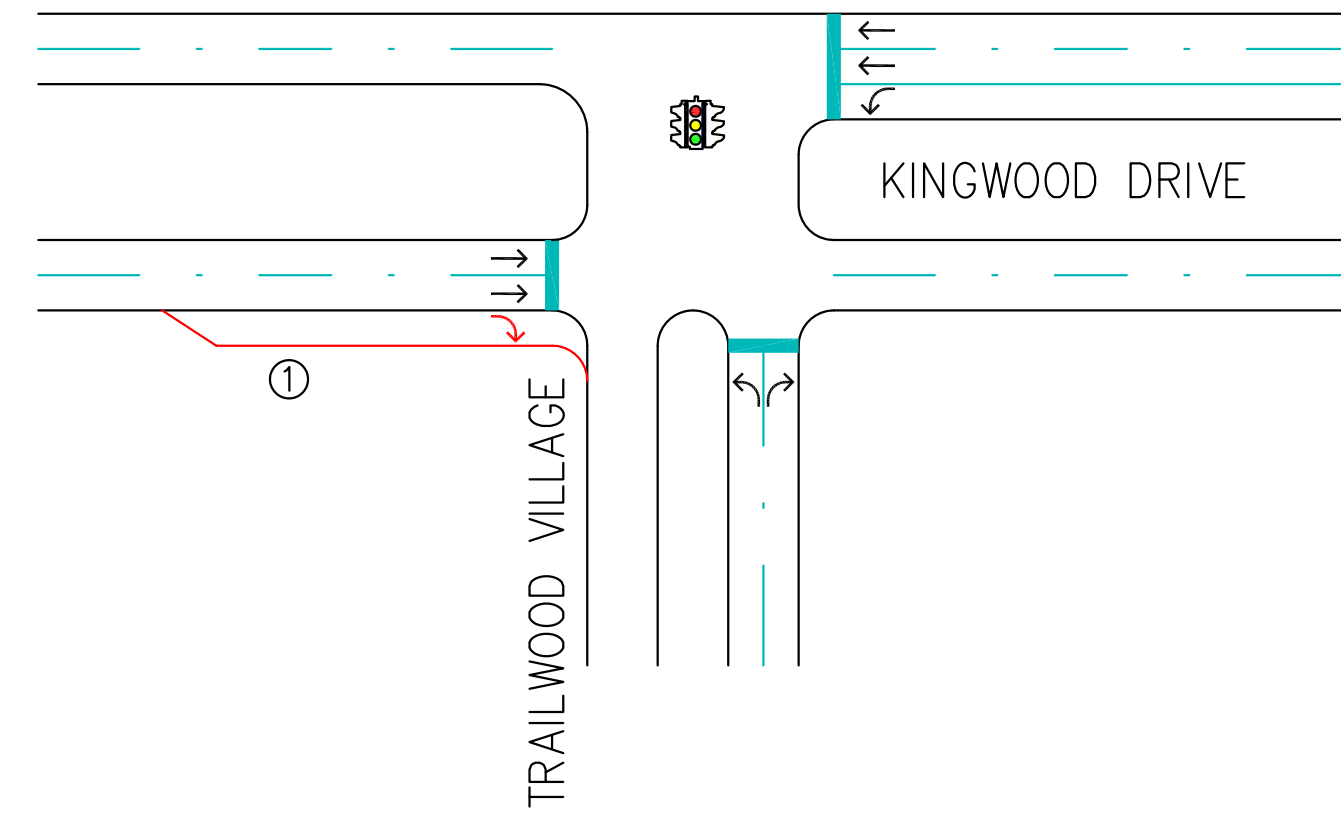
- ① ADD EASTBOUND RIGHT TURN LANE.

- LEGEND:
- EXISTING
 - PROPOSED IMPROVEMENT
 - EXISTING STRIPING
 - EXISTING CURB
 - PROPOSED CURB



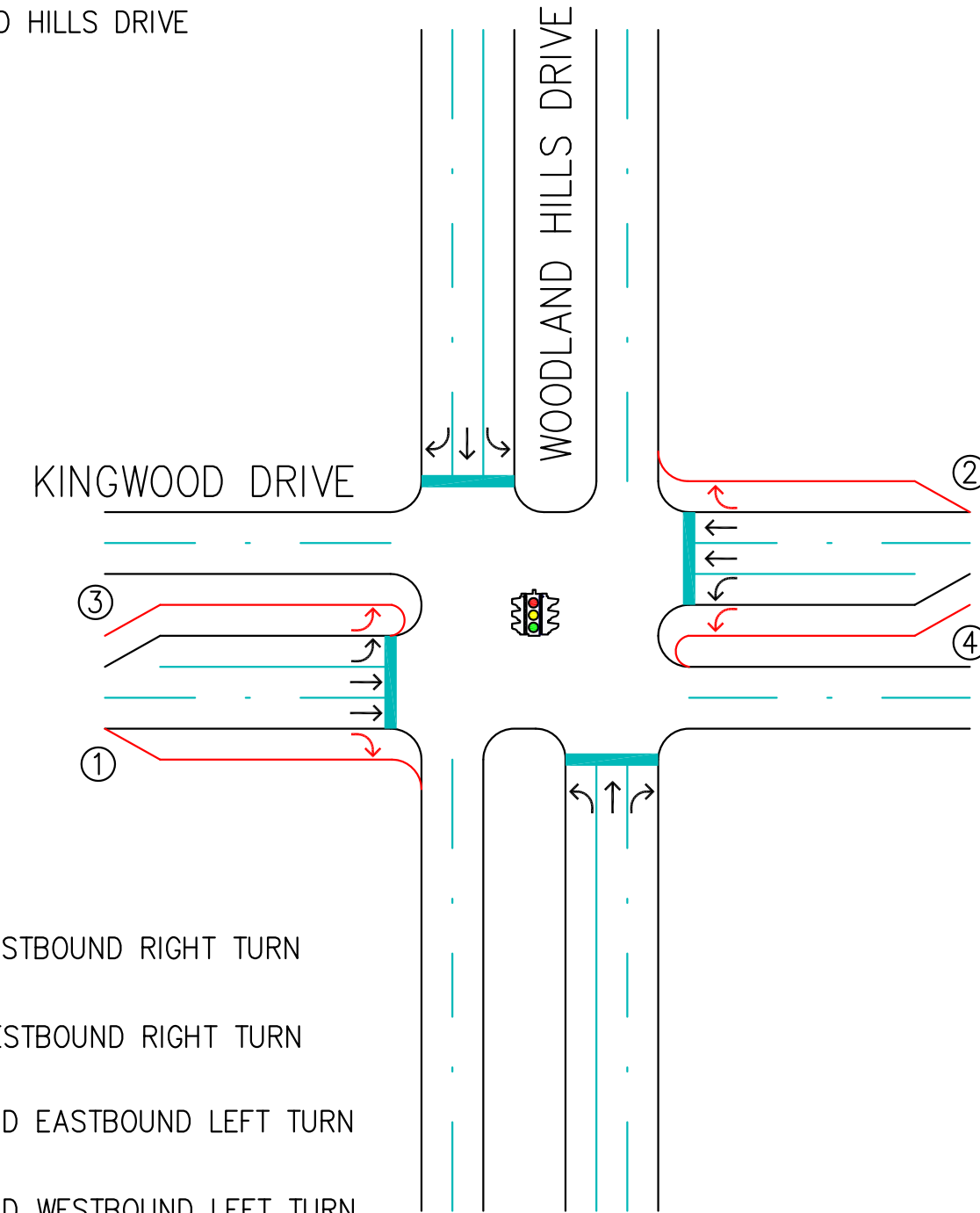
PROJECT NAME:		SHEET TITLE:	
LAKE HOUSTON KINGWOOD MOBILITY PLAN		INTERSECTION IMPROVEMENTS EXISTING (2014)	
		14004-01	EXHIBIT E7
		DATE:	SHEET 1 OF 2
		SEPT., 2014	

9 KINGWOOD DRIVE & TRAILWOOD VILLAGE



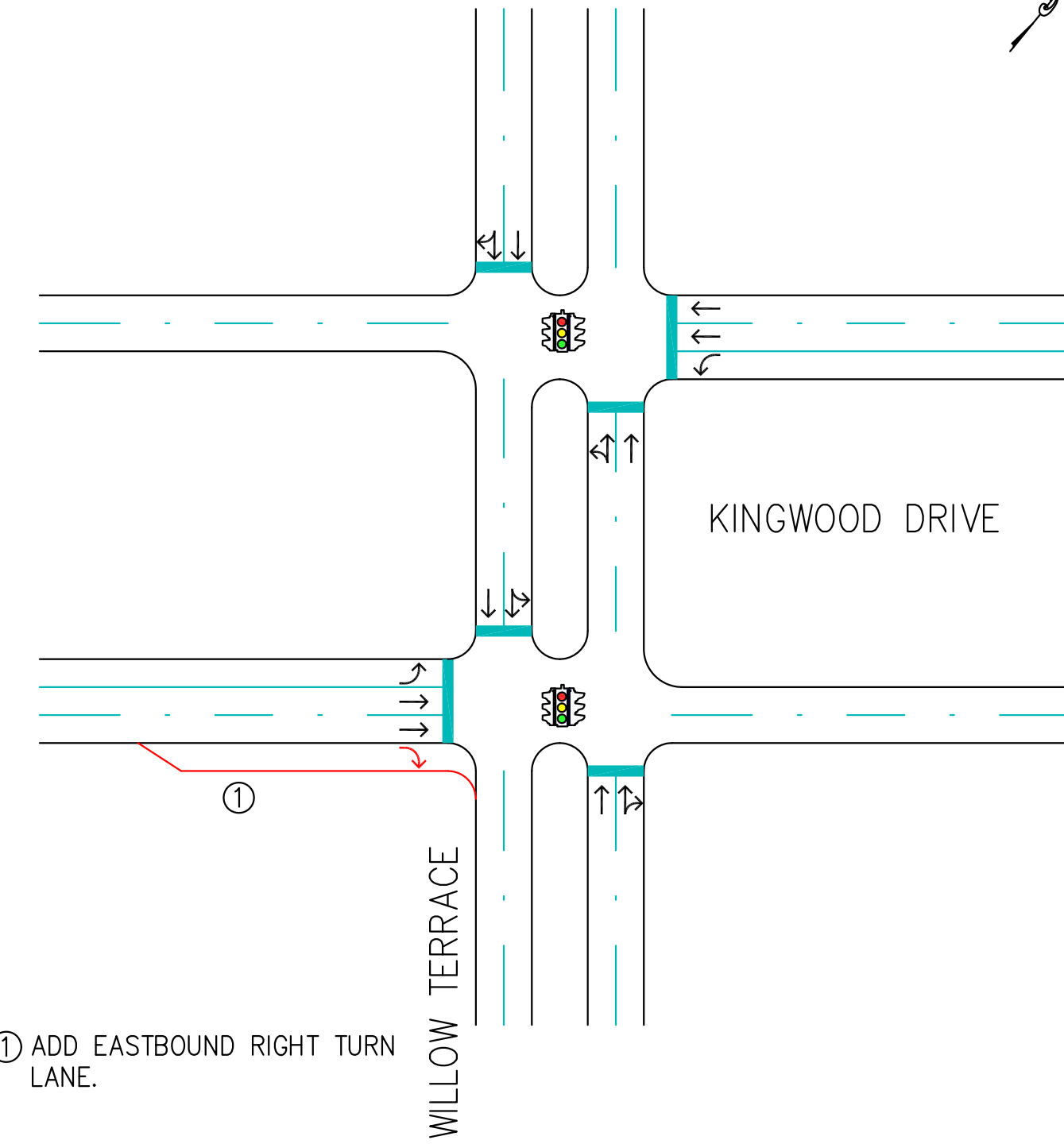
1 ADD EASTBOUND RIGHT TURN LANE.

10 KINGWOOD DRIVE & WOODLAND HILLS DRIVE



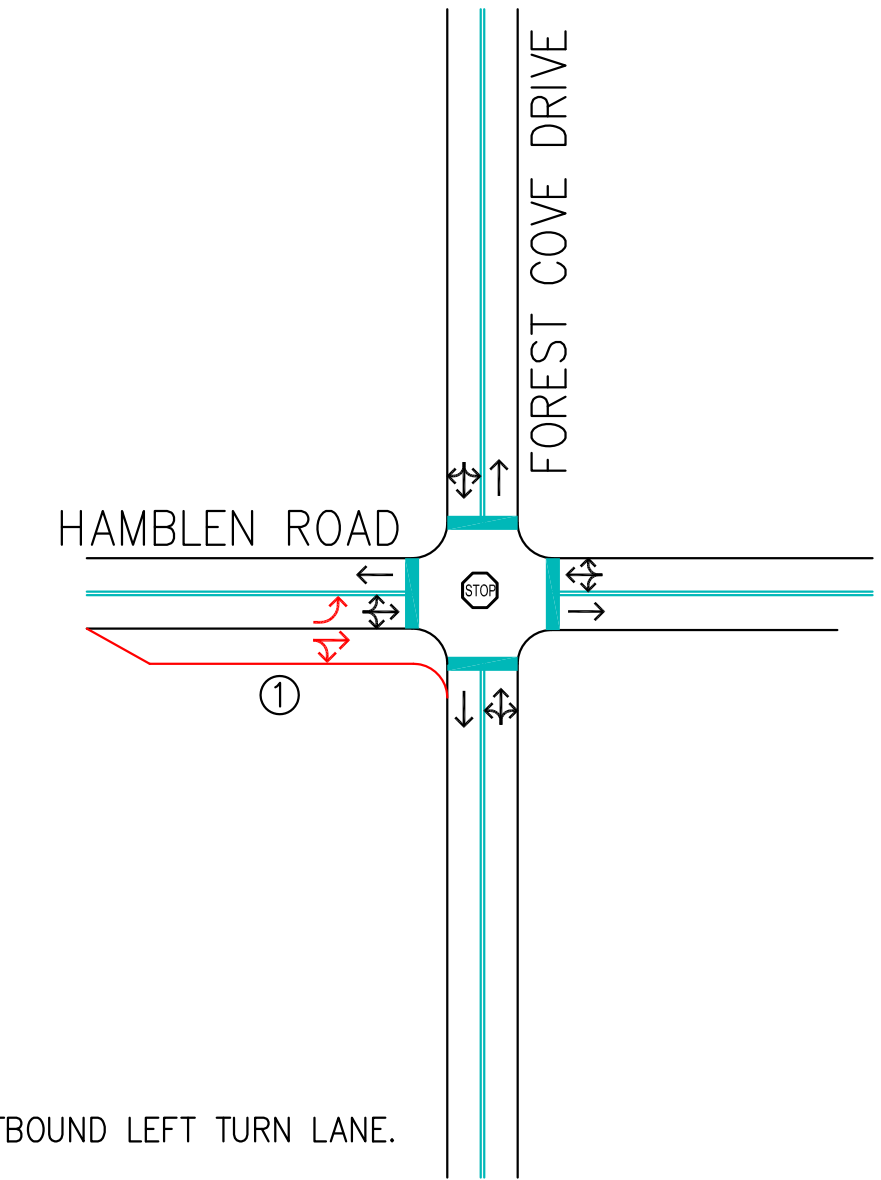
1 ADD EASTBOUND RIGHT TURN LANE.
2 ADD WESTBOUND RIGHT TURN LANE.
3 ADD 2ND EASTBOUND LEFT TURN LANE.
4 ADD 2ND WESTBOUND LEFT TURN LANE.

11 KINGWOOD DRIVE & WILLOW TERRACE



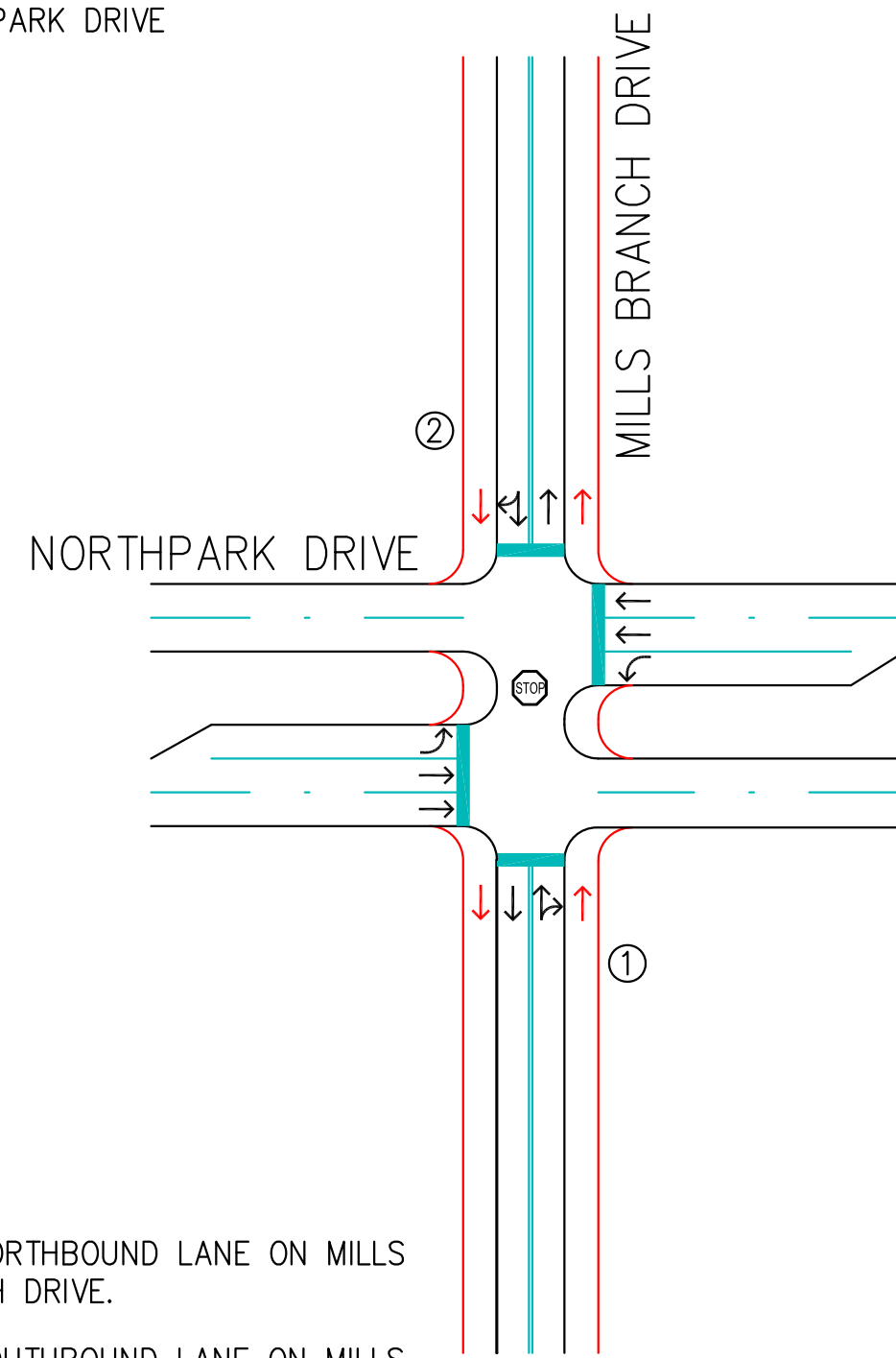
1 ADD EASTBOUND RIGHT TURN LANE.

12 HAMBLEN ROAD & FOREST COVE DRIVE



1 ADD EASTBOUND LEFT TURN LANE.

13 MILLS BRANCH DRIVE & NORTHPARK DRIVE



1 ADD NORTHBOUND LANE ON MILLS BRANCH DRIVE.
2 ADD SOUTHBOUND LANE ON MILLS BRANCH DRIVE.

LEGEND:

- EXISTING
- PROPOSED IMPROVEMENT
- EXISTING STRIPING
- EXISTING CURB
- PROPOSED CURB



PROJECT NAME:

**LAKE HOUSTON
KINGWOOD**
MOBILITY PLAN

SHEET TITLE:

**INTERSECTION
IMPROVEMENTS**
EXISTING (2014)

GUNDA PROJ. NO.:

14004-01

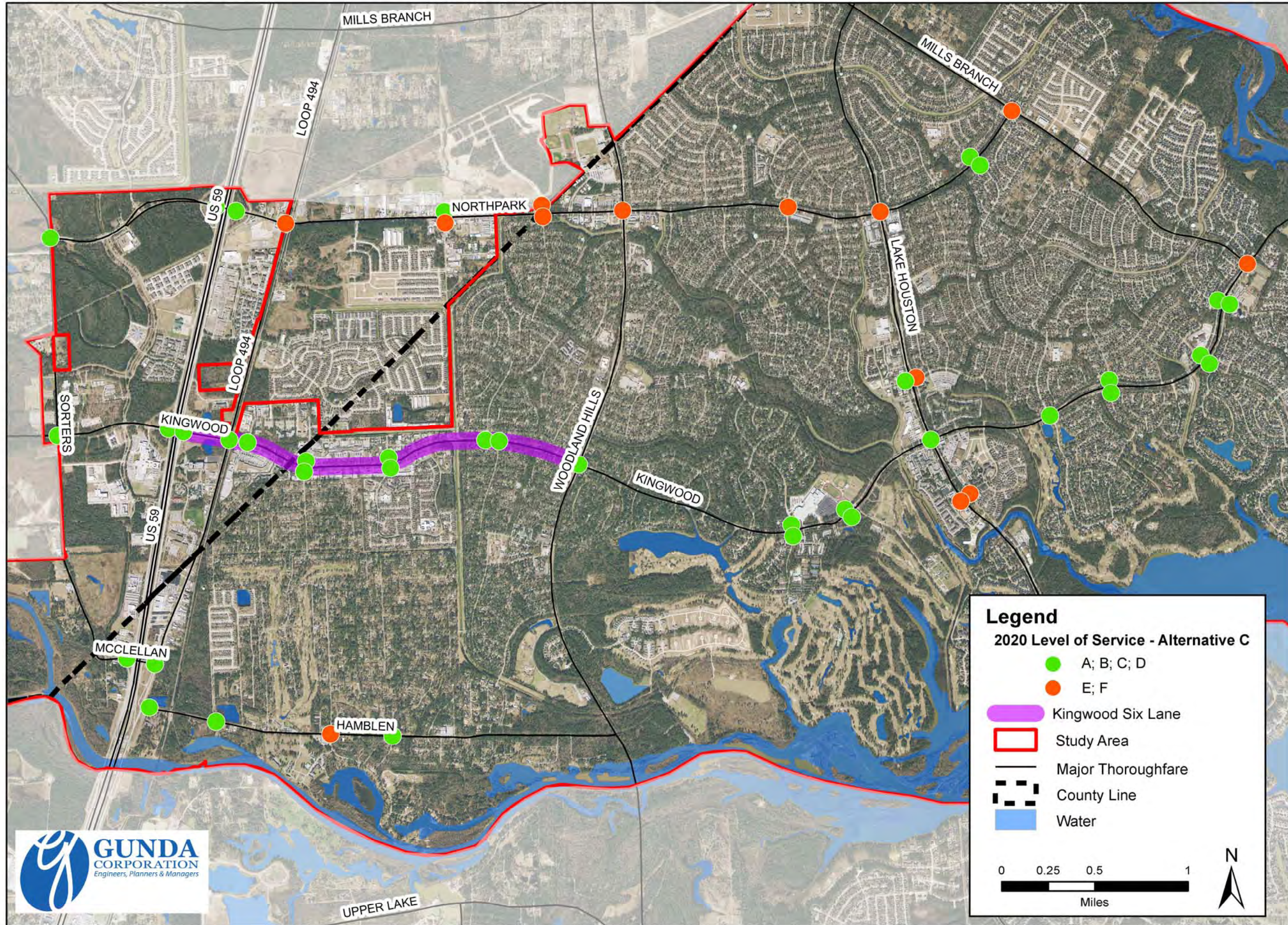
SHEET NO.

DATE:
SEPT., 2014

EXHIBIT E7
SHEET 2 OF 2

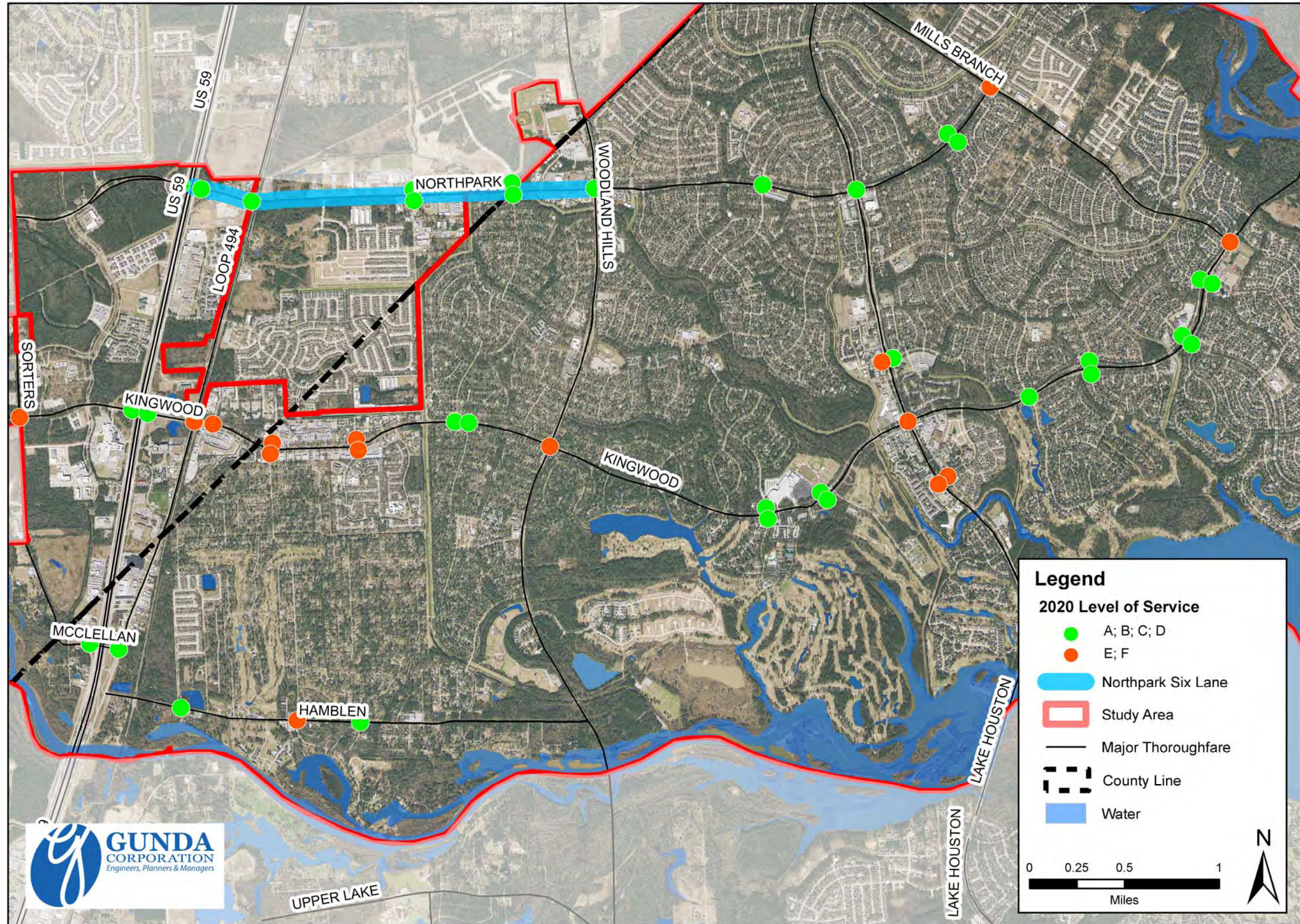
Lake Houston/Kingwood Area Mobility Study

Priority 2: Alternative C: Kingwood Six Lanes (US 59 to Woodland Hills)



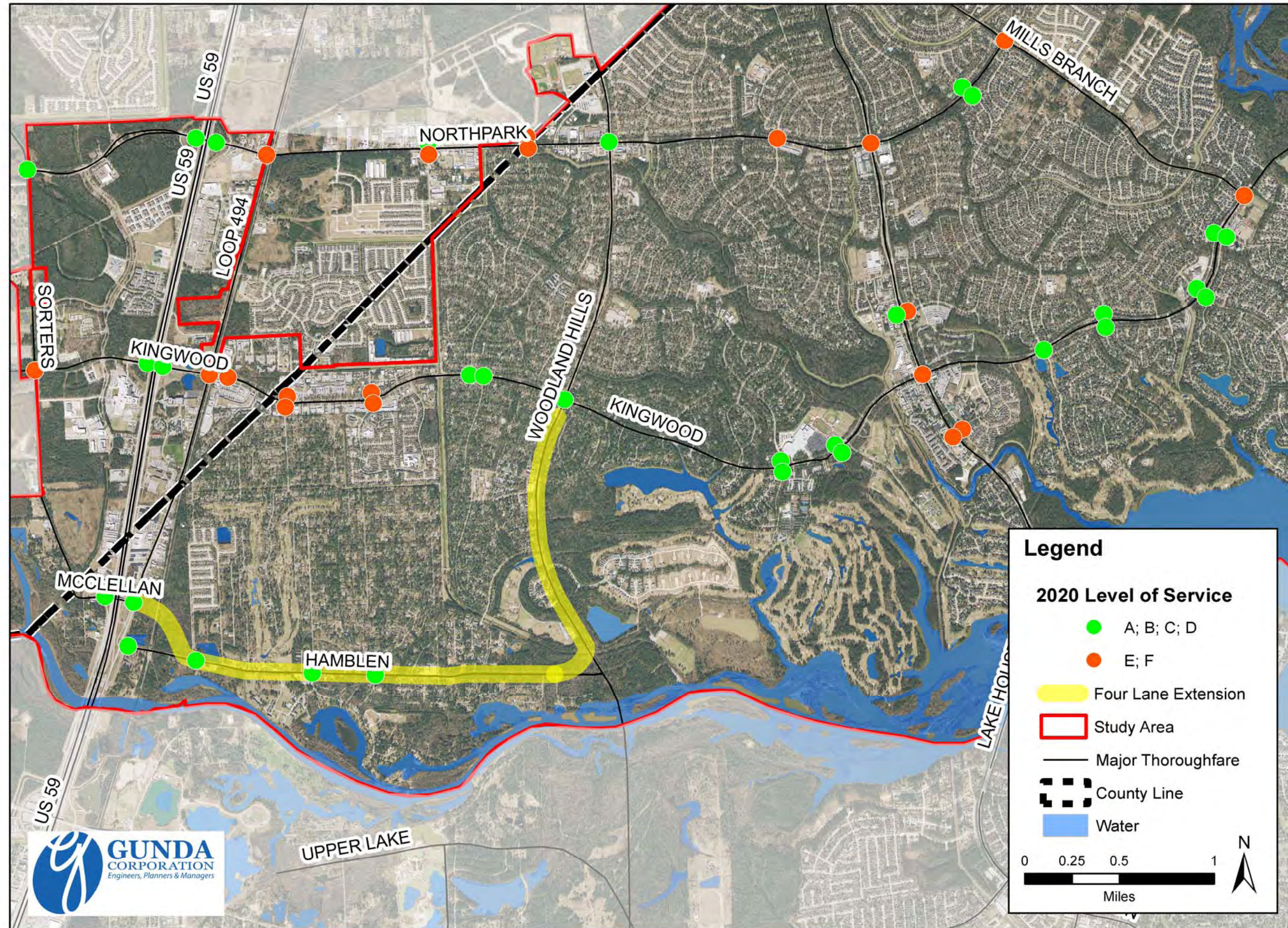
Lake Houston/Kingwood Area Mobility Study

Priority 3: Alternative D: Northpark Six Lanes (US 59 to Woodland Hills)



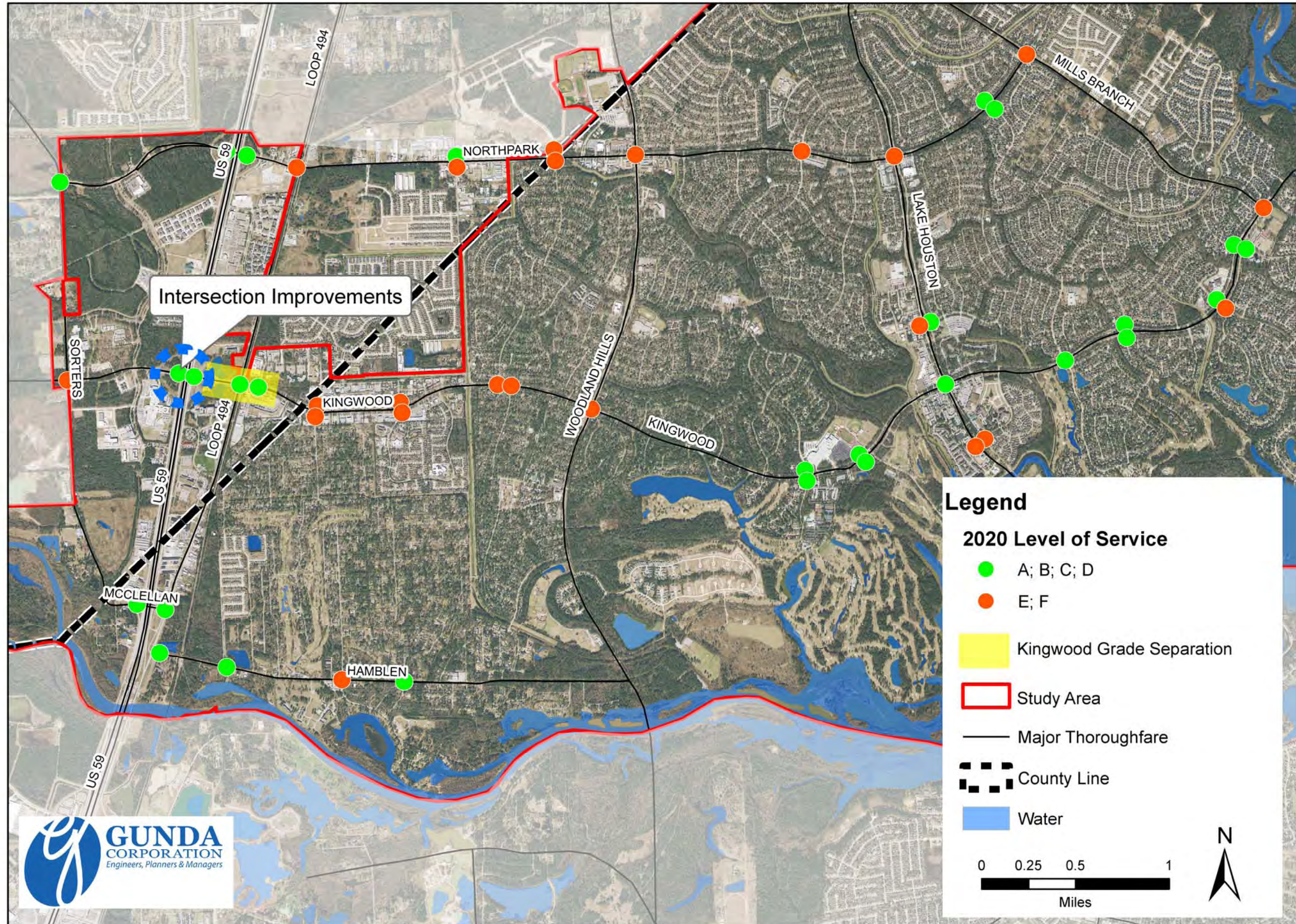
Lake Houston/Kingwood Area Mobility Study

Priority 4: Alternative J: Woodland Hills Drive and Hamblen Road Four Lane Extension



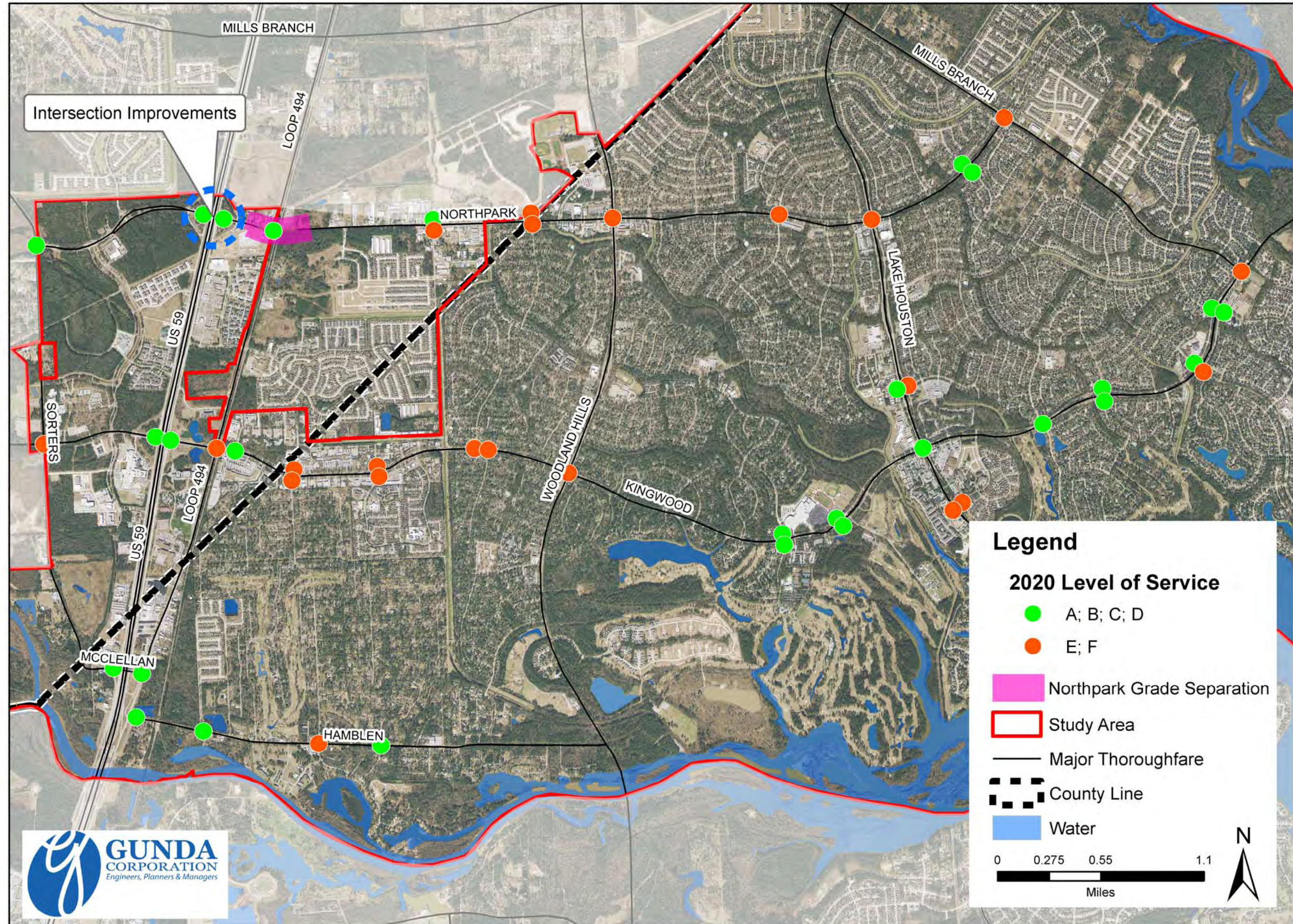
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Priority 5: Alternative L: Kingwood Drive Grade Separation



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Priority 6: Alternative M: Northpark Drive Grade Separation





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