Memo

To: Clay Pearson, City Manager

From: Vance L. Riley, Fire Chief *vlr*

CC: Jon Branson, Deputy City Manager; Trent Epperson, Assistant City Manager

Date: 7 April 2017

Re: Fire Department Standards of Cover and Staffing Study Final Report

Citygate Associates, LLC, our consultant for the Fire Department Standards of Cover and Staffing Study, has submitted their final report, electronically. This final report contains recommended changes and clarifications from Council and City staff that were noted after the presentation to Council on 27 February. All 3 Volumes are attached to this memorandum. The printed copies will be arriving in the near future.

At this point we do not see a need for Citygate Associates staff to return to Pearland. If you or Council feel it necessary for Citygate to return to the City please let us know so we can work on a schedule. They are, and have been, readily available by telephone and email when needed.

Fire Department staff is currently preparing our response to the recommendations of this final report. We are proposing that this final report be placed on the 24 April Council meeting agenda for Council acceptance. The Fire Department response will also be available before that date. If you have any questions, please do not hesitate to contact us. Thank you for your time and consideration.

VOLUME 1 OF 3 - EXECUTIVE SUMMARY

FIRE DEPARTMENT STANDARDS OF COVER AND STAFFING UTILIZATION STUDY

APRIL 4, 2017

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TABLE OF CONTENTS

Section ***Page***

Table of Tables

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VOLUME 1—EXECUTIVE SUMMARY

The City of Pearland (City) retained Citygate Associates, LLC to perform a Standards of Cover and Staffing Utilization Study for the Fire Department (Department). This study included reviewing the adequacy of the existing deployment system from the current fire station locations. This report is presented in three volumes, including this Executive Summary (**Volume 1**) summarizing our findings and recommendations, a Technical Report (**Volume 2**) that includes a Standards of Coverage (deployment) assessment and a headquarters staffing review, and a map atlas of deployment coverage measures (**Volume 3**).

Throughout this report, Citygate makes key findings, and, where appropriate, specific action item recommendations. Overall, there are 37 key findings and 25 specific action item recommendations in **Volume 2**. These findings and recommendations are presented throughout Sections 3 through 8 of **Volume 2** and summarized in Section 10 of **Volume 2** as a continuous list for ease of reference.

1.1 POLICY CHOICES FRAMEWORK

First, as the City Council understands, there are no mandatory federal or state regulations directing the level of fire service response times and outcomes. The level of service and resultant costs are a local community choice in the United States. The body of regulations on the fire service provides that *if fire services are provided, they must be done so with the safety of the firefighters and citizens in mind.* There is a constructive tension between a desired level of fire services and the level that can actually be funded. Thus, many communities do not have the level of fire services they may desire.

In rapidly growing communities like Pearland, it is an even harder challenge to keep fire service levels consummate with growth along with all the other competing needs as General Fund revenues grow. Over the past decade, Pearland has made significant investments in its fire services by adding career firefighters and fire stations, and combining the paramedic ambulance operation into a unified department providing fire and emergency medical services. Much of this fire service investment occurred even as the last recession was ending.

This study will identify that, in the near term, additional investment in fire services is still necessary as Pearland continues to evolve and consider the service level choices for its fire services. The fundamental policy choices are derived from two key questions:

1. *What outcome is desired for an emergency?* Is the desire to restrict a building fire to the room, building, or block of origin, or is it to provide paramedic care in time to lessen the possibility of preventable death and severe disability?

2. *Should equitable response time coverage be provided to all similar risk neighborhoods?* Once the desired outcomes are stated, the fire and emergency medical services (EMS) deployment system must be designed to cover the most geography in the fewest minutes to meet the stated outcome goals. In a large community such as Pearland, with multiple neighborhoods, it must be considered whether similarly developed areas, paying the same taxes, should all receive the same response time from a fire services unit.

1.2 CITYGATE'S OVERALL OPINIONS ON THE STATE OF THE CITY'S FIRE SERVICES

The City's fire and emergency medical services have not kept pace with growth and are still unable still to meet best-practice-outcome response times to all neighborhoods. To its credit, the City has staffed its fire crews at the best-practice level of four personnel, but does not have enough crews to cover a city the size of Pearland. Many emerging western-state cities allow non-contiguous neighborhoods to develop somewhat quickly over a few years. Stated this way, new urbanizing communities do not tend to grow outward from a solid core, with a grid or "right-angle" classic street system. Communities build in clusters and connect meandering subdivision streets with longer main boulevards. For quality of life and land owners, this can be a beneficial pattern. For fire services agencies trying to maintain response times from the most efficient (fewest) number of fire stations, it is **not** a cost-effective community design plan as most urban communities want best outcome response times to keep small fires small and to save people with potentially fatal medical emergencies.

If best outcome response times *to all similar risk and population density neighborhoods* are desired, then, in the near term, Pearland should consider at least three more fire stations for a total of eight. It might be necessary, by build-out and depending on the final City limits, to need nine to eleven fire stations with appropriate apparatus and personnel.

1.3 CHALLENGE – FIELD OPERATIONS DEPLOYMENT (FIRE STATIONS)

Fire department deployment, simply stated, is about the **speed** and **weight** of the attack. **Speed** calls for first-due, all-risk intervention units (engines, ladder trucks, and/or ambulances) strategically located across a department responding in an effective travel time. These units are tasked with controlling moderate emergencies, preventing the incident from escalating to a second alarm or greater size, which unnecessarily depletes department resources as multiple requests for service occur. **Weight** is about multiple-unit response for serious emergencies, such as a room-and-contents structure fire, a multiple-patient incident, a vehicle accident with extrication required, or a heavy rescue incident. In these situations, enough firefighters must be assembled within a reasonable time frame to safely control the emergency, thereby preventing it from escalating to greater alarms.

In **Volume 2** of this study, the Technical Report, Citygate's analysis of prior response statistics and use of geographic mapping tools reveals that the City currently does not have adequate fire station coverage. The deployment system largely does not meet the City's geographic coverage and incident demands. The maps provided in **Volume 3** and the corresponding text explanation beginning in **Volume 2** describe, in detail, the City's current deployment system performance.

For effective outcomes on serious medical emergencies and to keep serious, but still-emerging fires small, best practices recommend that the first-due fire unit should arrive within **7:30** minutes of fire dispatch being alerted of an incident, 90 percent of the time. In the City, the current fire station system provides the following unit response time performance, across a variety of population density/risk areas for emergency medical and fire incident types. As the table shows, no measure is close to a 7:30-minute, best-practice goal for an urban area.

Table 1—Call to First-Unit Arrival – 90 Percent Performance
(Taken from Table 23 in Volume 2)

Station	RY 15/16
Department-Wide	13:03
Station 1	13:30
Station 2	13:41
Station 3	12:31
Station 4	12:12
Station 5	13:22

As **Volume 2** of this report will detail, the dispatch, crew turnout, and travel times are all higher than recommended best practices. However, the travel times are very long, resulting in the bulk of the slow responses in Table 1. Travel times for Pearland were not reviewed based on fire station, but by response district, due to Pearland's use of closest-unit dispatch and not the closest fire station location. National Fire Protection Association (NFPA) Standard 1710 recommends a 4:00-minute travel time goal in urban and suburban areas. As seen in Table 2, none of the travel times meet this goal. There are several reasons for slower travel time, not all of which can be cost-effectively improved.

Table 2—First-Unit Travel Time – 90 Percent Performance
(Taken from Table 26 in Volume 2)

Station	RY 15/16
Department-Wide	09:44
Station 1	10:29
Station 2	09:00
Station 3	08:58
Station 4	09:01
Station 5	10:04

As a starting point, 37 percent of the City's public streets are within 4:00 minutes travel time of a fire station, which is well below Citygate expectations of 70 to 90 percent. The fire stations' travel coverage of the City at commute hours is negatively impacted down to 21 percent. The initial, multiple-unit coverage of five units at commute hours is impacted down to only five percent as units must travel across large sections of the City.

Pearland's travel times are reflective of the reality that, in congested urban areas, given the lack of an adequate number of fire stations, exacerbated by traffic congestion, achieving 4:00-minute travel coverage to substantially all the urban density neighborhoods will not be possible to 90 percent of the serious incidents from only five fire stations.

If at least an eight-station, three-ladder-truck deployment plan can be achieved, as modeled in this study, first-due unit coverage improves by 10 percent during normal traffic, and multiple-unit coverage improves 56 percent during normal traffic. During congested traffic, first-due unit coverage improves by 6 percent, and multiple-unit coverage improves by 58 percent.

1.4 Overall Deployment Evaluation and Summary Recommendations

If the risk of fire is to be limited to only part of the inside of an affected building, for the foreseeable future, the City will need both a first-due firefighting unit and Effective Response Force (multiple-unit, also known as First Alarm) coverage in all parts of the City and possibly the most populated areas of the Extra Territorial Jurisdictions (ETJs), consistent with current best-practice recommendations.

While the volume of, and response times to, EMS incidents consume much of the City's attention, all communities need a "stand-by and readily available" firefighting force to respond to fires that break out. The Fire Department provides ambulance care but, in addition, the threat of fire, even if low, still requires resources *in addition to EMS hourly demand* for an effective response to emerging fires.

If the City can continue to add fire stations over time, it will be able to provide:

- Equitable response times to all similar risk neighborhoods.
- Depth of response when multiple incidents occur.
- A concentration of response forces for high-risk properties.

The first deployment step for the City Council, in the near term, is to adopt updated and complete performance measures from which to set forth fire service outcome expectations and, on an annual budget basis, monitor and fund Fire Department performance.

Based on the deployment analysis contained in this study, Citygate's multiple recommendations in **Volume 2** of our Technical Report will strengthen deployment performance and ensure quality paramedic coverage as incidents increase year to year. The broad themes of our recommendations are:

- Adopt updated, outcome-driven response time goals.
- Consider the equity of coverage issue to similar neighborhoods.
- If continued incremental growth in fire services is desired, build a multi-year plan for additional fire services balanced to revenue growth projections.

1.5 Overall Headquarters Services Evaluation and Summary Recommendations

The findings and recommendations for headquarters services, programs, and staffing should be taken in the context of a best-practice review. The Pearland Fire Department has made significant progress in the last 10 years. The current leadership is in the process of meeting best practices. The community's expectations, and the Department's personnel and qualifications, *are outstanding*.

However, the Department's organization of positions will likely continue to grow over at least the next 10 years. Therefore, headquarters services need to be scalable to manage current programs and to prepare the personnel and capital assets for the future. This is difficult for a smaller agency.

Citygate cautions the City's leadership that adding fire stations and personnel is not enough. The line personnel also must be led, equipped, trained, and given quality oversight to comply with state and federal requirements. This requires the same serious commitment as providing additional fire stations. Citygate advises the City that, if it cannot fund both line and headquarters positions in the safe manner required, then it first focus on headquarters positions. While this seems counterintuitive, line firefighters that are not properly led, equipped, trained, and given quality oversight are a danger to themselves and the community they serve. They can also become a costly liability for accidents, injury, and apparatus loss time and claims.

Citygate does not recommend that Pearland stop adding fire stations, but Citygate recommends that, as revenues increase with growth, if the City plans to add fire stations, then it should add the appropriate balance of headquarters personnel to support line firefighters.

Citygate finds that, at present, the headquarters unit is at capacity and recommends Pearland consider headquarters additions *before* it hires additional personnel to staff another fire station. While Citygate does not recommend adding a Planning Officer position to specifically manage new fire station and personnel growth at this time, such a position will become necessary if the revenue projections are such that the City will continue opening new fire stations every two years until the City's desired response time goals are achieved.

The broad themes of Citygate's headquarters recommendations are:

- As soon as possible, the City should fill the vacant Operations Chief position.
- Evolve the use of the Fire Captain—EMS positions to that of Fire Captain Safety/Training Officers to support overall platoon training, EMS oversight, and incident command safety functions.
- The Department, in the near term, needs to add one Business Manager position to the Administration Division and two Administrative Assistant positions in the Administration and Training/Clinical Oversight Divisions.
- Continue to broaden the Department's Standard Operating Procedures.
- Provide a second set of Personal Protective Equipment to all personnel to allow for decontamination of the primary set when needed.
- Develop a written Career Development Guide to assist employees in preparing for promotions and ensure the requirements are stipulated in the plan and policies.

1.6 Next Steps

The City can continue to build on what it has accomplished to date in growing best-practices-based, urban fire and paramedic services. The purpose of this deployment and headquarters assessment is to compare the City's current firefighting, emergency medical, and code enforcement abilities against the local risks to be protected, as well as to compare against nationally recognized best practices. This analysis of performance forms the basis from which to make recommendations for changes, if any, in fire station locations, equipment types, staffing, and headquarters programs.

As one step, the City Council should adopt updated and best-practices-based response time goals for the Department and provide accountability for the Department personnel to meet those standards. The goals identified in Recommendation #2 meet national best practices. As the City

continues to evolve, measurement and planning will be necessary for the City to meet these goals. Citygate recommends that the City's next steps be to work through the issues identified in this study:

- Absorb the policy recommendations of this fire services study and adopt revised Fire Department performance measures to drive the deployment of firefighting and emergency medical resources.
- Develop a growth-to-revenues forecast for five years, and program dates for adding fire crews and headquarters positions.
- Implement the low- to no-cost recommendations in this study over the course of the next year.
- If the fire station growth curve is aggressive, add a Planning Officer to the Fire Department to focus only on the projects needed to accomplish the necessary growth.

VOLUME 2 OF 3 - TECHNICAL REPORT

FIRE DEPARTMENT STANDARDS OF COVER AND STAFFING UTILIZATION STUDY

APRIL 4, 2017

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TABLE OF CONTENTS

Section ***Page***

Table of Tables

Table of Figures

Appendices

VOLUME 3 of 3 – Map Atlas (separately bound)

SECTION 1—INTRODUCTION AND BACKGROUND

Citygate Associates, LLC's detailed work product for a Standards of Cover and Staffing Utilization Study for the City of Pearland (City) Fire Department (Department) is presented in this volume. Citygate's scope of work and corresponding Work Plan was developed consistent with Citygate's Project Team members' experience in fire administration. Citygate utilizes various National Fire Protection Association (NFPA) publications as best-practice guidelines, along with best practices from the criteria of the Commission on Fire Accreditation International (CFAI).

1.1 REPORT ORGANIZATION

This report volume is structured into the following sections. **Volumes 1** (Executive Summary) and **3** (Map Atlas) are separately bound.

Section 1 Introduction and Background: An introduction to the study and background facts about the City.

Section 2 Standards of Response Coverage Introduction: An introduction to the Standards of Coverage (SOC) process and methodology used by Citygate in this review.

Section 3 Deployment Goals/Measures and Risk Assessment: An in-depth examination of the City's deployment ability to meet the community's risks, expectations, and emergency needs through deployment of firefighters and apparatus.

Section 4 Staffing and Geo-Mapping Analysis: A review of: (1) the critical tasks that must be performed to achieve the City's desired outcome; and (2) the City's existing fire station locations and future locations.

Section 5 Response Statistical Analysis: A statistical data analysis of the City's incident responses.

Section 6 SOC Evaluation and Deployment Recommendation: A summary of deployment priorities and an overall deployment recommendation.

Section 7 Headquarters and Support Functions Staffing Utilization Review: An analysis of the headquarters functions.

Section 8 Headquarters Review Recommendations: A summary of headquarters priorities and recommendations.

Section 9 Next Steps: A summary of recommended next steps.

Section 10 Findings and Recommendations Summary: A comprehensive list of all findings and recommendations.

1.1.1 Goals of Report

This report will cite findings and make recommendations, if appropriate, that relate to each finding. Findings and recommendations are numbered sequentially throughout Sections 3 through 8 of this report. To provide a comprehensive summary, a complete list of all these same findings and recommendations, in order, is found in Section 10. Section 9 of this report brings attention to the highest priority needs and recommended next steps.

This document provides technical information about how fire services are provided, legally regulated, and how the City currently operates. This information is presented in the form of recommendations and policy choices for the City leadership to discuss.

1.2 Project Scope of Work

1.2.1 Standards of Response Coverage Review

The scope of this Standards of Response Coverage review includes the following elements:

- Modeling the response time ability of the current fire station locations. Although this is not a study of fire departments adjacent to the City, the study does consider the impacts of the City's mutual aid agreements common throughout the area.
- Establishing performance goals for the City consistent with best practices and national guidelines from the NFPA and the CFAI.
- Using an incident response time analysis program called StatsFD™ to review the statistics of prior historical performance.
- Using a geographic mapping response time measurement tool called FireView™ to measure fire unit driving coverages from the City's current fire stations.

SOC Study Questions

Our study addresses the following questions:

1. Is the type and quantity of apparatus and personnel adequate for the City's deployment to emergencies?
2. What is the deployment recommended to maintain adequate emergency response times as growth continues to occur?

1.3 City Overview

The City of Pearland is bordered by the City of Houston on the north, unincorporated areas of Fort Bend County to the west, and the City of Manvel and unincorporated areas of Brazoria and

Fort Bend Counties to the south. The City of Pearland is bordered by the City of Friendswood and unincorporated areas of Brazoria County to the east. Pearland is located within three counties: Harris County, Fort Bend County, and, predominantly, Brazoria County.

The City is served by State Highway (SH) 288 on the west, a major commuter route to Houston, and the Sam Houston Tollway (Beltway 8) on the northern boundary of the City. The major arterial highways through Pearland are Main Street (SH 35), which runs north and south, and Broadway (FM 518), which is an east-west major transportation and commuter highway.

The terrain of Pearland is relatively flat. Elevations in the City range from 31 to 65 feet above mean sea level, with minimally perceptible grade changes.

The City's Police Department is the primary Public Safety Answering Point (PSAP) for 9-1-1 calls within the City limits. For the Extra Territorial Jurisdictions (ETJs), the Brazoria County Sheriff's Office is the primary PSAP. Fire dispatch services are currently provided by Cypress Creek EMS, effective in December 2016. Prior to that date, the Harris County Emergency Corps was the dispatch center.

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SECTION 2—STANDARDS OF RESPONSE COVERAGE INTRODUCTION

2.1 STANDARDS OF COVERAGE STUDY PROCESSES

The core methodology used by Citygate in the scope of its deployment analysis work is outlined in the "Standards of Cover" (SOC) 5th Edition, which is a systems-based methodology to fire department deployment as published by the CFAI. The SOC is a systems-based approach assuring that local factors, such as local risk and demographics, help determine the level of protection best fitting the City's needs. Citygate has adopted this methodology as a comprehensive tool to evaluate fire station locations.

In the United States, there are no federal or state government requirements for a minimum level of fire services. Service levels are a local choice issue for each community to consider and fund as it deems necessary. The systems approach to deployment, rather than a one-size-fits-all prescriptive formula, allows for local determination. In this methodical approach, each agency can match local needs (risks and expectations) with the costs of various levels of service. In an informed public policy debate, a governing board "purchases" the fire and emergency medical service levels the community needs and can afford.

While working with multiple components to conduct a deployment analysis is admittedly more work, it yields a much better result than using only a singular component. For instance, if only travel time is considered, and frequency of multiple calls is not considered, the analysis could miss over-worked companies. If a risk assessment for deployment is not considered, and deployment is based only on travel time, a community could under-deploy to incidents.

The Standards of Response Coverage methodology process consists of the following eight parts:

Table 1—Standards of Response Coverage Methodology Elements

Element	Meaning
Existing Deployment Policies	Reviewing the deployment goals the agency has in place today.
Community Outcome Expectations	Reviewing the expectations of the community for response to emergencies.
Community Risk Assessment	Reviewing the assets at risk in the community. (In this Citygate study, see Section 3.2 Community Risk Assessment.)
Critical Task Study	Reviewing the tasks that must be performed and the personnel required to deliver the stated outcome expectation for the Effective Response Force.
Distribution Study	Reviewing the spacing of first-due resources (typically engines) to control routine emergencies.
Concentration Study	Reviewing the spacing of fire stations so that building fires can receive sufficient resources in a timely manner (First Alarm Assignment or the Effective Response Force).
Reliability and Historical Response Effectiveness Studies	Using prior response statistics to determine the percent of compliance the existing system delivers.
Overall Evaluation	Proposing Standard of Cover statements by risk type as necessary.

Fire department deployment, simply stated, is about the **speed** and **weight** of the attack. **Speed** calls for first-due, all-risk intervention units (engines, ladder trucks, and/or ambulances) strategically located across a department responding in an effective travel time. These units are tasked with controlling moderate emergencies, preventing the incident from escalating to a second alarm or greater size, which unnecessarily depletes department resources as multiple requests for service occur. **Weight** is about multiple-unit response for serious emergencies, such as a room-and-contents structure fire, a multiple-patient incident, a vehicle accident with extrication required, or a heavy rescue incident. In these situations, enough firefighters must be assembled within a reasonable time frame to safely control the emergency, thereby preventing it from escalating to greater alarms.

This deployment design paradigm is reiterated in the following table.

Table 2—Fire Department Deployment Simplified

	Meaning	Purpose
***Speed* of Attack**	Travel time of first-due, all-risk intervention units strategically located across a department.	Controlling moderate emergencies without the incident escalating to second alarm or greater size.
***Weight* of Attack**	Number of firefighters in a multiple-unit response for serious emergencies.	Assembling enough firefighters within a reasonable time frame to safely control the emergency.

Thus, small fires and medical emergencies require a single- or two-unit response (engine and specialty unit) with a quick response time. Larger incidents require more crews. In either case, if the crews arrive too late, or the total personnel sent to the emergency are too few for the emergency type, responders are drawn into a losing and more dangerous battle. The science of fire crew deployment is to spread crews out across a community for quick response to keep emergencies small with positive outcomes without spreading the crews so far apart that they cannot amass together quickly enough to be effective in major emergencies.

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SECTION 3—DEPLOYMENT GOALS/MEASURES AND RISK ASSESSMENT

3.1 WHY DOES THE CITY'S FIRE DEPARTMENT EXIST AND HOW DOES IT DELIVER THE EXISTING FIRE CREW DEPLOYMENT SERVICES?

3.1.1 Existing Response Time Policies or Goals—Why Does the Fire Department Exist?

SOC ELEMENT 1 OF 8*
EXISTING DEPLOYMENT POLICIES
**Note: This is an overview of Element 1. The detail is provided on page 45.*

The Pearland City Council has not adopted a formal policy for response times for the Department; however, the annual budget document has performance measures. Additionally, Pearland does not dispatch its fire and emergency medical services (EMS) units. Dispatch is currently provided through Cypress Creek EMS, and previously by the Harris County Emergency Corps Communications Center. The City of Pearland Police Department is the primary PSAP for all 9-1-1 calls in the City limits. The Fire Department, for many years, was a volunteer organization, with several fire stations located throughout the area. Emergency medical services were also provided by a separate organization. The City consolidated both departments in 2013 and continues to blend the two as a cohesive emergency services delivery organization.

The lack of specific response time goals, including definitions of the start and stop times by type of risk, is not congruent with best practices for emergency response time tracking. Nationally recognized standards for fire/EMS response times, and best practices, call for a timeline with several important time measurements.

Using the data from this, best practices, and our experience, Citygate will recommend response-time goals to include all risks, including fire, EMS, hazardous materials, and technical rescue responses. The goals will be consistent with nationally recognized best practices.

3.1.2 Existing Outcome Expectations

SOC ELEMENT 2 OF 8
COMMUNITY OUTCOME EXPECTATIONS

The Standards of Response Cover process begins by reviewing existing emergency services outcome expectations. This includes determining for what purpose the response system exists and whether the governing body has adopted any response performance measures. If so, the time measures used must be understood and good data must be collected.

Current national best practice is to measure percent completion of a goal (e.g., 90 percent of responses) instead of an average measure. Mathematically this is called a "fractile" measure.[1] This is because the measure of average only identifies the central or middle point of response time performance for all calls for service in the data set. Using an average makes it impossible to know how many incidents had response times that were way over the average, or just over. The Department's current budget performance measures appropriately use fractile measures.

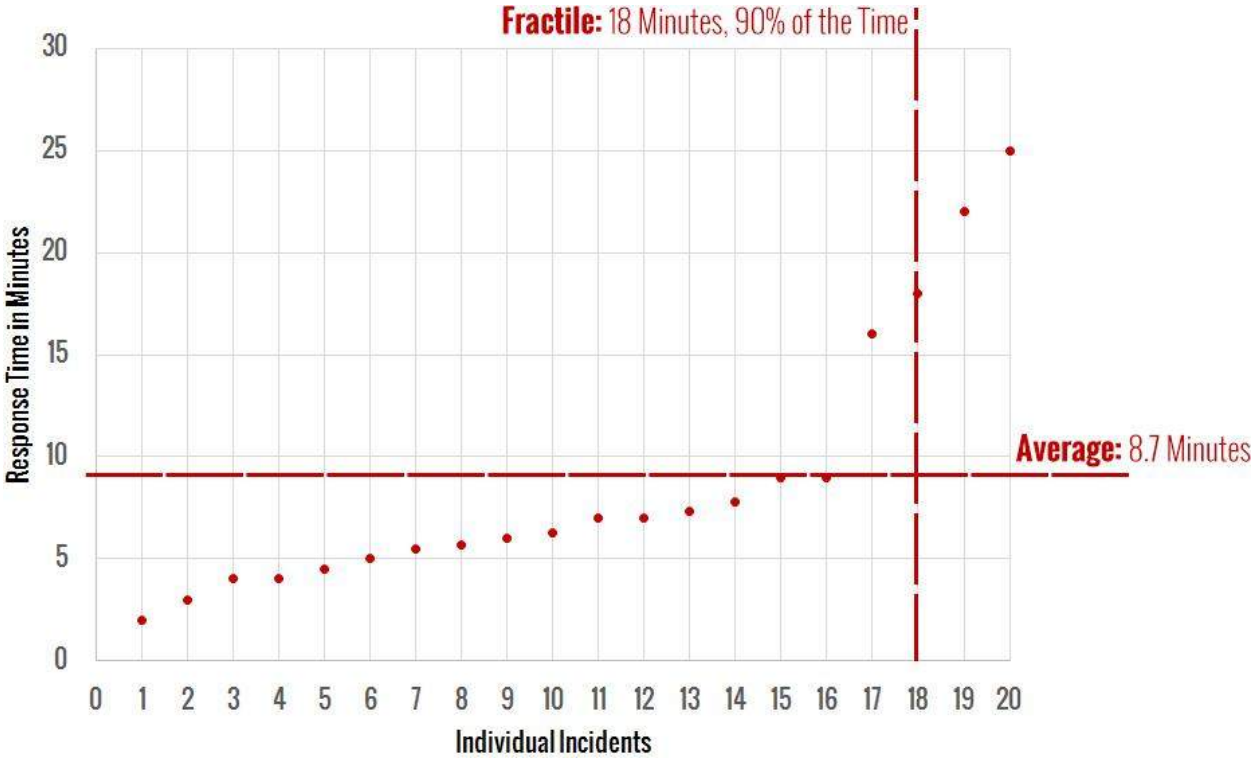
For example, Figure 1 shows response times for a fictitious city fire department in the United States. This city is small and receives 20 legitimate calls for service each month. Each response time for the calls for service has been plotted on the graph. The call response times have been plotted in order from shortest response time to longest response time.

The figure shows that the average response time is 8.7 minutes. However, the average response time fails to properly account for four calls for service with response times far exceeding a threshold in which positive outcomes could be expected. In fact, it is evident in Figure 1 that, in this fictitious U.S. city, 20 percent of responses are far too slow and this city has a potential life-threatening service delivery problem. Average response time as a measurement tool for fire departments is simply not sufficient. This is a significant issue in larger cities, if hundreds or thousands of calls are answered far beyond the average point.

By using the fractile measurement with 90 percent of responses in mind, this small city has a response time of 18:00 minutes, 90 percent of the time. This fractile measurement is far more accurate at reflecting the service delivery situation in this small city.

[1] A *fractile* is that point below which a stated fraction of the values lie. The fraction is often given in percent; the term percentile may then be used.

Figure 1—Fractile versus Average Response Time Measurements



More importantly, within the Standards of Response Coverage process, positive outcomes are the goal, and from that crew size and response time can be calculated to allow efficient fire station spacing (distribution and concentrations). Emergency medical incidents have situations with the most severe time constraints. The brain can only survive 6:00 to 8:00 minutes without oxygen. Heart attacks and other events can cause oxygen deprivation to the brain. Heart attacks make up a small percentage; drowning, choking, trauma constrictions, or other similar events have the same effect. In a building fire, a small incipient fire can grow to involve the entire room in a 6:00- to 8:00-minute timeframe. If fire service response is to achieve positive outcomes in severe emergency medical situations and incipient fire situations, ***all*** responding crews must arrive, assess the situation, and deploy effective measures before brain death occurs or the fire leaves the room of origin.

Thus, from the time of 9-1-1 receiving the call, an effective deployment system is ***beginning*** to manage the problem within a 7:00- to 8:00-minute total response time. This is right at the point that brain death is becoming irreversible and the fire has grown to the point of leaving the room of origin, becoming very serious. Thus, the City needs a first-due response goal that is within a range to give the situation hope for a positive outcome. It is important to note the fire or medical emergency continues to deteriorate from the time of inception, not the time the fire engine starts to drive the response route. Ideally, the emergency is noticed immediately and the 9-1-1 system

is activated promptly. This step of awareness—calling 9-1-1 and giving the dispatcher accurate information—takes, in the best of circumstances, 1:00 minute. Crew notification and travel time take additional minutes. Once arrived, the crew must walk to the patient or emergency, assess the situation, and deploy its skills and tools. Even in easy-to-access situations, this step can take 2:00 or more minutes. This time frame may be increased considerably due to long driveways, apartment buildings with limited access, multi-storied apartments or office complexes, or shopping center buildings, all of which are found in parts of the City.

Unfortunately, there are times that the emergency has become too severe, even before the 9-1-1 notification and/or fire department response, for the responding crew to reverse; however, when an appropriate response time policy is combined with a well-designed system, then only issues like bad weather, poor traffic conditions, or multiple emergencies will slow the response system down. Consequently, a properly designed system will give citizens the hope of a positive outcome for their tax dollar expenditure.

For this report, "total" response time is the sum of the alarm processing, dispatch, crew turnout, and road travel time steps. This is consistent with the recommendations of national best practices.

Finding #1:	The City Council has not adopted a complete and best-practices-based deployment measure, a set of specialty response measures for all-risk emergency responses that includes the beginning time measure from the point of the Pearland Police Department Public Safety Answering Point (PSAP) receiving the 9-1-1 phone call, nor a goal statement tied to risks and outcome expectations. The deployment measure should have a second measurement statement to define multiple-unit response coverage for serious emergencies.

3.2 COMMUNITY RISK ASSESSMENT

SOC ELEMENT 3 OF 8
COMMUNITY RISK ASSESSMENT

The third element of the SOC process is a community risk assessment. The broad objectives of a community risk assessment are to:

1. Identify specific hazards with potential to adversely impact the community or jurisdiction.
2. Quantify the risk for each hazard based on probability of occurrence and likely severity of resultant occurrence impacts.
3. Establish a foundation for current or future risk-reduction / hazard mitigation planning and evaluation.

Hazard is broadly defined as a situation or condition that can cause or contribute to harm. Hazard examples include fire, medical emergency, vehicle collision, earthquake, flood, etc. *Risk* is broadly defined as the *probability of hazard occurrence* in combination with the *likely severity of resultant impacts* to people, property, and the community.

3.2.1 Risk Assessment Methodology

The methodology employed by Citygate to assess community risks as an integral element of an SOC study incorporates the following components:

1. Identification of geographic risk assessment sub-zones (risk zones) as appropriate or desired for the community or jurisdiction.
2. Identification of the fire and non-fire hazards (risks) to be evaluated.
3. Identification and evaluation of relevant risk factors for each hazard by risk zone.
4. Determination of the *probability of an occurrence*. Probability includes the hazards at a location that could create an incident, and the likelihood that those hazards can or will create an incident. Probability is required to categorize risk and determine workload required to control and mitigate the hazard.
5. Determination of the *severity of that occurrence*. Severity is the magnitude of loss, such as life loss and economic loss (e.g., taxes and employment, property value).

Citygate used multiple data sources for this study to understand the risks to be protected in the City of Pearland, as follows:

- U.S. Census Bureau population data and demographics

- Insurance Services Office (ISO) building fire flow and construction data
- Pearland City Geographical Information Systems (GIS) data
- 2015 Pearland Comprehensive Plan and zoning information
- 2012 Pearland Local Hazard Mitigation Plan.

3.2.2 Community Demographics

Table 3 summarizes key demographic data for the City of Pearland.

Table 3—Pearland Demographics

Demographic	2010	2015
Population	**92,252**	**101,725**
Under 5 years	8,287	8,443
5-19 years	20,546	21,362
20-64 years	55,382	56,152
Over 65 years	7,037	9,086
Median age	34.1	34.8
Housing Units		
Owner-Occupied	79.6%	78.4%
Renter-Occupied	20.4%	21.6%
Employment		
Employment	N/A	53,014
Ethnicity		
White	56,553	63,328
Hispanic/Latino	18,694	21,827
Black/African American	14,462	18,150
Asian	11,302	14,914
Education (age 25 and over)		
High School Graduate	N/A	11,467
Undergraduate Degree	N/A	24,032
Graduate Degree	N/A	11,546

Source: U.S. Census Bureau

3.2.3 Community Growth and Development

Overview[2]

The Comprehensive Plan is the fundamental policy document of the City of Pearland. It provides the framework for management and utilization of the City's physical, economic, and human resources. By providing a basis for rational decision-making, the Comprehensive Plan (Plan) guides civic decisions regarding land use, the design and/or character of buildings and open spaces, the conservation of existing housing and the provision of new dwelling units, the provision of supporting infrastructure and public services, the protection of environmental resources, the allocation of fiscal resources, and the protection of residents- from natural and human-caused hazards.

The Plan acts to clarify and articulate the City's intentions, with respect to the rights and expectations of the public, property owners, and prospective investors and business interests. Through the Plan, the City informs these groups of the community's goals, objectives, and policies, thereby communicating the expectations and responsibilities of all sectors in fulfilling the Comprehensive Plan. In addition to the written goals, objectives, and policies, the Plan contains a Land Use Plan that is the prevailing determinant of land use in the City. The Zoning Maps and development standards are secondary to the Comprehensive Plan.

Land use within the City, excluding roads and other rights of way, is approximately 62 percent residential, 5.3 percent airport/light/heavy industrial, 6.2 percent retail commercial, 4 percent public/quasi-public/institutional, and 6.5 percent parks / open space / vacant / other uses.

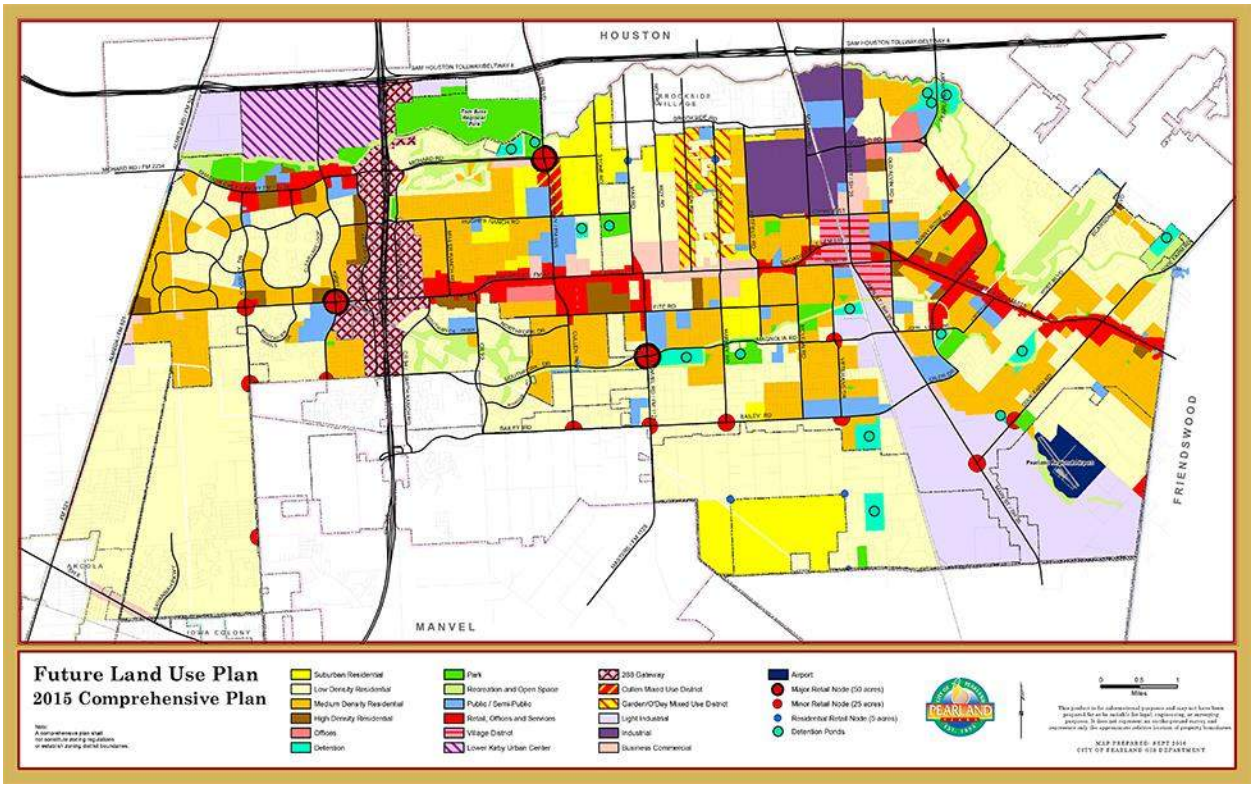
The Plan envisions the preservation of valued resources and maintaining the current quality of life while pursuing new economic and development opportunities. Its strategic vision includes:

- To provide a balance of land uses and services throughout the community to meet the needs and desires of the City's population.
- To ensure adequate public facilities to meet the demands of future development, and redevelopment.
- To achieve and maintain a development pattern that reflects the values of the community, and which ensures a balanced tax base between residential, and nonresidential development.
- To ensure the long-term protection and enhancement of the image, and visual appearance of the community.

[2] 2015 City of Pearland Comprehensive Plan

- To involve local citizens in the decision-making process, and reach consensus on the future vision for Pearland, and its ongoing development.
- To guide annual work programs, and prioritize improvements consistent with the comprehensive plan.
- To enhance the quality of life of residents.

Figure 2—City of Pearland Zoning Plan Map



Source: 2015 City of Pearland Comprehensive Plan

Projected Growth

Table 4 summarizes the population growth projection for the City.

Table 4—Projected Growth[3]

Growth Factor	2014	2030	Projected Growth (Percentage)
Population	106,500	190,000	**56%**

Future Development[3]

Pearland's existing boundaries are coterminous with the boundaries of the cities of Houston, Friendswood, and Manvel, and unincorporated areas Fort Bend, Harris, and Brazoria Counties. Pearland has Extra Territorial Jurisdictions (ETJs) outside and within the limits of its existing boundaries, and opportunity for expansion/growth of its area.

3.2.4 Hazard Identification

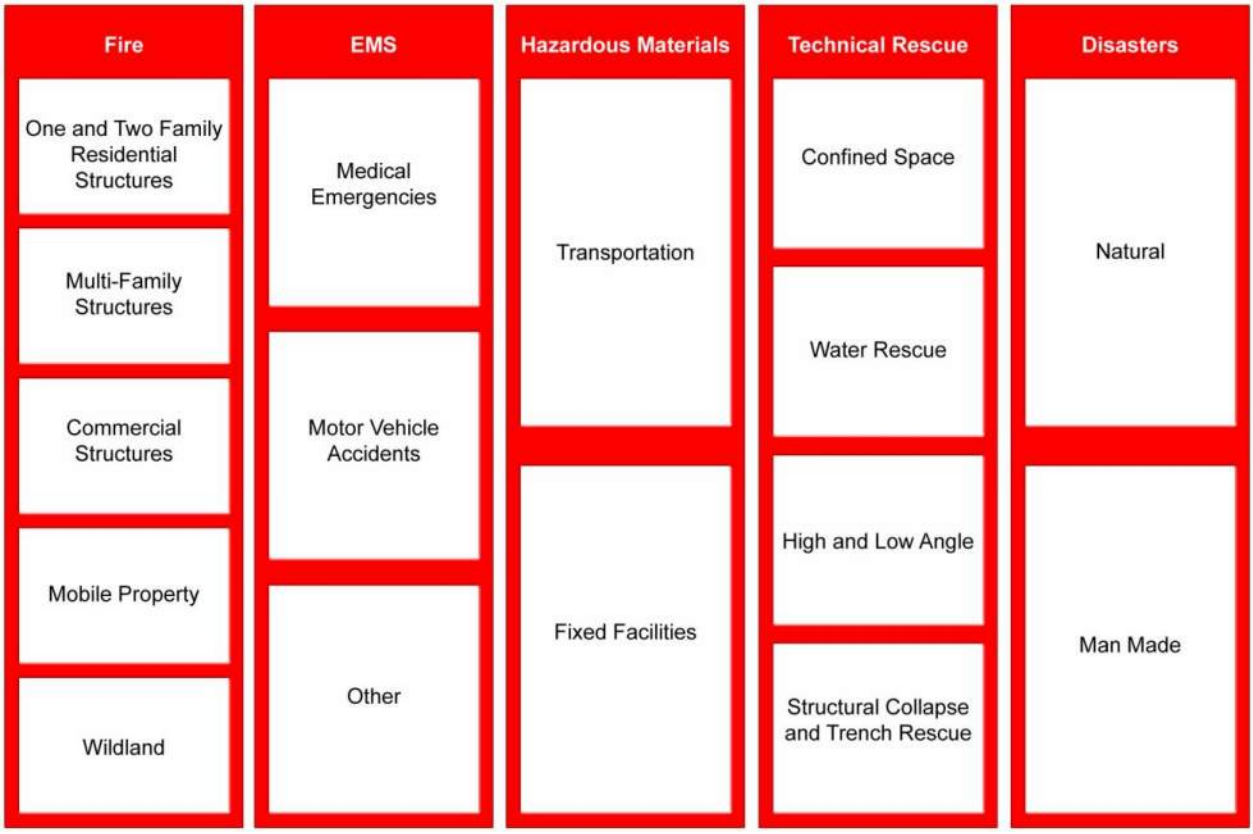
Citygate utilizes fire and non-fire hazards (risks), as identified by the agency/jurisdiction-specific data and information, to identify the risks evaluated for this study.

The primary risks identified in the 2012 Pearland Local Hazard Mitigation Plan (LHMP), as they relate to services provided by the Fire Department, include natural hazards such as thunderstorms, hurricanes, winter storms, earthquake/seismic-related hazards, disruption of critical lifeline infrastructure systems, and flooding.

Figure 3 illustrates the fire and non-fire risks used by Citygate in our risk analyses. Identification and quantification of the various fire and non-fire risks are important factors in evaluating how fire department resources are, or can be, deployed to mitigate those community risks.

[3] 2015 City of Pearland Comprehensive Plan

Figure 3—Risk Types



Source: Commission on Fire Accreditation International

3.2.5 Probability of Occurrence[4]

Probability of occurrence refers to the likelihood of an incident occurring at the location of a risk, and at what frequency. In essence, this is a determination of the hazards at the location (there could be more than one) and the likelihood that the hazard(s) can or will create an incident. Without determining probability, the risks cannot be categorized to help determine workload and effective response forces for mitigation.

In evaluating probability of occurrence, there are five factors to consider:

- Define the hazard(s).
- Assess the likelihood the hazard can/will create an incident.

[4] CFAI 5th Edition Standards of Cover

- Define mitigating factors.
  - *Positive factors* include fire suppression/detection systems present, building construction, and demography of the occupants.
  - *Negative factors* include poor building or system maintenance or worker or resident training to respond to that emergency.
- Know and understand the infrastructure that may influence responses.
- Remote area risks may exist and an expectation of service delivery may drive the responses depending on the severity of those risks.

3.2.6 Severity

Severity refers to the magnitude, or reasonably expected loss that will be experienced by the response area, community, and the citizens should an incident occur. The magnitude of the loss is relative to risk, the relevance of the affected area, and what level of response will be required. There are six factors that help determine the severity:

- Severity determination can be a relative consideration to the significance of loss based on the worst-case potential of an incident to occur.
- In many cases, the evaluation is a matter of establishing relative and available loss data such as employment loss, property tax revenue loss, and historical values to the community.
- A comparative analysis to other similar risk groups and levels of loss to the community.
- Mitigating factors can modify the severity:
  - *Positive factors* include fire protection and detection systems present or good evacuation training of occupants.
  - *Negative factors* include unaccounted for hazardous materials on site, or incorrect or poor building construction.
- Infrastructure impacts that may affect the control and termination of the incident such as road networks and topography.
- Agency impacts should be considered. Agency impacts can be limited resources and personnel, demand on the current response system, and the ability for the agency to handle simultaneous calls for service. Does the agency have the correct response teams and personnel to mitigate the incident, or is mutual/automatic aid

required? Does the agency have the funding to prepare for the incident response with training, equipment, and staffing?

3.2.7 Risk Factors

Elements to be evaluated in a community risk assessment include factors that influence the potential outcome severity of a hazard occurrence. Outcome severity refers to the potential negative impacts a hazard occurrence may have on a community relative to people, property, the environment, economic stability, and overall community resilience. It is important to note that while some risk factors contribute to more severe outcome impacts, other risk factors, such as response capacity and effective mitigation measures, can also contribute to *reducing* the potential severity of outcome impacts.

In conducting a community risk assessment, Citygate examines prior risk studies, community demographics including, current and projected population, land use, future development potential, employment, and building occupancy data as available, as well as, prior risk-specific service demand data and service capacity. Additionally, Citygate extensively tours the City to assure accuracy in the assessment.

3.2.8 Risk Zones

To develop a comprehensive risk assessment for the Pearland Fire Department, the CFAI suggests the jurisdiction be broken down into geographical zones for the analysis of the risk. Citygate used 11 zones, corresponding with the fire response districts.

3.2.9 Probability and Severity Risk Matrix

Probability and severity determine the magnitude of the risk.

Table 5—Risk Category Matrix

	Low Severity	High Severity
High Probability of Occurrence	**Moderate Risk** (***High*** Probability) (***Low*** *Severity*)	**Maximum Risk** (***High*** Probability) (***High*** *Severity*)
Low Probability of Occurrence	**Low/Isolated Risk** (***Low*** Probability) (***Low*** *Severity*)	**High/Special Risk** (***Low*** Probability) (***High*** *Severity*)

Source: CFAI *Standards of Cover* (5th Edition)

3.2.10 Building Fire Risk

One of the primary hazards in any community is a building fire. Citygate used available data from the City of Pearland, the U.S. Census Bureau, and the Insurance Services Office (ISO) to assist in identifying the City's building fire risk. Resource deployment (distribution/concentration), staffing, and response time are three critical factors influencing severity for building fire risk.

Type of Building Occupancy – Risk Categories Defined

Occupancy risk categories, based on potential severity, are here listed:

Low Risk Occupancies – includes detached garages, storage sheds, outbuildings, and similar buildings that pose a relatively low risk of harm to humans or the community if damaged or destroyed by fire.

Moderate Risk Occupancies – includes detached single-family or two-family dwellings, mobile homes, commercial and industrial buildings less than 10,000 square feet without a high hazard fire load, aircraft, railroad facilities, and similar buildings where loss of life or property damage is limited to the single building.

High Risk Occupancies – includes apartment/condominium buildings, commercial and industrial buildings more than 10,000 square feet without a high hazard fire load, low-occupant

load buildings with high fuel loading or hazardous materials, and similar occupancies with potential for substantial loss of life or unusual property damage or financial impact.

Special Risk Occupancies – includes single or multiple buildings that require an Effective Response Force (ERF) greater than what is appropriate for the risk which predominates the surrounding area such as apartment/condominium complexes more than 25,000 square feet, Critical Infrastructure/Key Resource (CIKR) facilities, commercial/industrial occupancies with fire flows greater than 3,500 gallons per minute (GPM), vacant/abandoned buildings, buildings with required fire flow exceeding available water supply, and similar occupancies with high-life hazard or large fire loss potential.

Maximum Risk Occupancies – includes buildings or facilities with unusually high risk requiring an ERF involving a significant augmentation of resources and personnel, and where a fire would pose the potential for a catastrophic event involving large loss of life and/or significant economic impact to the community.

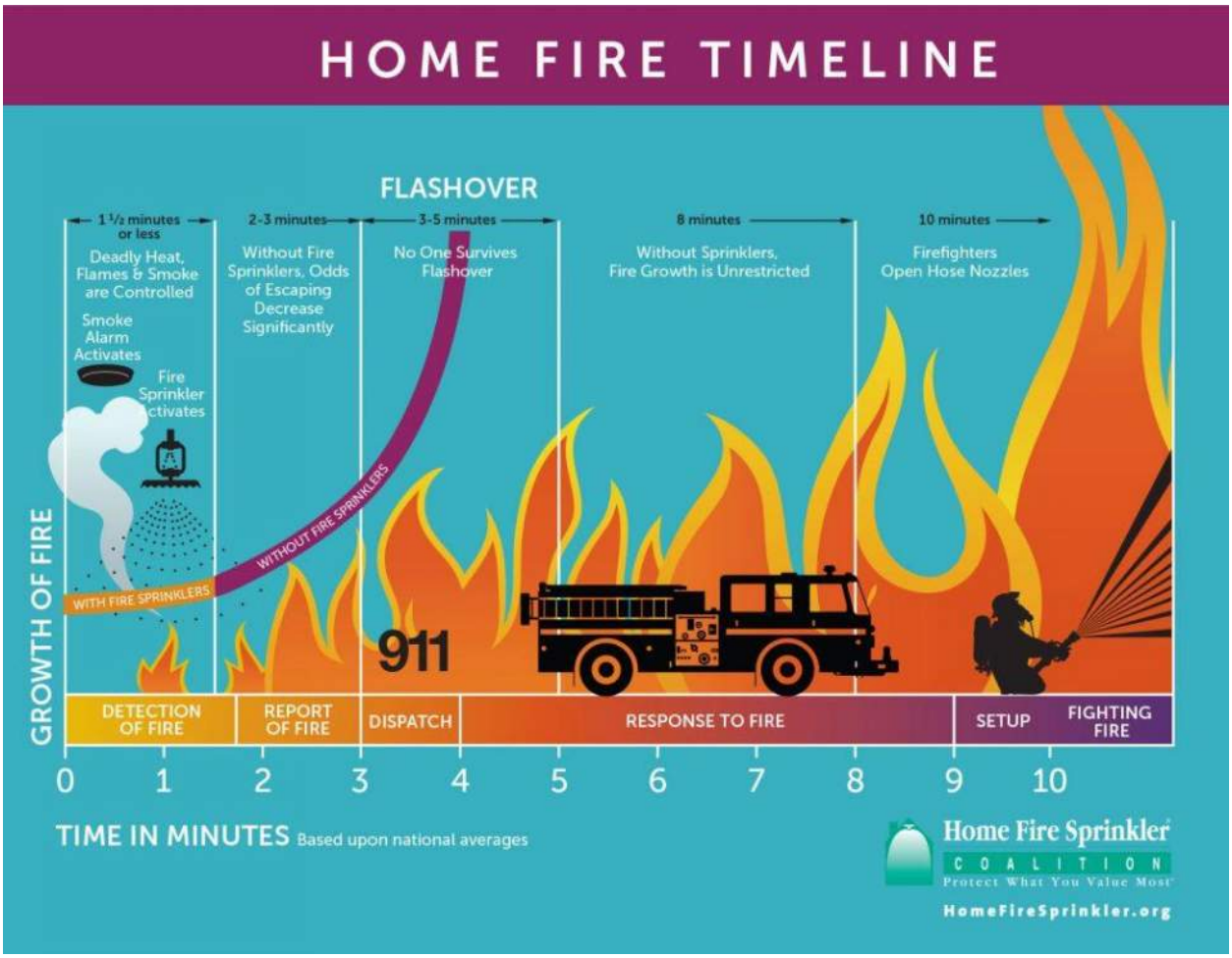
Building Fire Risk Factors

Building fire risk determination is made using several factors including type of construction; occupancy classification (who and what is in the building); how the building is constructed; and fire and life safety features installed such as automatic fire sprinklers, fire detection alarms, emergency exit lightening, and enclosed exit corridors.

Figure 4 illustrates the fire progression timeline for a building fire and the way automatic fire sprinklers impact fire progression and spread. The graphic also shows that a total response time[5] of 7:30 minutes or less is necessary to stop a building fire before it reaches flashover, which is the point at which the entire room erupts into fire after all the combustible objects in that room reach their ignition temperature. Human survival in a room after flashover is extremely unlikely.

[5] Time interval from time of receipt of 9-1-1 call to initiation of suppression actions

Figure 4—Building Fire Progression Timeline



Source: http://www.homefiresprinkler.org

Pearland has benefited from newer building and fire codes requiring fire sprinklers in commercial buildings. However, Texas is one of the few states in the nation preventing local agencies from also requiring fire sprinklers in new home construction. Given this, and that Pearland's oldest commercial buildings do not have fire sprinklers, the City will always have to maintain an effective multiple-unit response force in all neighborhoods for the suppression of non-sprinklered building fires.

High Risk Building Inventory

An evaluation of Pearland's building inventory reveals high-risk building uses as they relate to the CFAI building fire risk categories as shown in Table 6 and Table 7. The predominant risk category, based on the number of occupancies, is **Moderate.**

Table 6—Occupancy Use Classification and Risk Category

Building Occupancy Classification[2]	Number[3]	Risk Category[1]
Assembly	521	***High***
Educational	138	***High***
HealthCare, Detention, and Correction Facilities	278	***Special***
Industrial, Utility, Defense, Agriculture, Mining	56	***Special***
Institutional (I-1.1, 1.2, 3, 4)	278	***Special***
Mercantile, Business	2,428	***Moderate***
Residential: Multi Family, Hotels/Motels	1,687	***Moderate***
Residential Board and Care Facilities	12	***High***
Storage and Utility	185	***Moderate***
Total	**5,595**	

[1] CFAI *Standards of Cover* (5th Edition)

[2] NFIRS Property Use Code Definitions; no Single Family Residential property numbers were available.

[3] Data Source: City of Pearland Fire Department Community Risk Reduction (CRR) Division Occupancy Records; City & ETJ combined

High-Rise Buildings

High-rise buildings present unique fire risks, particularly as they relate to the number of potential building occupants, the time required to evacuate those occupants in the event of an emergency, and the time required to get firefighters and fire suppression equipment to the floor(s) involved in fire. A high-rise building is defined by the International Building Code as any building having floors, used for human occupancy, more than 75 feet above the lowest floor having building access, except hospitals.

However, even a "mid-rise" building of between 30 and 75 feet is a high-hazard risk for life safety as both firefighting and occupant evacuations are much more difficult for every floor above the third. Another way to understand the risks to firefighters and occupants from a mid-rise building is to consider it as a very large warehouse building on its side. Both types of buildings are so large that the distance to an exit, and thus fresh air, is equally large. Both types of large buildings are hazardous to firefighters and thus both have stringent fire suppression and occupant evacuation systems.

Pearland has no high-rise buildings. However, four buildings in Pearland exceed four stories in height, which exceeds the reach of the Department's aerial ladder trucks.

Critical Facilities

The City of Pearland has identified 145 critical facilities[6] within the City limits. Additionally, there are 100 sewer lift stations and pump stations providing essential public or community services. There are 29 schools that could be used for sheltering residents, if needed. A fire or other disaster occurrence with significant severity, in one or more of these facilities, would adversely impact essential public or community services.

Table 7—Critical Facilities and Schools by Risk Zone

Risk Zone[1]	Critical Facilities	Schools
1	89	3
2	10	1
3	11	4
4	17	3
5	8	3
6	1	2
7	4	2
8	2	3
9	3	3
10	0	3
11	0	2
Total	**145**	**29**

[1] Risk zones are defined as the current fire response districts.

Water Supply[7]

The City's water customers enjoy an abundant water supply from three sources. The City draws water from 10 City-owned wells, which tap the Chicot and Evangeline aquifers. The City's second source is water purchased from the City of Houston, which Pearland receives from two surface water connections. The third source is raw water from the Gulf Coast Water Authority's American and Briscoe Canal System.

Ground Water

The 10 City-owned wells have a combined pumping capacity of 13,360 gallons per minute.

[6] Critical Facilities as defined in the 2012 Pearland LHMP
[7] 2015 City of Pearland Comprehensive Plan

Surface Water

The current surface water contract with the Alice Water Plant is a pay-as-you-go contract for up to 10 million gallons per day. The current surface water contract for the Shadow Creek Water Plant is a take-or-pay contract of 40 million gallons per month (1,333,333 gallons per day) with a maximum day capacity of 6 million gallons per day.

Raw Water

The City recently entered into a long-term raw water supply contract with the Gulf Coast Water Authority (GCWA) to purchase up to 10 million gallons per day (MGD). This contract arrangement is coupled with the City's purchase of the former Chocolate Bayou Water Company through the GCWA for an additional 10 MGD.

The Pearland Water Department supplies approximately 33 MGD to 37,000 water meters. Typically, three-fourths of the City's water is supplied by groundwater wells, while one-fourth is from imported sources; however, at present, the City is receiving 80 percent of its water from groundwater wells. There are approximately 5,800 City-owned fire hydrants.

- Combined, the City's water treatment facilities provide roughly three billion gallons of clean drinking water every year.
- The City provides continuous production of water to residential and commercial customers with no current wholesale customers for City water.
- The total available Citywide storage capacity is 19.1 million gallons. This combines the 14.6 million gallons in ground storage, and the 4.5 million gallons of available elevated storage.

High Fire Flow Requirements

One of the factors evaluated by the Insurance Services Office (ISO) is "Needed Fire Flow" (NFF), which is the amount of water that would be required, in gallons per minute (GPM), if a building were seriously involved in fire. For Pearland, the ISO databases identifies 1,237 buildings evaluated, of which 234 have a NFF of 1,500-3,000 GPM, 73 have a NFF of 3,000-5,000 GPM, and 18 buildings have a NFF of 5,000 GPM or more.

This is a significant amount of firefighting water to deploy, and a major fire at any one of these buildings would require a significant commitment of the Department's on-duty force. Using a generally accepted figure of 50 GPM per firefighter on large building fires, a fire in a building requiring 2,000 GPM would require 40 firefighters. A significant fire in any of these buildings would likely have high severity.

Building Fire Service Capacity

Pearland's service capacity for building fire risk consists of a minimum, daily on-duty response force of 32 personnel staffing three engines, two 75' ladder (quint) trucks, five medic ambulances, one Fire Captain—EMS, and one Battalion Chief from five fire stations. In addition, the Department has mutual aid agreements with adjacent fire agencies within a 15:00-minute travel time.

Building Fire Service Demand

Over the past three years, there were 191 building fire responses in the City. The Effective Response Force to emerging serious fire has been defined as two engines, one ladder, and one EMS apparatus. During the three years of this study, there were 113 incidents that had this deployment on the scene. Of those incidents, 55 were in-City building fires. Table 8 summarizes building fire risk service demand for the City of Pearland.

Table 8—Building Fire Risk Service Demand by Year

RY 13/14*	RY 14/15	RY 15/16	Total
76	60	55	**191**

* RY = Report Year (August 1 to July 31 of following year)

Probability of Occurrence

Based on evaluation of the building fire risk, utilizing data such as building age, construction type, roofing material, available fire detection and suppression devices, occupancy type/use, occupant load and occupant mental capacity, the likelihood that the identified hazard(s) can or will create an incident, that the City has robust building and fire codes, an occupancy fire inspection program based on risk, and a high historical building fire service demand, the City of Pearland's probability of a serious building fire occurring over the next 12 months has been determined to be ***High***.

Severity

Severity refers to the impact, magnitude, or reasonably expected loss that will be experienced by the response area, community, or the citizens should an incident occur. The magnitude of the loss is relative to risk, the relevance of the affected area, and what level of response will be required. Therefore, the impact to the community for a structure fire has been determined to be ***Low***.

Risk Category Determination

Based on the probability and the severity determined for structure fires, the overall risk determination is ***MODERATE***.

3.2.11 Emergency Medical Services Risk

EMS Risk Factors

Emergency medical services (EMS) risk in most communities is predominantly attributed to population density and demography, violence, and vehicle traffic. Relative to population demography, EMS risk tends to be higher among poorer, older, less educated, and uninsured populations. As would be expected, EMS risk is higher in those areas of a community with high daily vehicle traffic volume, particularly those travelling at higher speeds. The two heavily travelled vehicle routes in the City are Highway 288, which transects all or parts of the City from North to South, and Broadway Road, which transects the City East to West. Additionally, there are several major three-lane roadways, leading to the City of Houston, and to the recreational areas, with heavy traffic all year.

The City has 12 Residential Care Facilities. These facilities typically increase EMS call volume due to the health issues that senior citizens experience.

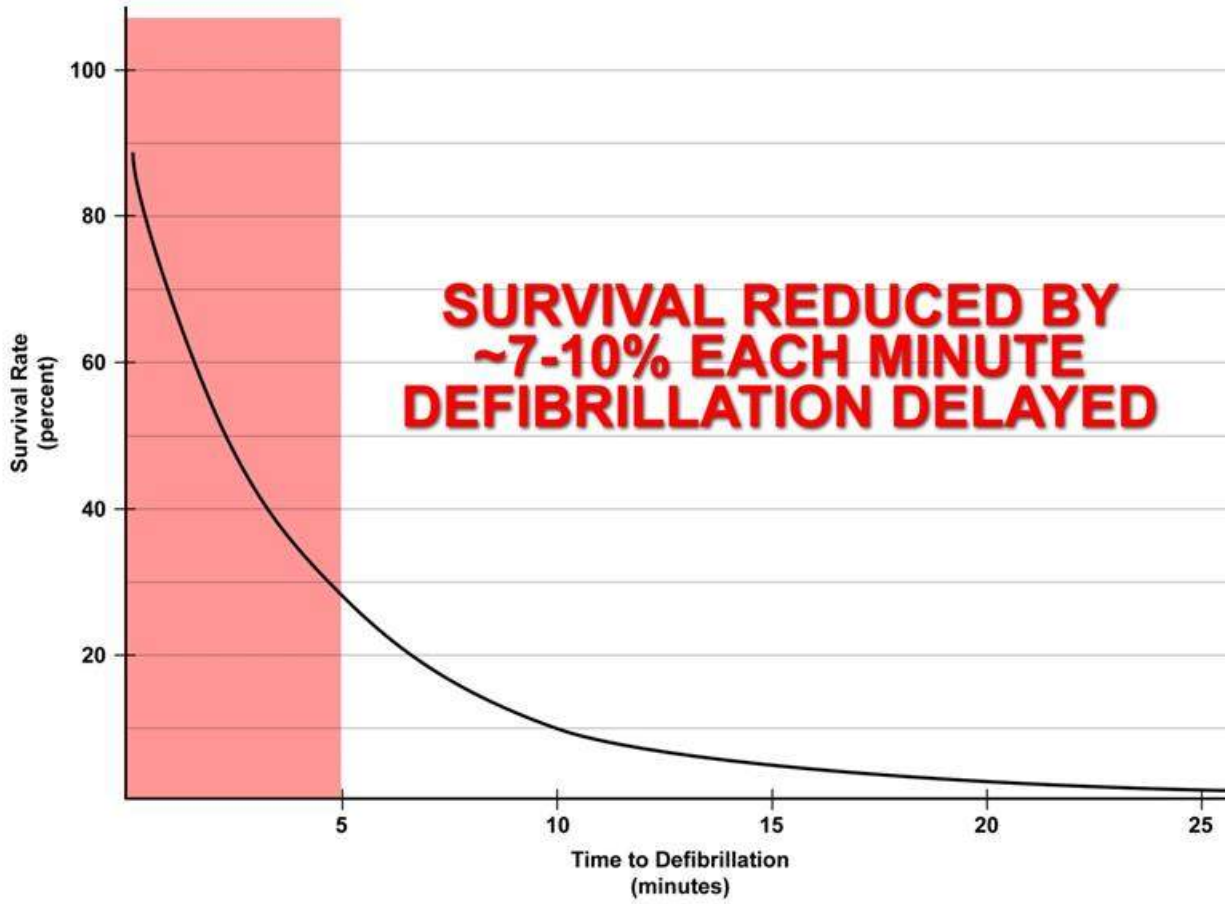
Table 9—Number of Residential Care Facilities by Risk Zone

Risk Zone	Number of Residential Care Facilities
1	0
2	1
3	2
4	1
5	5
6	0
7	1
8	1
9	1
10	0
11	0
Total	**12**

EMS risk can also be categorized as either a medical emergency resulting from a health-related condition or event, or a traumatic injury. One example of a serious medical emergency is cardiac arrest or some other emergency where there is an interruption or blockage of oxygen to the brain.

Figure 5 illustrates the reduced survivability of a cardiac arrest victim, as time to defibrillation increases. While early defibrillation is one factor in cardiac arrest survivability, other factors can influence survivability as well, such as early CPR, and pre-hospital advanced life support (ALS) interventions (Paramedic services).

Figure 5—Survival Rate vs. Time of Defibrillation



Source: www.suddencardiacarrest.com

According to the 2015 U.S. Census, 8.9 percent of Pearland's population is 65 and older. There is 4.5 percent of the population at or below poverty level.[8]

EMS Service Capacity

Pearland's EMS service capacity consists of a minimum, daily on-duty response force of 32 personnel staffing three engines, two quint trucks, five paramedic transport units, one Fire Captain—EMS, and one Battalion Chief from five fire stations. All calls for medical assistance

[8] U.S. Census Bureau (2015)

are triaged in the dispatch center and receive the appropriate closest Fire Department unit based on Automatic Vehicle Location (AVL) and the seriousness of the incident. If a paramedic transport unit is within an 8:00-minute response time, only that unit is sent; if the incident is deemed more serious, then a Fire Department apparatus is also sent. All Department response personnel are trained to either the Emergency Medical Technician (EMT) level, capable of providing Basic Life Support (BLS) pre-hospital emergency medical care, or Paramedic level, capable of providing ALS pre-hospital emergency medical services.

The American Heart Association (AHA) recommends a minimum of two emergency medical technicians and two certified paramedics to adequately operate at an emergency cardiac arrest incident. A 2010 EMS study conducted by the National Institute of Standards and Technology (NIST) clearly demonstrates a crew of four first responders on-scene, including two paramedics, is the most expedient and efficient means of delivering advanced emergency medical services care.

There are three hospitals with emergency room facilities within 10 miles of central Pearland. These are Pearland Medical Center, Memorial Hermann-Pearland, and Memorial Hermann-Southeast.

EMS Service Demand

Table 10 shows EMS service demand for the City of Pearland over the previous three years, which is 60.55 percent of total service demand over the same period.

Table 10—EMS Service Demand by Year

RY 13/14	RY 14/15	RY 15/16	Total
3,537*	6,015	6,118	**15,670**

* Does not include five months of ambulance incidents before EMS was merged into the Fire Department.

Overall, the City of Pearland has EMS service demand typical of other suburban communities.

Probability of Occurrence

Based on evaluation of the EMS risk factors, including community demographics, high vehicle traffic volume, and historic high EMS service demand, the City of Pearland's probability of a serious EMS event occurring over the next 12 months has been determined to be ***High***.

Severity

Severity refers to the impact, magnitude, or reasonably expected loss that will be experienced by the response area, community, and the citizens should an incident occur. The magnitude of the

loss is relative to risk, the relevance of the affected area, and what level of response will be required. The impact for an EMS risk has been determined to be ***Low***.

EMS Risk Determination

The overall risk determination for EMS based on probability and severity has been determined to be ***MODERATE***.

3.2.12 Hazardous Materials Risk

Hazardous Materials Risk Factors

Hazardous materials are chemical substances that, if released or misused, can pose a threat to health or the environment. Hazardous materials incidents are most often caused by transportation accidents or industrial chemical accidents. A natural disaster, such as flooding, might also result in spills and pipeline ruptures.

Hazardous materials come in many forms, such as explosives, flammable and combustible substances, poisons, and radioactive materials. Since their chemical properties vary significantly, an incident could be obvious (e.g., airborne plume, spill on the ground, bad smell) or not readily apparent (e.g., beneath the surface of the ground, no odor or color).

Hazardous material incidents are one of the most common technological threats to public health and the environment. The Texas Commission on Environmental Quality (TCEQ) is the State's lead agency in the response to most hazardous substance spills and spills of other substances that cause pollution or damage to the environment.

An analysis of TCEQ data indicates that the number of incidents reported is declining, probably because manufacturers, users, and transporters of hazardous materials are becoming more aware of the financial and political costs of hazardous materials incidents. Roughly 65 percent of all incidents occur at fixed facilities, and some 25 percent involve highway, rail, water, or pipeline transportation. The remaining 10 percent involve other situations or undetermined causes.

The City has a large number of underground pipelines transecting the City, as well as local lines for oil and natural gas production. The pipelines are under pressure and include diameters of the ranging from 2" to 36." The pipelines carry a variety of types of liquids, including crude oil, natural gas, liquefied natural gas, propane, and high volatility liquids (HVL), such as propylene. There is a concentration of pipelines in the Southeast corner of the City, and on the northern portion of the City running east to west.

In Pearland, the Fire Department coordinates planning and response for hazardous materials incidents with the Brazoria County Local Emergency Planning Council (LEPC), Houston Fire Department, and Harris County Fire Marshal's Office Hazardous Materials Response Team.

Transportation of hazardous materials through Pearland poses a daily threat, given that the Burlington Northern/Santa Fe Railroad, Union Pacific, State Highway 288, and State Highway 35 run through the City. All are major transportation routes of hazardous materials.

Hazardous Materials Service Capacity

The Department does not have a Hazardous Material Response Team. Those services are primarily provided by the Harris County Fire Marshal's Office Hazardous Materials Response Team. The City of Houston Fire Department Hazardous Materials Response Team is also a provider of this service when required. All Department response personnel are trained to the Hazardous Material First Responder operational level to provide initial hazardous material incident assessment, hazard isolation, and support for the Hazardous Material Response Team. This service capacity is appropriate to minimize severity for Pearland's current and anticipated hazardous material risk.

The following hazardous material service demand table summarizes hazardous material service demand for Pearland over the previous three years, which is 0.7 percent of total service demand over the same period.

Table 11—Hazardous Material Risk Service Demand

RY 13/14	RY 14/15	RY 15/16	Total
3	3	2	**8**

Probability of Occurrence

The City has 56 facilities that store, use, or produce hazardous materials; underground pipelines carrying hazardous materials; 12 miles of rail line; and rail and vehicle transportation of hazardous materials. Large, at-risk populations exist throughout the community. Thus, based on these factors, Citygate concludes that the City of Pearland's probability of a serious hazardous materials event occurring over the next 12 months is ***High***.

Severity

Severity refers to the impact, magnitude, or reasonably expected loss that will be experienced by the response area, community, or the citizens should an incident occur. Based on the potential impacts to the community, life, property, and the environment, the overall impact from a hazardous materials incident is deemed ***High***.

Risk Determination

Based on the probability and the severity determined for hazardous materials risk, the overall risk determination is deemed ***HIGH***.

3.2.13 Technical Rescue Risk

Technical Rescue Risk Factors

Technical rescue risk factors include active construction projects, structural collapse, confined spaces such as tanks and underground vaults, bodies of water and rivers or streams, machinery, transportation accidents, and storm water runoff flood potential.

Technical Rescue Risk Service Capacity

Pearland has access to a Type-1 Urban Search and Rescue (USAR) company capable of conducting low-angle and high-angle rope rescue, structural collapse, confined space, and trench rescue operations. This resource responds from the City of Houston Fire Department or the Fort Bend County Technical Rescue Team. On-duty staffing for Pearland is at the operational level for all firefighters. This service capacity is appropriate to mitigate Pearland's current and anticipated near-future technical rescue risk.

Technical Rescue Service Demand

Over the most recent three-year period evaluated for this study, there were six technical rescue incidents in Pearland. These consisted of a confined space rescue, a below-grade rescue, and entrapments requiring extrication.

Table 12—Technical Rescue Service Demand by Year

RY 13/14	RY 14/15	RY 15/16	Total
3	3	0	**6**

Probability of Occurrence

Based on our evaluation of the technical rescue risk factors, including the number of active construction projects, number of confined spaces, bodies of water, serious transportation collision potential, and flood potential, Citygate concludes that the City of Pearland's probability of a significant technical rescue event occurring over the next 12 months is ***High***.

Severity

Severity refers to the impact, magnitude, or reasonably expected loss that will be experienced by the response area, community, or the citizens should an incident occur. Based on the potential impacts to the community, life, and property, the overall impact from a technical rescue incident is deemed ***Low***.

Overall Risk Determination

Based on the probability and the severity determined for technical rescue risk, the overall risk determination is deemed ***MODERATE***.

3.2.14 Transportation Risk

Transportation Risk Factors

Transportation risk factors include motor vehicle, railway, pipelines containing hazardous materials, and aircraft traffic in and through Pearland.

Vehicle Transportation Routes

Several highways transect all or parts of Pearland:

- State Highway 288 – north-south
- Broadway (FM 518) – east-west
- Main Street (State Highway 35) – north-south.

Rail Services

Rail service in Pearland consists of approximately 12 miles of track owned by Burlington Northern Santa Fe Railroad traversing from north to south in the Eastern portion of the City. On the Western City boundary, approximately six miles of track owned by Union Pacific Railroad also transports hazardous materials through the City.

Pipelines

In Pearland, numerous pipelines (above and below grade) cross the City, transporting crude oil, natural gas, and various other petrochemical products. The heaviest concentration is in the southeastern part of the City, especially near Dixie Farm Road. This area is predominantly outside of the 100-year Federal Emergency Management Agency (FEMA) floodplain. Pipelines and the potential environmental impacts of a break, leak, or explosion are a real concern to City officials and residents of Pearland. Although there have been no pipeline incidents in Pearland for nearly 30 years, there is still a significant potential. Since the entire City is only 46.5 square miles in size, it is estimated that all people and property within the City have the same degree of risk from pipelines. In the Extra Territorial Jurisdictions (ETJs) in the southeast corner of the City, there are a considerable number of oil wells and pipelines supporting oil fields.

Transportation Risk Service Capacity

Pearland's service capacity for transportation risk consists of a minimum, daily on-duty response force of 32 personnel staffing three engines, two quints, five medic units, one Fire Captain—

EMS, and one Battalion Chief from five fire stations. The Department also has mutual aid agreements with adjacent fire agencies.

Transportation Risk Service Demand

Over the most recent three-year period evaluated for this study, there were 1,976 transportation-related incidents in Pearland, as shown in Table 13. The predominant response types are vehicle accidents.

Table 13—Transportation Risk Service Demand by Year

RY 13/14	RY 14/15	RY 15/16	Total
593	689	694	**1,976**

Probability of Occurrence

Based on evaluation of the transportation risk factors including daily vehicle, railway, and truck traffic, and relatively low historic service demand, Citygate concludes that the City of Pearland's probability of a serious transportation event occurring over the next 12 months is ***Moderate***.

Severity

Severity refers to the impact, magnitude, or reasonably expected loss that will be experienced by the response area, community, or the citizens should an incident occur. The magnitude of the loss is relative to risk, the relevance of the affected area, and what level of response will be required. The overall impact is deemed ***Moderate***.

Overall Risk Determination

Based on the probability and the severity determined for transportation risk, the overall risk determination is deemed ***MODERATE***.

3.2.15 Natural Hazard Risks[9]

Tornadoes

Tornadoes pose a significant threat to life and safety in Pearland. The National Weather Service (NWS) defines a tornado as a violently rotating column of air in contact with the ground and extending from the base of a thunderstorm. Tornadoes can form any time of the year, and the season of greatest activity runs from March to August.

[9] 2012 Pearland Local Hazard Mitigation Plan

Probability of Occurrence

Based on an evaluation of historical event factors, including recent regional and state events, Citygate concludes that the City of Pearland's probability of a significant tornado event occurring over the next 12 months is ***High***.

Severity

Severity refers to the impact, magnitude, or reasonably expected loss that will be experienced by the response area, community, or the citizens should an incident occur. The magnitude of the loss is relative to risk, the relevance of the affected area, and what level of response will be required. The overall impact is deemed ***Low***.

Risk Determination

Based on the probability and severity of an occurrence of a tornado, the risk is ***MODERATE***.

Thunderstorms and High Winds

Several meteorological conditions can result in winds severe enough to cause property damage. High winds have been associated with extreme hurricanes traveling inland, tornadoes, and local strong thunderstorms. Thunderstorms are the byproducts of atmospheric instability, which promotes vigorous rising of air particles. A typical thunderstorm may cover an area three miles wide. The NWS considers a thunderstorm "severe" if it produces tornadoes, hail of 0.75 inches or more in diameter, or winds of 58 miles per hour or more. Structural wind damage may imply the occurrence of a severe thunderstorm. Thunderstorms and high winds impact the entire City.

Probability of Occurrence

Based on an evaluation of the storm risks factors including historical storms, Citygate concludes that the City of Pearland's probability of a thunderstorm and high wind event occurring over the next 12 months is ***High***.

Severity

Severity refers to the impact, magnitude, or reasonably expected loss that will be experienced by the response area, community, or the citizens should an incident occur. The magnitude of the loss is relative to risk, the relevance of the affected area, and what level of response will be required. The impact is deemed ***Low***.

Risk Determination

Based on the probability and severity of thunderstorms and high winds, the overall risk determination is ***MODERATE***.

Extreme Heat

Temperatures that hover 10 degrees or more above the average high temperature for the region, and last for several weeks, are defined as extreme heat. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. Excessively dry and hot conditions can provoke dust storms.

Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Other conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality.

In Pearland and the surrounding area, numerous heat-related deaths have occurred. The climate is humid subtropical, with hot summers and frequent, prolonged heat waves. The extreme heat hazard impacts the entire planning area. Many of these deaths are likely to have occurred in more rural areas of Brazoria County (and thus outside the City of Pearland) where there are a greater number of homes without air conditioning. Within the City of Pearland, extreme heat risks to people and property cannot be distinguished by area; the hazard is reasonably predicted to have uniform probability of occurrence across the entire City. All people and assets are considered to have the same degree of exposure.

Probability of Occurrence

Based on an evaluation of extreme heat risk factors including climate projection, population densities and age, Citygate concludes that the City of Pearland's probability of an extreme heat event occurring over the next 12 months is ***High***.

Severity

Severity refers to the impact, magnitude, or reasonably expected loss that will be experienced by the response area, community, or the citizens should an incident occur. The magnitude of the loss is relative to risk, the relevance of the affected area, and what level of response will be required. The impact is deemed ***Low***.

Risk Determination

Based on the probability and the severity determined for extreme heat, the overall risk determination is deemed ***MODERATE***.

Drought

Drought is generally defined as a condition of climatic dryness severe enough to reduce soil moisture and water supplies below the requirements necessary to sustain normal plant, animal, and human life. In Texas, drought is often defined in terms of agricultural and hydrologic drought:

- Agricultural drought is considered a dry period of sufficient duration and intensity that crop and animal agriculture are markedly affected.
- Hydrologic drought is considered a long-term condition of abnormally dry weather that ultimately leads to the depletion of surface and ground water supplies. During hydrologic drought, a significant reduction in flow of rivers, streams, and springs is notable.

In Pearland**,** drought periods were experienced in 1996, 1998, and 2000. The drought hazard affects the entire planning area. The 1996 drought affected the entire state. Its impacts were greatest on major population centers, prompting water conservation and reduction measures over an extended period. Within the City of Pearland, drought risks to people and property cannot be distinguished by area; the hazard is reasonably predicted to have uniform probability of occurrence across the entire City. All people and assets are considered to have the same degree of exposure

Probability of Occurrence

Based on an evaluation of drought factors in all areas, Citygate concludes that the City of Pearland's probability of a drought event occurring over the next 12 months is ***High***.

Severity

Severity refers to the impact, magnitude, or reasonably expected loss that will be experienced by the response area, community, or the citizens should an incident occur. The magnitude of the loss is relative to risk, the relevance of the affected area, and what level of response will be required. The severity is deemed ***Low***.

Risk Determination

Based on the probability and severity of drought occurrence, the overall risk determination is ***MODERATE***.

Winter Storms

Winter storms bring various forms of precipitation that occur only at cold temperatures. These kinds of precipitation include snow, sleet, or a rainstorm where ground temperatures are cold enough to allow icy conditions. These cold weather storms can also take the form of freezing rain or a wintry mix.

In Pearland**,** where the climate is subtropical, winter storms resulting in property damage occasionally occur and should be expected. The Texas Department of Transportation has posted signs on a number of bridges to warn drivers that icy conditions may occur.

Probability of Occurrence

Within the City of Pearland, winter storm risks to people and property cannot be distinguished by area; the hazard is reasonably predicted to have uniform probability of occurrence across the entire City. All people and assets are considered to have the same degree of exposure. The probability for an event is ***Low***.

Severity

Severity refers to the impact, magnitude, or reasonably expected loss that will be experienced by the response area, community, and the citizens should an incident occur. The magnitude of the loss is relative to risk, the relevance of the affected area, and what level of response that will be required. The impact is deemed ***Low***.

Risk Determination

Based on the probability and the severity determined for winter storms, the overall risk determination is deemed ***LOW***.

Hurricanes and Tropical Storms

A hurricane is a tropical storm with winds that have reached a constant speed of 74 miles per hour or more. Hurricane winds blow in a large spiral around a relative calm center known as the "eye." The "eye" is generally 20 to 30 miles wide, and the storm may extend outward 400 miles. As a hurricane approaches land, the skies will begin to darken and winds will grow in strength, often accompanied by torrential rains, high winds, and storm surges. A single hurricane can last for more than two weeks over open waters and can run a path across the entire length of the Eastern seaboard. While coastal counties are exposed to storm surge flooding, inland area experience flooding due to intense and prolonged rainfall.

In Pearland, located within proximity to the Gulf of Mexico, the City is exposed to risk from hurricanes. The hurricane and tropical storm hazard affects the entire community. Between 1995 and 2005, there were ten hurricanes (including Ike) or tropical storms that impacted Brazoria County.

Probability of Occurrence

Based on an evaluation of storm risk factors including regional historical storm events, Citygate concludes that the City of Pearland's probability of a significant hurricane or tropical storm event occurring over the next 12 months is ***High***.

Severity

Severity refers to the impact, magnitude, or reasonably expected loss that will be experienced by the response area, community, or the citizens should an incident occur. The magnitude of the loss

is relative to risk, the relevance of the affected area, and what level of response will be required. The impact is deemed ***Moderate***.

Risk Determination

Based on the probability and the severity determined for hurricanes and tropical storms, the overall risk determination is deemed ***MODERATE***.

Flooding Hazards

When rainfall runoff collects in rivers, creeks, and streams, and exceeds the capacity of channels, floodwaters overflow onto adjacent lands. Floods result from rain events, whether short and intense or long and gentle. Flood hazards are categorized as follows:

- Flash floods not only occur suddenly, but also involve forceful flows that can destroy buildings and bridges, uproot trees, and scour out new channels. Most flash flooding is caused by slow-moving thunderstorms, repeated thunderstorms in a local area, or heavy rains from hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urban areas, where much of the ground is covered by impervious surfaces and drainageways are designed for smaller flows. Flood Insurance Rate Maps (FIRM) typically show a one-percent-annual-chance (100-year) floodplain for waterways with at least one square mile of drainage area. The flood hazard areas for waterways with less than one square mile of drainage area typically are not shown.

- Riverine floods are a function of precipitation levels and water runoff volumes, and occur when water rises out of the banks of the waterway. Flooding along waterways that drain larger watersheds often can be predicted in advance, especially where it takes 24 hours or more for the flood crest (maximum depth of flooding) to pass. In Pearland, riverine flooding is caused by large rainfall systems and thunderstorm activity associated with seasonal cold fronts. These systems can take as long as a day to pass, giving ample opportunity for large amounts of rain to fall over large areas. The FIRMs show the one-percent-annual-chance floodplains.

- Urban drainage flooding occurs where development has altered hydrology through changes in the ground surface and modification of natural drainageways. Urbanization increases the magnitude and frequency of floods by increasing impervious surfaces, increasing the speed of drainage collection, reducing the carrying capacity of the land, and, occasionally, overwhelming sewer systems.

The City of Pearland is partially located in three counties (Brazoria, Fort Bend, and Harris), and therefore portions of the City are included in two separate Flood Insurance Studies (FIS) for

Brazoria and Harris County. The FIS dated September 22, 1999, covers Brazoria County and its incorporated municipalities, including the majority of the City of Pearland. FIRMs for the portion of the City that is in Brazoria County are dated 1999, while maps for the portion of the City in Harris County are dated 2007. The area of the City near Clear Creek, along the City's northern boundary, was recently studied and new flood maps were produced by FEMA in June of 2007. Both FISs compile all previous flood information into the countywide format and includes data collected on numerous waterways. The FISs indicate that riverine flooding results primarily from overflow of the streams and drainage ditches caused by rainfall runoff, ponding, and sheet flow. Storms occurring during the summer months are often associated with tropical storms moving inland from the Gulf of Mexico.

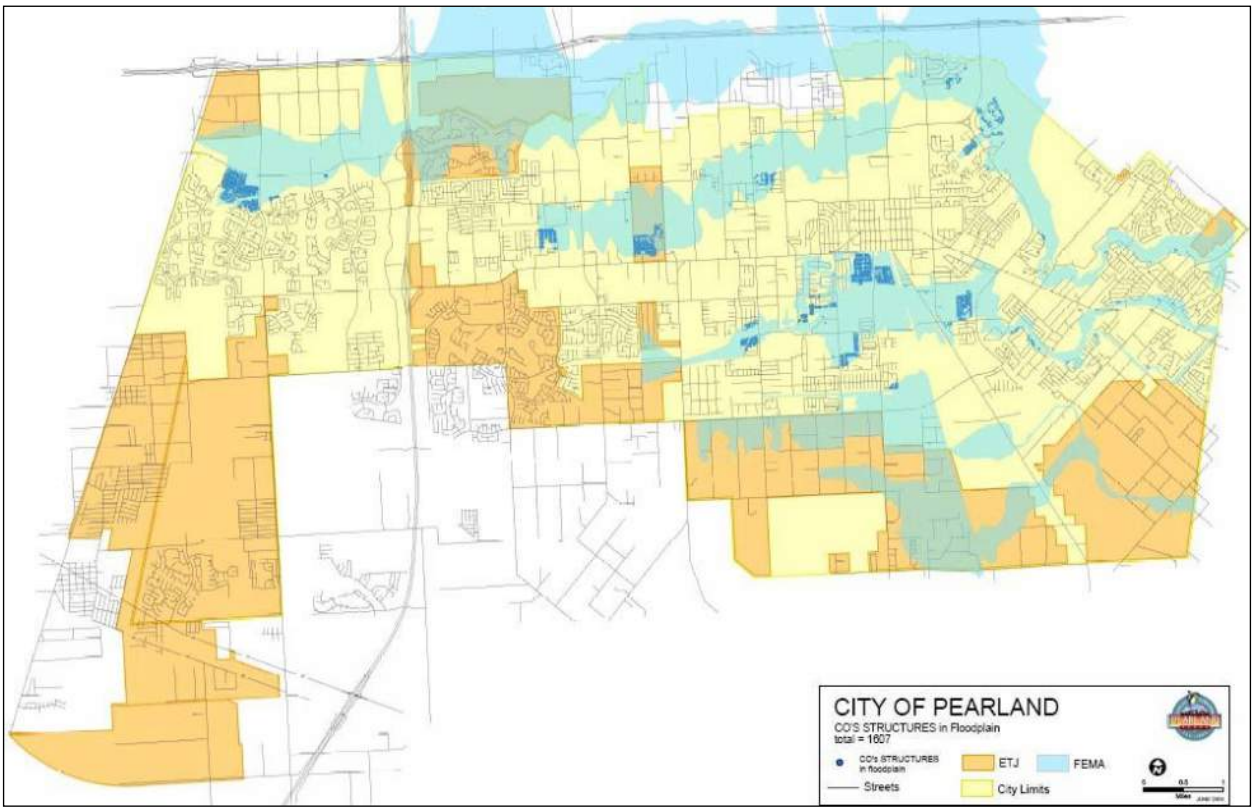
Thunderstorms are common throughout the spring, summer, and fall months. The frequent hurricanes and tropical storms interrupt the summer with high winds, heavy rainfalls, and high storm surges.

Flooding Locations and Extent

The City of Pearland joined the Federal Emergency Management Agency (FEMA) flood insurance program on September 5, 1983 by adoption of Floodplain Regulations, Title 44 of the Code of Federal Regulations Section 60.3. Following City Council direction in 1994, the Planning Department submitted an application to FEMA for participation in the Community Rating System (CRS), a special program that rewards communities that implement more activities than the minimum requirements for participation in the flood insurance program. CRS works by awarding points for implementing certain activities. In 1995, FEMA's consultant verified the activities, which resulted in 1,112 points. The points were then related to a class rating which allows a reduction in flood insurance premiums. As of September 21, 2011, the City's current CRS rating of Class 7 was reviewed and recertified for an additional year. The City's continued participation in the CRS allows property owners in the 100-year flood zones a 15 percent reduction in flood insurance premium. A five percent reduction is the maximum available to property owners outside the 500-year flood zone.

Several areas of Pearland lie within a 100-year flood zone as designated by FEMA, as shown in Figure 6.

Figure 6—Flooding Hazard Areas in Pearland



Source: 2012 Pearland Local Hazard Mitigation Plan

Probability of Occurrence

Based on an evaluation of flood risk factors including known designated flood-prone areas and multiple recent local/regional flood events, Citygate concludes that the City of Pearland's probability of a significant flood event occurring over the next 12 months is ***High***.

Severity

Severity refers to the impact, magnitude or reasonably expected loss that will be experienced by the response area, community, and the citizens should an incident occur. The magnitude of the loss is relative to risk, the relevance of the affected area, and what level of response will be required. The impact is deemed ***Low***.

Risk Determination

Based on the probability and the severity determined for flood events, the overall risk determination is deemed ***MODERATE***.

3.2.16 Risk Assessment Summary

Citygate's evaluation of the various risks likely to adversely impact Pearland yields the following conclusions:

1. Pearland has a diverse urban population density with suburban and rural population densities in the outlying areas.
2. Pearland's population is projected to grow by 56 percent over the next 15 years.
3. The City has a mix of residential, commercial, office, and industrial buildings typical of other medium-sized cities.
4. Pearland has a transportation network including highways and other primary vehicle transportation routes, mass transportation modes, and truck traffic along major arterials and Highway 288.
5. Pearland has varying probabilities of occurrence and severity relative to six known hazards:
    a. Building Fire Risk
    b. Emergency Medical Services Risk
    c. Hazardous Materials Risk
    d. Technical Rescue Risk
    e. Transportation Risk
    f. Natural Hazard Risks

Table 5, the risk/severity matrix, is repeated here and was used to determine overall risk categories.

Table 5—Risk Category Matrix

	Low Severity	High Severity
High Probability of Occurrence	**Moderate Risk** (***High*** Probability) (***Low*** Severity)	**Maximum Risk** (***High*** Probability) (***High*** Severity)
Low Probability of Occurrence	**Low/Isolated Risk** (***Low*** Probability) (***Low*** Severity)	**High/Special Risk** (***Low*** Probability) (***High*** Severity)

Source: CFAI *Standards of Cover* (5th Edition)

Table 14 indicates the summary for each risk type. The determination for each risk is based on the probability of occurrence of that type of incident, and the severity to life and property should that risk type occurs.

Table 14—Overall Citywide Risk Assessment

Risk Type	Risk Determination
Building Fire	MODERATE
EMS	MODERATE
Hazardous Material	HIGH
Technical Rescue	MODERATE
Transportation	MODERATE
Natural Hazards Risk[10]	MODERATE

[10] Natural Hazard Risks are an overall MODERATE risk. Several types of Natural Hazard Risks are individually rated differently, based on impacts to the community.

3.3 EXISTING CITY DEPLOYMENT

3.3.1 Existing Deployment Situation—What the City Has in Place Currently

SOC ELEMENT 1 OF 8*
EXISTING DEPLOYMENT POLICIES
*Note: Continued from page 9.

As the City Council has not adopted a best-practices-based response time policy, this study will benchmark the City against the response time recommendations of NFPA 1710 for career fire service deployment. These are:

- Four (4) minutes travel time for the first-due unit to all types of emergencies
- Eight (8) minutes travel time for multiple units needed at serious emergencies (First Alarm).

The City's current daily staffing plan is summarized in Table 15.

Table 15—Current Daily Minimum Staffing per Unit for the City

Units	Minimum Staffing	Staff	Extended Minimum
3 Engines	4	Firefighters per day	12
2 Quints (Pumper / Ladder Trucks)	4	Firefighters per day	8
1 Fire Captain—EMS	1	Fire Captain—EMS per day	1
1 Battalion Chief (BC)	1	Per day for command	1
Subtotal Firefighters and BC			**22**
5 EMS Ambulance Units	2	Personnel per day (1 paramedic per day, minimum)	10
Total Staffing			**32**

This *total* daily staffing is adequate for the immediate response needs presented in the built-up, urban areas of the City—if the needed staff all can reach the emergency in time which, as the mapping section of this study will show, is not always possible. For an adequate staffing statement to be accurate for a building fire, the assumption is that the closest crews are available and not already operating on another emergency medical or fire call, which does occur. For example, if one engine or quint is committed to an emergency medical services call, then an adjacent engine company or quint company must respond, sometimes from another fire department via the mutual aid system.

The daily staffing for EMS is five medic transport units (ambulances), each with a minimum of one paramedic, and one EMT along with one Citywide Fire Captain—EMS/Supervisor.

Additionally, each engine and quint company is staffed with four personnel (minimum EMT level).

Services Provided

The City provides an "all-risk" fire department providing the people it protects with services that include structure fire, first responder technical rescue, and first responder hazardous materials response, as well as other services.

Given these risks, the City uses a tiered approach of dispatching different types of apparatus to each incident category. The Communications Center[11] selects the closest and most appropriate resource type. As an example, the following table shows the resources dispatched to common risk types.

Table 16—Resources Sent to Common Risk Types

Risk Type	Minimum Type of Resources Sent	Total City Firefighters Sent
1-Patient EMS	1 Medic Unit and possibly 1 Engine or Quint based on severity	2-6 EMS & FF
Auto Fire	1 Engine or Quint	4 FF
Building Fire	2 Engines, 1 Quint, 1 Medic Unit, 1 Fire Captain—EMS, and 1 Battalion Chief	16 FF
Technical Rescue	1 Engine, 1 Quint, 1 Medic Unit, 1 Fire Captain—EMS, 1 Battalion Chief, and mutual aid for additional/specialty resources	12 FF
Hazardous Materials	2 Engines, 1 Quint, 1 Medic Unit, 1 Fire Captain—EMS, and 1 Battalion Chief	16 FF

Technical Rescue

The City uses mutual aid responses for technical rescue incidents. Pearland personnel are trained to the technical rescue operations level only.

Hazardous Materials

The City uses the Harris County Fire Marshal's Office Hazardous Materials Response Team for hazardous materials response resources. Pearland personnel are trained to the hazardous materials operations level only. Some Pearland firefighters are trained at the Technician level.

[11] Harris County Emergency Corps was the communications center which provided the data when this report was drafted. Effective December 15, 2016, the Department is dispatched by Cypress Creek EMS Communications Center.

SECTION 4—STAFFING AND GEO-MAPPING ANALYSIS

4.1 CRITICAL TASK-TIME MEASURES—WHAT MUST BE DONE OVER WHAT TIME FRAME TO ACHIEVE THE STATED OUTCOME EXPECTATION?

SOC ELEMENT 4 OF 8
CRITICAL TASK-TIME STUDY

Standards of Response Coverage (SOC) studies use task-time information to determine the number of firefighters needed within a timeframe to accomplish the desired fire control objective on moderate residential fires and modest emergency medical incidents.

4.1.1 Firefighting Critical Tasks

Pearland's Effective Response Force (ERF, also known as a First Alarm) to structure fires in built-up, suburban areas includes two engines, one quint, one medic unit, one Fire Captain—EMS, and one Battalion Chief, for a minimum ERF total of **16** personnel.

The following table shows what a minimum force of 16 can accomplish. The larger the force (weight of attack), the faster the tasks are completed.

Scenario: *The following is a simulated one-story residential working structure fire with no rescue situation. Responding companies received dispatch information as typical for a witnessed fire. Upon arrival, they were told approximately 1,000 square feet of the home was involved in fire.*

Table 17—First Alarm Working Structure Fire – 16 Personnel

Company Level Tasks
1st-Due Engine
1. Lay in a hydrant supply line.
2. Stretch the 150-foot, 1¾-inch hose line to the point of access for search and rescue.
3. Operate the pump to supply water and attach hydrant supply line.
4. Assume command of initial operations.
5. Conduct search and rescue.
2nd-Due Engine
1. If necessary, lay in a hydrant supply line.
2. Stretch a second 200-foot hose line as a back-up line and for fire attack.
3. Establish 2 in 2 out.
1st-Due Quint
1. Provide search and rescue for trapped persons.
2. Perform positive pressure and/or vertical ventilation for fire attack.
1st-Due Medic Unit
1. Secure utilities.
2. Raise additional ladders, open concealed spaces.
3. Establish treatment section as needed.
1st-Due Battalion Chief and Fire Captain—EMS
1. Establish exterior command and scene safety.

The duties in Table 17, grouped together, form an *Effective Response Force or First Alarm Assignment*. These tasks must be performed simultaneously and effectively to achieve the desired outcome; arriving on-scene does not stop the escalation of the emergency. While firefighters accomplish these tasks, the incident progression clock keeps running.

Fire spread in a structure can double in size during its *free-burn* period before firefighting starts. Many studies have shown that a small fire can spread to engulf an entire room in less than six to eight minutes after free burning has started. Once the room is completely superheated and involved in fire (known as flashover), the fire will spread quickly throughout the structure and into the attic and walls. For this reason, it is imperative that fire attack and search commence before the flashover point occurs if the outcome goal is to keep the fire damage in or near the room of origin. In addition, flashover presents a serious danger to both firefighters and any occupants of the building.

4.1.2 Emergency Medical Services Critical Tasks

The Pearland Fire Department responds to over 6,500 EMS incidents per year. These incidents include car accidents, childbirths, strokes, heart attacks, difficulty breathing, falls, and many other medical emergencies.

The Department routinely responds to EMS calls that require treatment for more than one patient. These calls include vehicle accidents, chemical exposures, construction or industrial accidents, and any other event that occurs with several people in close proximity. Patient conditions can range from minor cuts and bruises to life-threatening injuries.

Dispatchers are responsible for screening calls to establish the correct initial response. The first Fire Department officer on scene amends the response once conditions have been assessed. Standard operating procedures are used to request adequate personnel and resources.

For comparison purposes, the following critical task table reviews the tasks required on a critical response to a cardiac arrest.

Table 18—Cardiac Arrest – Four Firefighters plus a Two-Person Ambulance[12]

Task	Personnel Required	Type of Treatment Administered
Compressions	1-2	Compression of chest to circulate blood
Ventilate/oxygenate	1-2	Mouth-to-mouth, bag-valve-mask, apply O_2
Airway control	1-2	Manual techniques/intubation/cricothyrotomy
Defibrillate	1-2	Electrical defibrillation of dysrhythmia
Establish I.V.	1-2	Peripheral or central intravenous access
Interpret ECG	2	Identify type and treat dysrhythmia
Administer drugs	1	Administer appropriate pharmacological agents
Patient charting	1-2	Record vitals, treatments administered, etc.
Hosp. communication	1-2	Receive treatment orders from physician
Treat en route	2-4	Continue to treat/monitor/transport patient
Total	**6**	**Personnel required per patient**

4.1.3 Critical Task Analysis and Effective Response Force Size

What does a deployment study derive from a critical task analysis? The total task needs (as displayed in Table 17 and Table 18) to stop the escalation of an emergency must be compared to

[12] Minimum of one paramedic.

outcomes. Nationally published fire service "time vs. temperature" tables that, after about four to five minutes of free burning, a room fire will grow to the point of flashover. At this point, the entire room is engulfed, the structure becomes threatened, and human survival near or in the fire room becomes impossible. Additionally, brain death begins to occur within six to eight minutes of the heart having stopped. Thus, the Effective Response Force must arrive in time to stop these catastrophic events from becoming worse.

The City is staffed with enough firefighters to deliver one Effective Response Force of 16 firefighters to a building fire per day—if they can arrive in time, which the mapping and statistics sections of this study will show is not always possible. Mitigating an emergency event is a team effort once the units have arrived. This refers to the "weight" of response analogy; if too few personnel arrive too slowly, then the emergency will worsen instead of improve. The outcome times, of course, will be longer, with less desirable results, if the arriving force is later or smaller.

The quantity of staffing and the arrival time frame can be critical in a serious fire. Fires in older and/or multi-story buildings could well require the initial firefighters needing to rescue trapped or immobile occupants. If a lightly staffed force arrives, it cannot simultaneously conduct rescue and firefighting operations.

Fires and complex medical incidents require that the other units arrive in time to complete an effective intervention. Time is one factor that comes from ***proper station placement***. Good performance also comes from ***adequate staffing*** and training. In the critical tasks identified previously, the Pearland Fire Department can perform well in terms of staffing. But where fire stations are spaced too far apart, then when one unit must cover another unit's area, or multiple units are needed, these units can be too far away and the emergency will worsen.

Previous critical task studies conducted by Citygate and NFPA Standard 1710 find that all units need to arrive with 15+ firefighters within 11:30 minutes (from the time of call) at a room and contents structure fire to be able to ***simultaneously and effectively*** perform the tasks of rescue, fire attack, and ventilation.

A question one might ask is, "If fewer firefighters arrive, *what* from the list of tasks mentioned would not be completed?" Most likely, the search team would be delayed, as would ventilation. The attack lines would only consist of two firefighters, which does not allow for rapid movement above the first-floor deployment. Rescue is conducted with only two-person teams; thus, when rescue is essential, other tasks are not completed in a simultaneous, timely manner. Effective deployment is about the **speed** *(travel time)* and the **weight** *(firefighters)* of the attack.

Sixteen initial firefighters could handle a moderate-risk, confined house fire; however, even an Effective Response Force (ERF) of 16 will be seriously slowed if the fire is above the first floor,

in a low-rise apartment building, or commercial/industrial building. This is where the capability to add alarms to the standard response becomes important.

Given the fact that Pearland's First Alarm plan (ERF) delivers 16 personnel to a moderate risk building fire, it reflects the City's goal to confine serious building fires to, or near the room of origin, and to prevent the spread of fire to adjoining buildings. This is a typical desired outcome in built-out areas, and requires more firefighters, more quickly than the typical rural outcome of keeping the fire contained to the building, not room, of origin.

Given that there is not a current Pearland *City Council* response time policy, the City's current physical response to building fires is, in effect, the City's de-facto deployment measure to built-up urban/suburban areas—*if those areas are within reach of a fire station*. Thus, this becomes the baseline policy for the deployment of firefighters.

4.2 Distribution and Concentration Studies—How the Location of First-Due and First Alarm Resources Affects the Outcome

SOC Element 5 of 8
Distribution Study

SOC Element 6 of 8
Concentration Study

The City is served today by five fire stations fielding three engine companies, two quint companies, and five transport paramedic ambulances. It is appropriate to understand what the existing stations do and do not cover, if there are any coverage gaps needing one or more stations, and what, if anything, to do about them.

In brief, there are two geographic perspectives to fire station deployment:

- **Distribution** – the spacing of first-due fire units to stop routine emergencies.
- **Concentration** – the clustering of fire stations close enough together so that building fires can receive sufficient resources from multiple fire stations quickly. As indicated, this is known as the **Effective Response Force**, or, more commonly, the "First Alarm Assignment"—the collection of a sufficient number of firefighters on scene, delivered within the concentration time goal to stop the escalation of the problem.

To analyze first-due fire unit travel time coverage, Citygate used a geographic mapping tool called *FireView*^{TM} that can measure theoretical travel time over the street network. For this time calculation, Citygate staff uses the base public roads map and the current posted City speed limits, which are then calibrated to actual fire company travel times from previous responses to simulate real-world coverage. Because the speed limits are both slowed or exceeded by actual fire truck travel across the road network, the positive effect of red light traffic signal preemption is considered. Using these tools, Citygate runs several deployment tests and measures their

impact on various parts of the City. The travel time measure used was 4:00 minutes over the road network, which is consistent with the "benchmark" recommendation in NFPA 1710 and desirable outcomes in critical emergencies. When up to a total of 3:30 minutes is added for dispatch processing and crew turnout times, then the maps effectively show the area covered within 7:30 minutes of the Pearland Police Communications Center receiving the request for the first-due unit, and 11:30 minutes (8:00 minutes travel) for a First Alarm Assignment.

In all the GIS models to follow, great care was taken to add into the model as many of the newest and future streets as possible. *This work included moving Station 1 to its new location, and extending McHard Road west to Cullen Boulevard.*

4.2.1 Traffic Congestion Impacts

Citygate's team members personally observed the current rush-hour traffic congestion in the City. The legacy approach to predict fire apparatus travel times over a street network insufficiently accounts for rush-hour traffic. The study data does not contain sufficient fire unit travel time occurrences at peak commute hours to be statistically significant enough to slow down the GIS travel time model during morning and evening commute hours.

Citygate thus used traffic throughput travel speed data from the company that provides real-time traffic data to internet-based traffic map applications. This is the same data used to show traffic congestion with red, yellow, and green road segments to indicate flow impedance and thus sluggish travel times at peak congestion hours. The data is obtained from traffic speed samples from a variety of public and private sources and measures traffic speeds in 15:00-minute time blocks between intersections (segments) on a 24/7/365 basis for a rolling 36-month period.

For the *traffic congestion* time-over-distance maps to follow, the model first uses actual fire apparatus travel times averaged over a 24-hour period for one year. Then the traffic data is used to build a congested traffic model. Overall, the congestion impacts can be measured in the quantity of streets in the *City* (not including the Extra Territorial Jurisdictions (ETJs) covered at peak and off-peak hours, as shown in the following table:

Table 19—City Road Mile Coverage for First-Due and First Alarm Units

Measure	Total Public Road Miles	Non-Congested Miles Reached by *Current* Fire Stations	Congested Road Miles	Difference (Miles)
4:00-minute travel, current fire stations	535.9	198 *(37% of total public miles)*		**337.9**
			112.7 *(21% of total public miles)*	**423.2**
Initial First Alarm, 2 engines, 1 quint truck, 1 medic, 1 Chief, 8:00-minute travel	535.9	170.2 *(32% of total public miles)*		**365.7**
			25.9 *(5% of total public miles)*	**510.0**

As a starting point, only 37 percent of the City's public streets are within 4:00 minutes travel time of a fire station, which is well below Citygate expectations of 70 to 90 percent. The fire stations' travel coverage of the City at commute hours is negatively impacted down to 21 percent. The initial multiple-unit coverage of five units at commute hours is impacted down to only 5 percent, as units must travel across large sections of the City. The following maps will show where this normal and reduced coverage occurs. Then after this baseline coverage is visualized, new fire stations will be added to the model and the road mile coverage improvements measured.

Map #1 – General Geography and Station Locations

Map #1 shows the existing City fire station locations along with the City boundaries. This is a reference map for the other map displays that follow. As replacement Station 1 is under construction, all of the models to follow in this study place the station at its new, more northern location.

Map #1a – General Geography and Station Locations – City Only

Map #1a is the same map as Map #1, but features the City of Pearland limits only. Nearby ETJ and non-City areas have been masked out of the map for focus on the City.

Map #2a – Risk Assessment: High-Risk Occupancies and Critical Facilities

Risk assessment is an effort by the Department to classify properties by potential impact on service demand levels. The higher risk business sites and critical infrastructure building locations are shown, and require more firefighters in fewer minutes should a serious fire emerge due to the presence of hazardous materials or at-risk populations, such as those found in hospitals.

Most of these buildings are along the major road corridors where zoning has placed the City's commercial buildings. The important finding from this map is that these risks are spread throughout the City and, as such, the City needs a strong, multiple-unit response capacity for serious emergencies in all parts of the City.

Map #2b – Risk Assessment: High Needed Fire Flow Buildings

The Insurance Service Office (ISO) surveys buildings for fire risk underwriters upon which to base premiums. One measure of a building's risk is the calculated amount of firefighting water needed should a major fire take hold of a building. This "Needed Fire Flow" calculation is based on many factors, such as type of construction and spacing from other buildings. This map displays the locations of buildings in the City with needed fire flows equal to or in excess of 2,500 gallons per minute and, while most of these are clustered in the commercial areas of the City, they are also found in every fire station district.

Map #2c – Risk Assessment: Hazardous Materials Risks

Some commercial buildings use or store a significant amount of hazardous materials. Such sites are highly regulated by the Building and Fire Codes, and enforcement of the codes is conducted by the Fire Department. The location of these sites is mostly in the commercial and industrial zones of the City.

Map #2d – Risk Assessment: Population Density

Map #2d shows the population density of people per square mile in each of the Fire Department response districts in and around the City. This map was prepared by City of Pearland GIS from their best available data sources.

Map #3a – First-Due Unit Distribution: 4:00-Minute Engine Travel

Map #3a shows, using green street segments, the *distribution of City stations* per a best-practice-recommended response goal of 4:00 minutes *travel* time. Therefore, green indicates the locations an engine could reach within this time, ***assuming*** it is in its station and encounters no unusual traffic delays. In addition, the computer mapping tool uses actual fire company speed limits per roadway type. Thus, the green projection is realistic for engines with normal traffic present.

The purpose of computer response mapping is to determine response time coverage across a community's geography and balance station locations. This geo-mapping design is then checked in the study against actual dispatch time data, which reflects real response times. There should be some overlap between station areas so that a second-due unit can have a chance of an adequate response time when it covers a call in another fire company's first-due area.

As Section 5 will detail, the Citywide *travel* time to 90 percent of the fire and EMS incidents is 9:44 minutes Department-wide. This is supported by the GIS model that shows 4:00-minute coverage does not extend out beyond the core fire stations.

Map #3b – First-Due Ambulance Unit Distribution: 8:00-Minute Travel

Maps #3b shows, in green, the streets covered in 8:00 minutes travel, which is considered in most EMS systems as adequate ambulance drive time coverage. Most all the City, but not the ETJ areas, is covered by an ambulance in 8:00 minutes travel time.

Map #3c/d – First-Due Coverage – Traffic Congestion

Maps #3c and #3d show the effect of traffic congestion on travel time. Maintaining a 4:00-minute travel time for engines is more difficult with traffic than maintaining an 8:00-minute travel time for an ambulance with traffic.

Map #4 – ISO Coverage Areas

Map #4 displays the Insurance Service Office (ISO) requirement that stations cover a 1.5-mile *distance* response area. Depending on the road network in a department, the 1.5-mile measure usually equates to a 3.5- to 4.5-minute travel time. However, a 1.5-mile measure is a reasonable indicator of station spacing and overlap. As can be seen, the conservative ISO coverage is very weak and only connects between station areas in one location.

Map #5 – Effective Response Force (ERF) 8:00-Minute Travel Time Concentration (First Alarm)

Map #5 shows the *concentration* or massing of fire crews for serious fire or rescue calls. Building fires, in particular, require 15+ firefighters (per NFPA 1710) arriving within a reasonable time frame to work together and effectively to stop the escalation of an emergency. Otherwise, if too few firefighters arrive, or arrive too late in the fire's progress, the result is a greater-alarm fire, which is more dangerous to the public and the firefighters.

The concentration map exhibits look at the City's ability to send, initially, a *minimum* of two engines, one quint truck, one medic unit, and one Battalion Chief to serious building fires within 8:00 minutes travel time (11:30 minutes from fire dispatch receipt). This measure ensures that a *minimum* of 15 firefighters (four firefighters per engine and ladder truck, plus ambulance and command chief) can arrive on-scene to work ***simultaneously*** and effectively to stop the spread of a serious building fire.

This map shows in green where the City's current fire station system should deliver the initial Effective Response Force.

As can be seen, only the eastern core of the City is covered. There are several limiting factors to this finding—there are not enough stations, ladder companies, and Battalion Chiefs.

Map #5a – Effective Response Force (ERF) 8:00-Minute Travel Time – Traffic Congestion

Map #5a shows the effect of traffic congestion on the multiple-unit response. The limiting factor, when traffic congestion is applied, is the need to provide one ladder company (quint) to the incident within 8:00 minutes. Given the location of the two quints, it makes sense that the coverage is limited to between their two locations. In addition, the road network and traffic congestion makes the 8:00-minute coverage very small.

Map #5b – Effective Response Force (ERF) 8:00-Minute Travel Time – Traffic Congestion – City Only

Map #5b is the same map as Map #5a, but features the City of Pearland City limits only. Nearby ETJ and non-City areas have been masked out of the map for clarity to City coverage areas.

Map #6 – Two Engines Only at 8:00 Minutes Travel

Map #6 shows a different view of concentration by only showing the 8:00-minute coverage of two engine companies. Here, the green color shows the areas receiving two engines in 8:00 minutes travel time, which, with only five fire station locations, is not the entire City or ETJ areas.

Map #6a – Two Engines Only at 8:00 Minutes Travel – Traffic Congestion

When traffic congestion is applied, the coverage for two engines at 8:00 minutes travel time does shrink away from the edges of the City to the areas close to and in between the fire stations.

Map #7 – One Battalion Chief at 8:00 Minutes Travel

Map #7 displays the coverage for one Battalion Chief at 8:00 minutes travel time. While the chief officer is centrally located, even a smaller, faster unit cannot reach the western area at all, nor other east and southeast edges of the City, within 8:00 minutes travel time.

Map #7a – One Battalion Chief at 8:00 Minutes Travel – Traffic Congestion

Traffic congestion also reduces the one Battalion Chief coverage to the areas closest to Station 2. As Pearland absorbs more infill and edge area growth, the City will be large enough in stations, crews, and incident demands to need two Battalion Chiefs for effective coverage.

Map #8 – One Ladder Truck (Quint) Coverage at 8:00 Minutes Travel

Map #8 shows the coverage for one ladder truck (quint) at 8:00 minutes travel time. Given the location of the two staffed quints in the City, the coverage is not complete at 8:00 minutes out to the edge and ETJ areas. There is overlap between the two quints, which shows as a purple area between the two stations.

Map #8a – One Ladder Truck Coverage at 8:00-Minute Travel – Traffic Congestion

Map #8a shows only the reach of the two quints during traffic congestion hours. Due to the road network design, Station 4 actually covers a larger area onto the Station 1's area. In other words, the two coverage zones do not meet in a geographic middle. Therefore, the Station 1 quint, during traffic congestion, has the most impacted coverage.

Map #9 – All Incident Locations

Maps #9 shows, across a three-year period, the exact location for all fire and EMS incident types. It is apparent that there is a need for fire services on almost every street segment of the City. These plots do not include five months of EMS incidents in the first year when EMS was separate from fire.

Map #10 – Emergency Medical Services and Rescue Incident Locations

Map #10 further breaks out only the emergency medical and rescue call locations. With the majority of the calls for service being emergency medical, virtually all areas of the City *and the ETJs* need emergency medical services. These plots do not include five months of EMS incidents in the first year when EMS was separate from fire.

Map #11 – All Fire Type Locations

Map #11 identifies the location of all fires in the City for three years. All fires include any type of fire call, from auto to dumpster to building. There are obviously fewer fires than medical or rescue calls. Even given this, it is evident that all first-due engines in the City experience fires; the fires are more concentrated where the buildings are older and/or more densely spaced due to zoning and historic growth over the decades.

Map #12 – Structure Fire Locations

Displayed in this map are the structure fire locations. While the structure fire quantity is a smaller subset of the total fire quantity, there are two meaningful findings from this map. First, there are still structure fires in every first-due fire company district in the City. The location of many of the building fires parallels the older and higher risk building types in the City in which more significant risk, and the ISO-evaluated buildings, are more common. These areas and buildings pose a significant fire and life loss risk to the City. Second, fires in the more complicated building types must be controlled quickly or the losses could be very large. Fortunately, in the commercial and industrial zones, where commercial buildings tend to have automatic fire sprinklers and fire prevention practices, there are fewer building fires in the three-year period.

Map #13 – Emergency Medical Services and Rescue Incident Location Densities

Map #13 examines, by mathematical density, where clusters of emergency medical services incident activity occurred. In this set, the darker density color plots the highest concentration of all incidents. This type of map makes the location of frequent workload more meaningful than just mapping the locations of all EMS incidents, as was done for Map #10.

This perspective is important because the deployment system needs an overlap of units to ensure the delivery of multiple units when needed for serious incidents, or to handle simultaneous calls for service. For the City, this is true in several areas where the incident demand has been the highest.

Map #14 – All Fire Location Densities

Map #14 is similar to Map #13, but shows the hot spots of activity for all types of fires. Structure fire density is fairly evenly distributed amidst the populated areas of the City.

Map #15 – Structure Fire Densities

Map #15 shows only the building fire workload by density. The density is more focused in the southern half of the City.

Map #16 – Added Fire Station Scenarios

Given the growth in the City and the limited coverage of the existing five fire stations, Citygate and Fire Department staff tested the effects of the already planned fire station locations. In this map, the coverage model staffs Station 6 and adds new Fire Stations 7 and 8. A fire engine is placed at each of these three fire stations. As can be seen, there is a significant, but not complete, improvement in neighborhood-based unit coverage.

Map #17 – Added Ladder Truck Scenario

To improve First Alarm or ERF coverage, instead of adding a third quint, which is large and heavy for everyday EMS responses, Citygate and the Department tested a more typical, larger City model of separately staffed aerial ladder trucks "close to City build-out."

As can be seen, with three aerial ladder trucks at Stations 2, 3, and 8. The Citywide 8:00-minute travel time coverage is very good during normal traffic, and acceptable during traffic congestion. This suggests that, at the City's build-out, Pearland will only need three ladder trucks.

Map #18 – Effective Response Force (ERF) 8:00-Minute Travel Time – Eight Stations and Three Separately Staffed Ladder Trucks

This map combines the added three fire stations with the three dedicated ladder trucks, and remodels the multiple-unit coverage for serious fires. As can be seen, the increased coverage is

substantial as much of the City, even during traffic congestion, can be reached by the Effective Response Force.

The following table shows the road miles coverage from Table 19, and compares that with the impact of three fire stations and three ladder trucks from the map scenarios.

Table 20—City Road Mile Coverage Comparison for First-Due and First Alarm Units

Measure	Total Public Road Miles	Non-Congested Miles Reached by Fire Stations	Congested Road Miles	Difference (Miles)
Current Road Mile Coverage				
4:00-minute travel, current fire stations	535.9	198 *(37% of total public miles)*		**337.9**
			112.7 *(21% of total public miles)*	**423.2**
Initial First Alarm, 2 engines, 1 quint truck, 1 Chief, 1 medic, 8:00-minute travel	535.9	170.2 *(32% of total public miles)*		**365.7**
			25.9 *(5% of total public miles)*	**510.0**
Road Mile Coverage with 8 Stations and 3 Ladders				
4:00-minute travel, eight fire stations	535.9	252.6 *(47% of total public miles)*		**283.3**
			147.0 *(27% of total public miles)*	**388.9**
Initial First Alarm, 2 engines, 1 quint truck, 1 Chief, 1 medic, 8:00-minute travel	535.9	472.3 *(88% of total public miles)*		**63.6**
			337.8 *(63% of total public miles)*	**198.1**

In summary, the eight-station, three-ladder model improves first-due unit coverage by 10 percent during normal traffic, and multiple-unit coverage improves 56 percent during normal traffic. During congested traffic, first-due unit coverage improves by 6 percent, and multiple-unit coverage improves by 58 percent.

Finding #2: Five fire stations, along with using quints (pumper/ladders), does not provide sufficient first-due nor multiple-unit coverage to the City.

Finding #3: Traffic congestion severely limits the fire unit travel coverage and, at peak traffic hours, only 37 percent of the City's public street miles are within reach of a single fire station, and only 21 percent are covered by an effective multiple-unit force to serious emergencies.

Finding #4: At the City's current size plus the southwest Extra Territorial Jurisdictions (ETJs), a minimum of an eight-fire-station model, using eight engines and three aerial ladders, will be necessary.

Finding #5: If the City desires a best-practice recommendation of 4:00-minute travel time coverage to the urban developed neighborhoods, the City plus ETJ areas could well need 9 to 11 fire stations at final build-out.

SECTION 5—RESPONSE STATISTICAL ANALYSIS

5.1 HISTORICAL EFFECTIVENESS AND RELIABILITY OF RESPONSE—WHAT STATISTICS SAY ABOUT EXISTING SYSTEM PERFORMANCE

SOC ELEMENT 7 OF 8
RELIABILITY & HISTORICAL RESPONSE EFFECTIVENESS STUDIES

The maps described in Section 4 show the GIS-projected response times given perfect conditions with no competing calls, with and without traffic congestion, and units all in place. Examination of the actual response time data provides a picture of how response times are in the "real" world of simultaneous calls, rush hour traffic conditions, units out of position, and delayed travel time for events such as periods of severe weather.

5.1.1 Data Set Identification

The Pearland Fire Department provided continuous National Fire Incident Reporting System (NFIRS 5) incident and computer-aided dispatch (CAD) apparatus response data for the period 8/1/2013-7/31/2016. NFIRS 5 data showed 25,876 incidents and 40,508 apparatus response records.

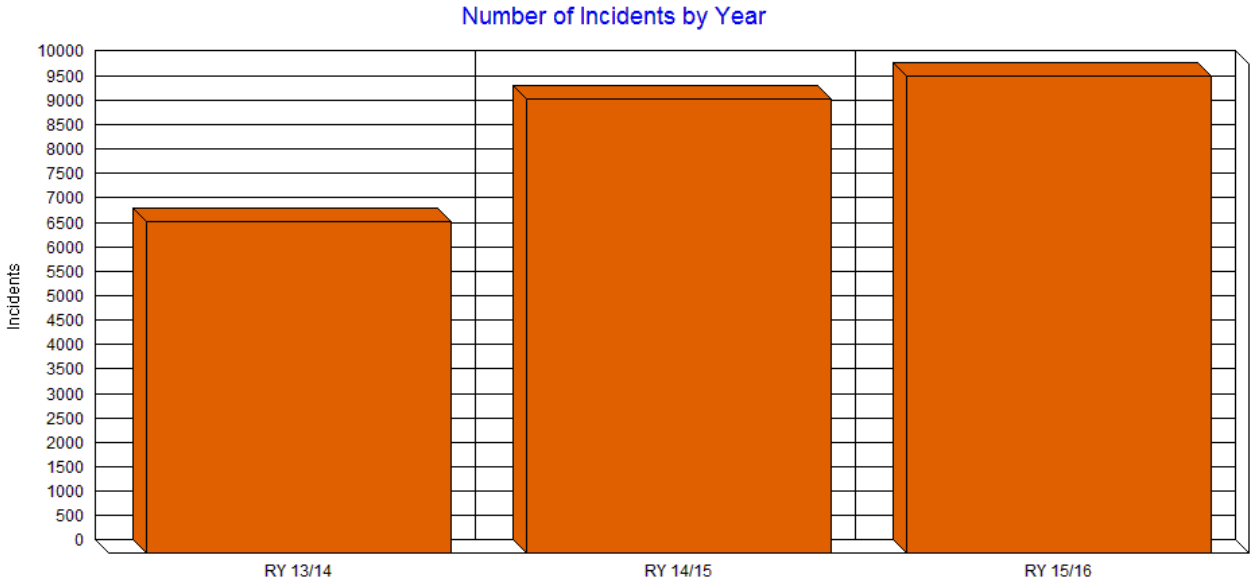
5.2 SERVICE DEMAND

In Report Year (RY) 2015/2016, the Department responded to 9,778 incidents. During this time, the Department had a daily demand of more than 26.79 incidents, of which 2.45 percent were to fire incidents, 69.51 percent were to EMS incidents, and 28.04 percent were to "Other" incident types. The percentage of fires is relatively high when compared to other fire departments.

During this same time, there were 15,850 individual fire apparatus unit responses. This indicates there was an average of 1.62 apparatus responses per incident.

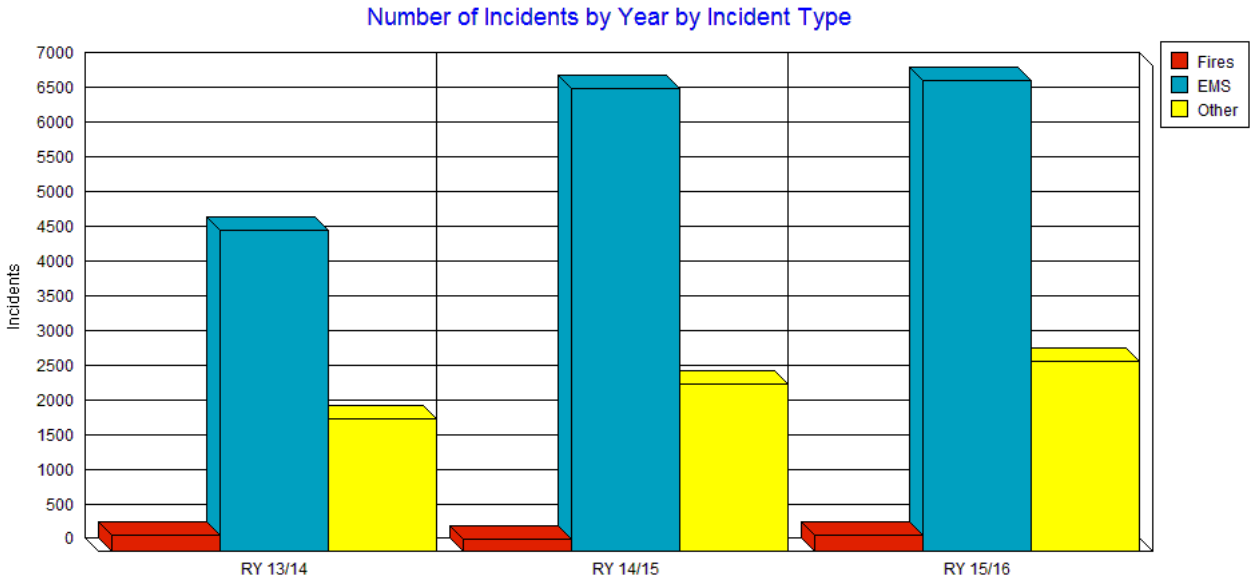
The Department experienced steady growth in the number of incidents from RY 13/14 through RY 2015/2016. This plot does not include five months of EMS incidents in the first year when EMS was separate from the Fire Department.

Figure 7—Number of Incidents by Year



The following graph shows the number of incidents by incident type. The number of each general incident type is increasing. This plot does not include five months of EMS incidents in the first year when EMS was separate from the Fire Department.

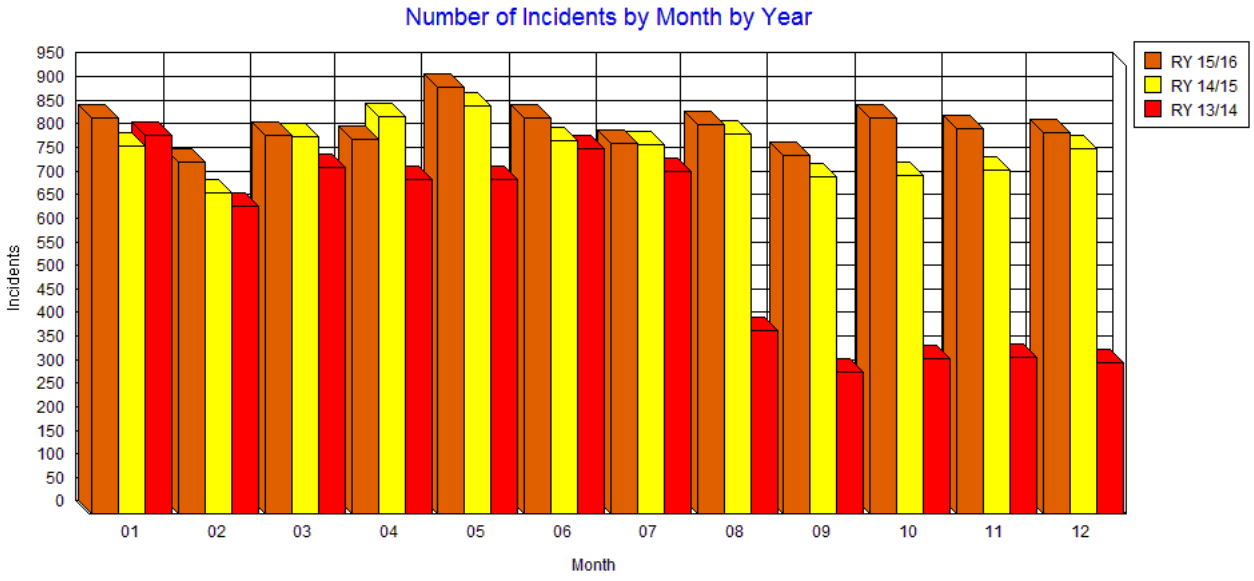
Figure 8—Number of Incidents by Incident Type by Year



5.2.1 Breakdown of Incident Demand Over Time

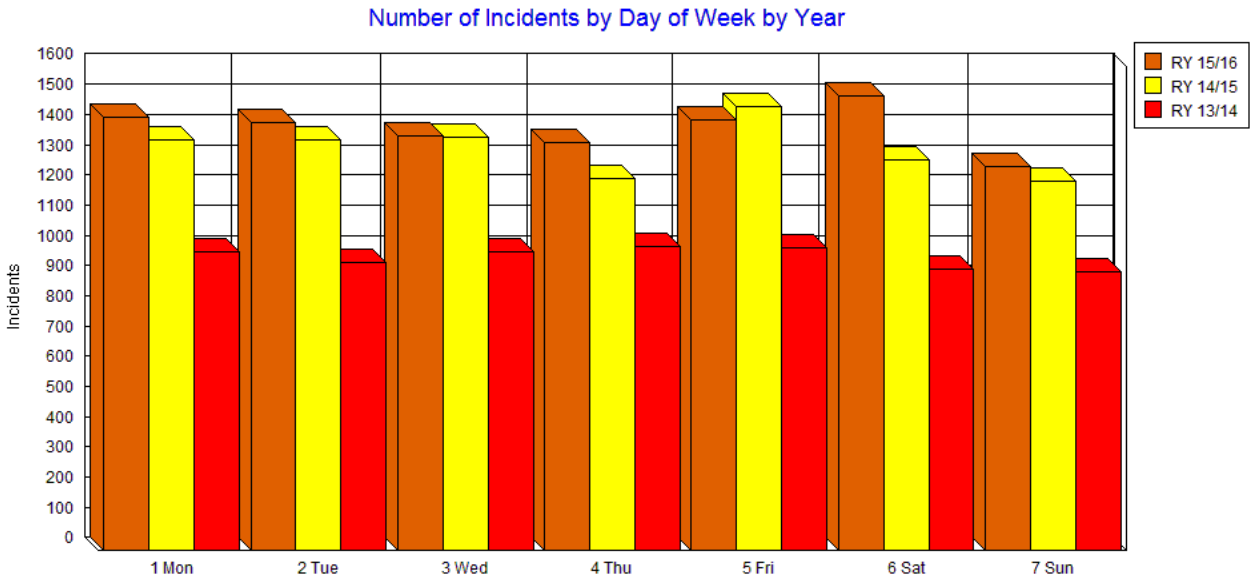
The following graph shows the number of incidents by month by year. *Note: For the following two graphs, incidents in months 8 through 12 in RY 13/14 and RY 14/15 are low due the pre-merger EMS data. Therefore, the increase in demand in 2015/2016 is not necessarily due to new incidents.*

Figure 9—Number of Incidents by Month by Year



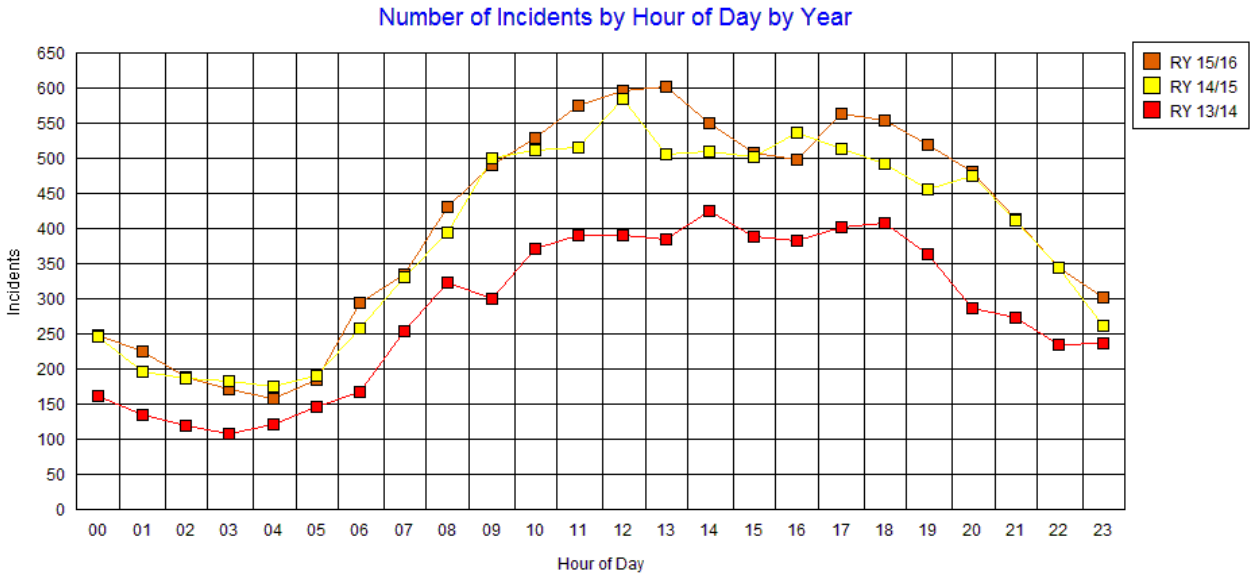
The following graph shows the number of incidents by day of week by year.

Figure 10—Number of Incidents by Day of Week by Year



The following graph shows the breakdown of incidents by hour of the day by year. The graph shows an increase in RY 2015/2016 from 10:00am to 03:00pm, and from 05:00pm to 08:00pm.

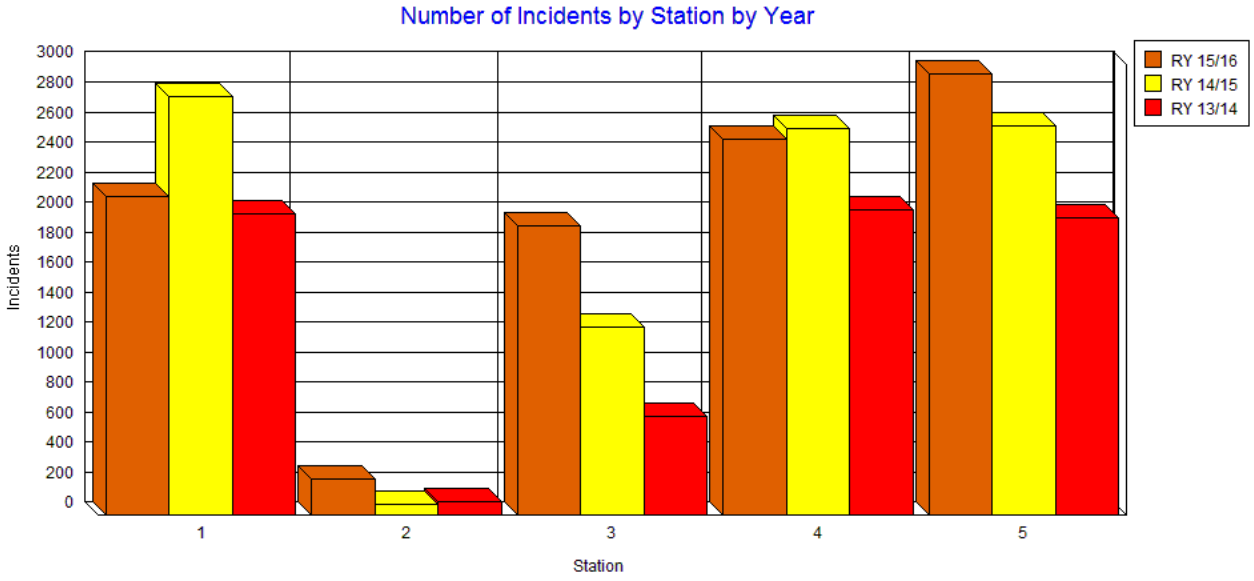
Figure 11—Number of Incidents by Hour of Day by Year



5.2.2 Breakdown of Incident Demand by Station Area

The following graph shows the breakdown of the number of incidents by station of the first-arriving apparatus by year. Incident activity increased in the last reporting year. It should be noted that Station 3 was not staffed until August 2015, and Station 2 was a volunteer fire station until June 2016 when new Fire Station 2 was staffed around the clock with one fire engine pumper and one ambulance.

Figure 12—Number of Incidents by Station by Year



Finding #6: The City's day-of-week and month-of-year calls for service demands are fairly consistent. This means the City needs to operate a fairly consistent 24/7/365 response system.

5.2.3 Breakdown of Incident Demand by Type

The following table shows activity rankings of incidents by incident quantity by year. Notice the strong ranking for EMS incidents. Cancelled-en-route incidents also rank high on the list. Building fires rank in 13th place by volume. Only those incident types with 35 or more occurrences in RY 2015/2016 are shown.

Table 21—Incident Quantity by Incident Type by Year

NFIRS Incident Type	RY 15/16
321 EMS call, excluding vehicle accident with injury	6,118
611 Dispatched & canceled en route	881
322 Vehicle accident with injuries	387
554 Assist invalid	314
745 Alarm system sounded, no fire - unintentional	310
735 Alarm system sounded due to malfunction	297
324 Motor vehicle accident no injuries	240
622 No incident found on arrival of incident address	135
412 Gas leak (natural gas or LPG)	100
733 Smoke detector activation due to malfunction	99
743 Smoke detector activation, no fire - unintentional	85
445 Arcing, shorted electrical equipment	57
111 Building fire	55
671 Hazmat release investigation w/ no hazmat	51
151 Outside rubbish, trash or waste fire	41
744 Detector activation, no fire - unintentional	35
131 Passenger vehicle fire	35
113 Cooking fire, confined to container	35

The following table shows the ranking of incidents by property use by year. In a broad sense, all residential property types are in the 400 series. Only the 20 most frequent property use categories are shown.

Table 22—Incident Quantity by Property Use by Year

Property Use	RY 15/16
419 1 or 2 family dwelling	4,585
311 24-hour care Nursing homes, 4 or more persons	609
429 Multifamily dwellings	556
963 Street or road in commercial area	345
161 Restaurant or cafeteria	208
962 Residential street, road or residential driveway	193
599 Business office	165
340 Clinics, Doctors offices, hemodialysis centers	165
519 Food and beverage sales, grocery store	156
961 Highway or divided highway	155
365 Police station	154
215 High school/junior high school/middle school	123
449 Hotel/motel, commercial	120
581 Department or discount store	114
500 Mercantile, business, other	99
965 Vehicle parking area	91
254 Day care, in commercial property	90
960 Street, other	71
559 Recreational, hobby, home repair sales, pet store	64

5.3 Response Time Analysis

Once the types of incidents are quantified, incident analysis shifts to the time required to respond to those incidents. Fractile breakdowns track the percentage (and count the number) of incidents meeting defined criteria, such as the first apparatus to reach the scene within progressive time segments.

5.3.1 Citywide Response Time Performance

A resident or visitor of a city measures the speed of fire department response from the time assistance is requested until the assistance arrives. This measurement is called "Call to First Apparatus Arrival" (or "Call to Arrival"). Police and sheriff's departments act as PSAP for 9-1-1 calls. All 9-1-1 calls for fire service in the City are received at the Pearland Police Department and dispatched from the Harris County Communications Center.[13]

Based on national recommendations, Citygate's response time test goal is for 90 percent call to arrival to be 7:30 minutes. This is comprised of three component parts:

Call Processing: 1:30 minutes (receive, determine need, and alert crew)

Turnout: 2 minutes (notify, don required protective gear, and begin traveling)

Travel: 4 minutes (travel time)

The following is the breakdown of 9-1-1 call received to first apparatus arrival for the overall City and by station area by year for *fire and emergency medical* incidents.

Table 23—Call to First-Unit Arrival – 90 Percent Performance

Station	RY 13/14	RY 14/15	RY 15/16
Department-Wide	13:23	13:19	13:03
Station 1	14:08	13:41	13:30
Station 2	12:35	14:03	13:41
Station 3	13:25	13:39	12:31
Station 4	13:07	12:17	12:12
Station 5	13:09	13:26	13:22

All the 9-1-1 call to arrival times to 90 percent of emergent incidents in the Table 23 are well past the Citygate-recommended 7:30 minutes. To determine the cause, the next set of tables will present the individual segments of total response time—dispatch, crew turnout, and travel—to understand which measure(s) are responsible for the total time being longer than 7:30 minutes.

Finding #7: The call to arrival times, in all fire station areas, are significantly longer than best-practice and Citygate recommendations to deliver desirable urban area outcomes to serious fires and medical events.

[13] Harris County Emergency Corps was the Communications Center at the time of this data analysis.

5.3.2 Dispatch Processing Time

Dispatch processing time is the time it takes to answer the 9-1-1 call, determine the emergency, enter information into the computer-aided dispatch system, and alert the closet crew. Best-practice advice is for 90 percent of the calls to be dispatched in 90 seconds. Where language barriers exist, or medical self-help instructions are needed, these calls should be dispatched within 120 seconds. The performance of the Harris County Communications Center is shown in Table 24. These times do **not** include the PSAP transfer times from Pearland Police Communications or Brazoria County Sheriff's Office to Harris County Emergency Corps Communications, which include an additional 15 seconds.

Table 24—Call Processing – 90 Percent Performance

Station	RY 13/14	RY 14/15	RY 15/16
Department-Wide	02:24	02:18	02:43
Station 1	02:31	02:18	02:26
Station 2	02:28	02:48	02:08
Station 3	01:43	02:03	02:16
Station 4	02:24	02:14	02:25
Station 5	02:37	02:33	03:14

Finding #8: The performance of the previous Communications Center, at 2:43 minutes to 90 percent of the EMS and fire emergencies, was longer than published best-practice recommendations of 1:30.

Recommendation #1: With the recent change in dispatch centers, the City should monitor, on a monthly basis, the dispatch processing times, including the PSAP transfer times from the Pearland Police Communications Center.

5.3.3 Turnout Time

Turnout time is the time it takes for all crews to hear the dispatch message, don safety clothing, and begin moving the assigned apparatus.

Table 25—Turnout Time – 90 Percent Performance

Station	RY 13/14	RY 14/15	RY 15/16
Department-Wide	02:14	02:15	02:15
Station 1	02:12	02:14	02:14
Station 2	01:59	01:36	02:20
Station 3	02:20	02:24	02:04
Station 4	02:16	02:10	02:13
Station 5	02:15	02:19	02:23

While the NFPA recommends 60-80 seconds for turnout time, it has long been recognized as a standard rarely met in practical experience. Crews must not just hear the dispatch message; they must also don the mandated personal protective clothing for the type of emergency. Citygate has long recommended that, due to this and the floor plan design of some stations, agencies can reasonably achieve a 2:00-minute crew turnout time to 90 percent of the emergency incidents.

Finding #9: The City's overall turnout times are slightly longer then the Citygate recommendation of 2:00 minutes. With focus, these can be reduced.

5.3.4 Travel Time

Travel time is defined as the time element between when the dispatch center is notified, either verbally or electronically, that the unit is en route to the call, and when the first unit arrives at the address or location street front (not the patient's side). The travel times listed are for fire and EMS responses to each individual fire station area.

Table 26—First-Unit Travel Time – 90 Percent Performance

Station	RY 13/14	RY 14/15	RY 15/16
Department-Wide	10:08	10:16	09:44
Station 1	10:28	10:44	10:29
Station 2	09:24	10:01	09:00
Station 3	09:39	10:30	08:58
Station 4	09:49	09:29	09:01
Station 5	10:09	10:28	10:04

NFPA Standard 1710 recommends a 4:00-minute travel time goal in urban and suburban areas for the first-arriving unit. As seen in Table 26, none of the travel times meet this goal. There are several reasons for slower travel time, not all of which can be cost-effectively improved. Not enough fire stations, traffic congestion variation, non-grid road network designs in newer subdivisions, open spaces, and limited cross-access highways impact travel time.

Finding #10: The first-due unit travel times in the City are significantly longer than a positive-outcomes-based, best-practice goal of 4:00 minutes. As the geographical information systems modeling in this study also indicated, the only way to appreciably lower response times is to add more fire stations as revenues permit.

Pearland also has five paramedic transport ambulances, fully staffed with two personnel, with at least one being a paramedic. Best practices for ambulance travel time is 8:00 minutes, 90 percent of the time.

Table 27—First-Arrival Medic Unit Travel Time – 90 Percent Performance

Medic Unit	Time
Medic 1	11:45
Medic 2	11:35
Medic 3	10:00
Medic 4	11:35
Medic 5	12:00

Finding #11: All Pearland ambulance travel times are slower than a desirable goal of 8:00 minutes, 90 percent of the time.

Table 28 indicates the time each medic unit is out of service for 90 percent of its incidents. During this period, another ambulance must respond to the calls for that home unit. This further delays paramedic transport for some patients.

Table 28—Medic Unit Out of Service Time per Transport – 90 Percent Performance

Medic Unit	Minutes
Medic 1	91:00
Medic 2	90:00
Medic 3	88:00
Medic 4	91:00
Medic 5	90:00

Finding #12: All Pearland ambulance units are out of service approximately 90 minutes for each response.

In addition to the normal engines, quints, and medic units, Pearland also staffs an on-duty Battalion Chief (BC) daily. The Battalion Chief is responsible for the daily operations of the shift, and for emergency responses, and is the on-scene Incident Commander.

The following table shows the travel time for the on-shift Battalion Chief.

Table 29—First-Arrival Battalion Chief Travel Time – 90 Percent Performance

Battalion Chief	Minutes
Battalion 1	10:45

Finding #13: The City is too large for a single Battalion Chief / Incident Commander from one central location to reach incidents in 8:00 minutes travel time.

The Department staffs a Fire Captain—EMS for each shift. The Fire Captain—EMS is responsible for the daily functions of each medic unit and responding to incidents. Data reveals the Fire Captain—EMSs, for RY 2015/2016, responded to only 838 incidents, which is a little

less than 2.25 incidents per day. The Fire Captain—EMS is stationed at Fire Station 4. The following table shows the Fire Captain—EMS's travel time at 90 percent compliance by district.

Table 30—Fire Captain—EMS Travel Time – 90 Percent Performance

District	Travel Time
1	11:16
2	09:26
3	13:33
4	07:49
5	11:23
6	14:45
7	10:40
8	12:52
9	10:04
10	14:29
11	10:23
OOJ	14:06

Finding #14: The Fire Captain—EMS response numbers are reflective of only one unit covering and backing up the paramedics across the City. However, this unit is not the initial patient care unit; its purpose is to assist and provide Quality Assurance on the most serious incidents. As such, at the current incident volumes, the Fire Captain—EMS travel times are acceptable.

5.3.5 First Alarm (Effective Response Force) Performance to Building Fires

First Alarm or Effective Response Force Performance to Building Fires: The Department responds to building fires initially with a minimum of two engines, one quint, one medic unit, and one Battalion Chief.

This response force is large to provide enough units when fires are very serious at the time of the 9-1-1 call. However, in a given year, there are few building fires *in every station area* where the entire force is needed at the incident location. Therefore, the following response time sample size is very small.

The best representation for the First Alarm or Effective Response Force units is **travel** time across the City's street network. The NFPA 1710 recommendation is for all units to arrive within

8:00 minutes travel time. The reader is cautioned that some of these sample sizes are very small and can readily change year-to-year depending on the exact locations of serious fires and the various units' availability.

A "no occurrence" (designated by a blank cell) simply means that there were no building fires in the station areas listed where **all** of the units were needed at the emergency. Station 2 was not fully staffed until June 2016, so the calculations are not as accurate.

Table 31—Travel for ERF by Response Group[14]

Station	Overall	RY 13/14	RY 14/15	RY 15/16
Department-Wide	16:54	19:12	16:54	12:29
Station 1	16:54	16:31	16:54	10:21
Station 2				
Station 3	12:29			12:29
Station 4	12:01	12:01	11:04	14:51
Station 5	19:12	19:12	18:04	

Finding #15: The First Alarm travel times are significantly longer than a positive-outcome, best-practice-based recommendation of 8:00 minutes. The only solution to improve these times in all neighborhoods is to add more fire stations.

5.3.6 Simultaneous Incidents

Simultaneous incidents occur when other incidents are already underway at the time a new incident begins. During RY 2015/2016, 59.58 percent of incidents occurred while one or more other incidents were underway.

[14] Blank fields in the table indicate no ERF responses were recorded for that period in that station.

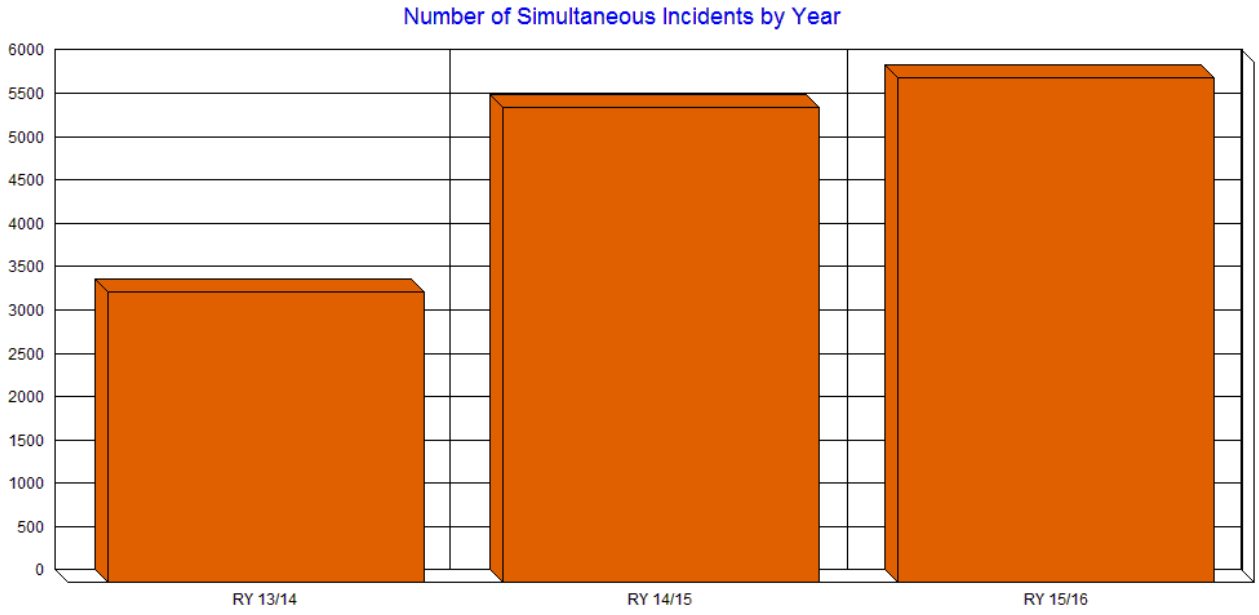
The following table shows the percentage of simultaneous incidents broken down by number of simultaneous incidents.

Table 32—Simultaneous Incident Proportions

Number of Incidents Underway	Proportion of Occurrence
1 or more simultaneous incidents	59.58
2 or more simultaneous incidents	25.05
3 or more simultaneous incidents	08.26

The following graph shows the number of simultaneous incidents by year.

Figure 13—Number of Simultaneous Incidents by Year



5.4 Station Demand Percentage and Unit-Hour Utilization

Due to the simultaneous incident rates measured in the previous table, this section presents the impact on individual fire station areas. This information is presented by the hour of day it occurs, which allows a determination to be made if the peak-hour demand is so high that response times suffer because units must cross the City to cover for overly busy units.

In the tables to follow, the different colors illustrate the variation in demand; the lowest rates of activity are green, progressing up to yellow, and finally red which indicates the greatest quantity of incidents or rate of activity.

The utilization percentage is calculated by two primary factors: the number of responses and duration of responses. The busiest stations are listed first. Stations 2 and 3 are newly staffed stations.

Table 33—Station Unit-Hour Utilization – RY 15/16

Hour	5	4	1	3	2
00:00	13.71%	13.90%	17.84%	7.09%	0.84%
01:00	12.32%	13.02%	12.43%	9.13%	0.47%
02:00	9.89%	9.23%	8.49%	7.01%	0.56%
03:00	9.98%	11.59%	8.33%	7.48%	1.06%
04:00	8.85%	12.90%	5.58%	7.50%	0.43%
05:00	9.91%	12.01%	10.00%	7.53%	0.43%
06:00	20.55%	15.20%	14.47%	12.38%	0.49%
07:00	14.86%	16.12%	17.34%	16.10%	1.79%
08:00	21.45%	21.49%	20.62%	16.85%	2.90%
09:00	27.56%	25.48%	22.94%	21.16%	1.62%
10:00	36.64%	27.44%	21.40%	18.60%	3.37%
11:00	35.42%	30.71%	22.79%	26.55%	1.10%
12:00	28.44%	28.25%	26.94%	22.82%	2.02%
13:00	34.40%	28.30%	24.12%	21.42%	3.36%
14:00	32.64%	31.16%	24.15%	21.11%	4.50%
15:00	33.84%	21.48%	21.46%	19.22%	3.63%
16:00	29.60%	25.93%	23.95%	23.19%	2.04%
17:00	32.39%	23.49%	29.00%	25.04%	4.33%
18:00	27.35%	26.14%	22.07%	25.15%	4.86%
19:00	29.04%	24.85%	20.16%	21.21%	2.46%
20:00	25.77%	22.64%	23.77%	18.96%	2.67%
21:00	24.37%	17.62%	17.53%	16.08%	2.94%
22:00	16.94%	14.96%	13.58%	20.99%	2.48%
23:00	24.41%	16.94%	14.26%	11.64%	1.39%
Overall	**23.35%**	**20.45%**	**18.47%**	**16.84%**	**2.15%**
Runs	**2,940**	**2,509**	**2,123**	**1,928**	**245**

The following table shows unit-hour utilization for the Department's EMS *vehicles*.

Table 33—EMS Vehicle Unit-Hour Utilization

Hour	M4	M1	M3	M5	M2
00:00	12.51%	16.15%	7.46%	9.03%	6.32%
01:00	14.17%	10.63%	11.06%	8.84%	4.83%
02:00	8.18%	7.98%	6.67%	8.92%	3.65%
03:00	11.12%	7.63%	8.23%	6.48%	3.70%
04:00	11.04%	5.40%	6.31%	6.70%	4.64%
05:00	11.68%	8.95%	6.96%	5.91%	4.44%
06:00	14.52%	13.81%	13.81%	15.15%	5.28%
07:00	13.69%	15.30%	12.64%	9.84%	6.58%
08:00	19.39%	21.12%	18.21%	14.36%	10.38%
09:00	23.47%	22.89%	19.82%	15.97%	12.79%
10:00	28.28%	25.07%	17.16%	25.22%	15.74%
11:00	28.82%	24.88%	27.15%	26.27%	15.17%
12:00	27.97%	27.29%	24.46%	19.10%	15.11%
13:00	28.16%	25.43%	20.06%	23.90%	17.25%
14:00	30.22%	25.35%	19.34%	23.26%	17.15%
15:00	23.09%	21.01%	20.88%	18.72%	16.59%
16:00	24.60%	26.13%	23.21%	19.17%	15.21%
17:00	21.92%	26.31%	22.59%	22.26%	16.41%
18:00	27.65%	24.29%	25.32%	20.27%	11.20%
19:00	23.76%	20.91%	19.32%	18.87%	14.29%
20:00	20.71%	22.54%	18.68%	16.93%	14.04%
21:00	17.04%	17.52%	16.15%	16.26%	8.92%
22:00	14.40%	12.63%	18.66%	12.03%	8.88%
23:00	16.87%	14.54%	12.39%	12.03%	10.37%
Overall	**19.72%**	**18.49%**	**16.52%**	**15.65%**	**10.79%**
Runs	**2,023**	**1,807**	**1,659**	**1,801**	**1,310**

What should be the maximum utilization percentage on a firefighting unit? During the nine-hour daytime work period, when crews on a 24-hour shift need to also pay attention to apparatus checkout, station duties, training, public education, and paperwork, plus required physical training and meal breaks, Citygate believes the maximum commitment UHU per hour *for an*

engine, quint, ladder or 24-hour ambulance unit should not exceed 30 percent. Beyond that, the most important element to suffer will be training hours.

For a dedicated unit, such as an ambulance or low-acuity squad working *less than* a 24-hour shift, such as an 8- to 12-hour shift, then UHU can rise to 40-50 percent at a maximum. At that UHU level, peak-hour squad crews must then have additional duty days for training only, and not responding to incidents, to meet their annual continuing education and training hours requirements.

Finding #16: The City's firefighting station areas are not yet close to a recommended maximum hourly saturation for incident demand. However, four of the five ambulances have reached, or are near, hourly saturation from mid-morning to early evening. At some point in the future, if the unit-hour utilization percentages stay at 30 percent for several hours in a row, an additional daytime ambulance may be necessary.

SECTION 6—SOC EVALUATION AND DEPLOYMENT RECOMMENDATION

6.1 OVERALL EVALUATION

SOC ELEMENT 8 OF 8
OVERALL EVALUATION

The Pearland Fire Department serves a diverse land use pattern that, in some locations, is geographically challenged with open spaces, and limited cross access streets, which limits quick response times. Population drives service demand, and development brings population. For a City of Pearland's size and population, the current five-fire-station plan is inadequate. The City is aware of the need for additional fire stations and infrastructure changes in the roadway system.

If the risk of fire is to be limited to only part of the inside of an affected building, for the foreseeable future, the City will need both a first-due firefighting unit and Effective Response Force (multiple-unit, also known as First Alarm) coverage in all parts of the City and possibly the most populated areas of the Extra Territorial Jurisdictions (ETJs), consistent with current best-practice recommendations.

While the volume of, and response times to, EMS incidents consume much of the City's attention, all communities need a "stand-by and readily available" firefighting force to respond to fires that break out. The Fire Department provides ambulance care but, in addition, the threat of fire, even if low, still requires resources *in addition to EMS hourly demand* for an effective response to emerging fires.

Stated simply, Pearland is already too large for five fire stations to provide desirable urban-area response times. Both the historical incident response times, and the geographic map models, clearly show this. Traffic congestion in a recovering economy also has a significant negative impact on response times. The only way to lower response times will be to add stations as economic growth permits.

The first deployment step for the City Council, in the near term, is to adopt updated and complete performance measures from which to set forth fire service outcome expectations and, on an annual budget basis, monitor and fund Fire Department performance.

6.1.1 Deployment Recommendations

Recommendation #2: **<u>Adopt City Council Deployment Measures Policies</u>**: The City's elected officials should adopt updated, complete performance measures to direct fire crew planning and to monitor the operation of the Department. The measures of time should be designed to save patients where medically possible and to keep small but serious fires from becoming greater-alarm fires. With this is mind, Citygate recommends the following measures:

2.1 <u>Distribution of Fire Stations</u>: To treat medical patients and control small fires, the first-due unit should arrive within 7:30 minutes, 90 percent of the time, from the receipt of the 9-1-1 call in the fire dispatch center. This equates to a 1:30-minute dispatch time, a 2:00-minute company turnout time, and a 4:00-minute drive time in the most populated areas.

2.2 <u>Multiple-Unit Effective Response Force for Serious Emergencies</u>: To confine fires near the room of origin, and to treat up to five medical patients at once, a multiple-unit response of a minimum of two engines, one quint, one medic unit, one Fire Captain—EMS, and one Battalion Chief, totaling 16 personnel, should arrive within 11:30 minutes from the time of 9-1-1 call receipt in fire dispatch, 90 percent of the time. This equates to a 1:30-minute fire dispatch time, a 2:00-minute company turnout time, and an 8:00-minute drive time spacing for multiple units in the most populated areas.

2.3 Hazardous Materials Response: Provide initial hazardous materials response designed to protect the community from the hazards associated with uncontrolled release of hazardous and toxic materials. The fundamental mission of the City response is to protect the public by isolating them from the event and waiting for additional trained personnel for mitigation. It can achieve this with a first company capable of investigating a hazmat release at the operations level within 11:30 minutes total response time, 90 percent of the time. After assessment and scene evaluation is completed, a determination will be made whether to request additional resources from the City's multiple-agency hazardous materials response partnership.

2.4 Technical Rescue: Respond to technical rescue emergencies as efficiently and effectively as possible with enough trained personnel to facilitate scene security and community safety until a trained Technical Rescue team from mutual aid companies can arrive. Deliver a first-due company for assessment of the rescue within 7:30 total response time minutes, 90 percent of the time. Assemble additional resources for technical rescue capable of initiating a rescue within a total response time of 11:30 minutes, 90 percent of the time. Safely complete rescue/extrication to ensure delivery of patient to a definitive care facility.

2.5 ALS Medical Services: The City should provide ALS services in all neighborhoods within 8 minutes travel time and thus 11:30 minutes total response time, 90 percent of the time.

Recommendation #3: Pearland needs three additional fire stations, with engines, as soon as funding permits in the northwest, southwest, and southeast areas of the City to better meet best outcome-based travel and response times.

Recommendation #4:	To improve aerial ladder unit coverage, Pearland should convert to staffing three dedicated aerial ladder trucks over time as the City continues to grow.
Recommendation #5:	To improve Battalion Chief coverage, Pearland could consider a second supervising chief unit in the western City.
Recommendation #6:	As the four busiest ambulances maintain 30 percent unit-hour utilization for multiple hours during the day, the City will need a sixth ambulance on a peak-hour schedule from 10:00am to 7:00pm at least Monday through Saturday.
Recommendation #7:	As the Department adds full-time firefighters, the goal should be to increase the number of paramedics to the point that every fire engine has one paramedic with equipment at all times to provide first responder paramedic care if the ambulance is not immediately available.

SECTION 7—HEADQUARTERS AND SUPPORT FUNCTIONS STAFFING UTILIZATION REVIEW

7.1 INTRODUCTION

Citygate's study includes a review of the Department's headquarters and support functions to ensure that the personnel are well trained, properly supported, and that enough prevention activities have been performed to reduce calls for service.

Citygate's methodology consisted of three steps:

- A review of the Department headquarters and support sections supporting documents
- Interviews with the lead personnel in each section
- Interviews with participants to corroborate the interview findings.

7.2 MANAGEMENT ORGANIZATION

NFPA 1201[15] states, in part, "the [department] shall have a leader and organizational structure that facilitates efficient and effective management of its resources to carry out its mandate as required [in its mission statement]."

A fire department needs a committed management organization that is properly sized, adequately trained, and appropriately supported. Compliance regulations for fire services operation are increasing, so the proper hiring, training, and supervision of response employees requires a serious leadership and general management commitment.

[15] NFPA 1201 – Standard for Providing Emergency Services to the Public (2015 Edition)

Figure 14—Pearland Fire Department Management Organization

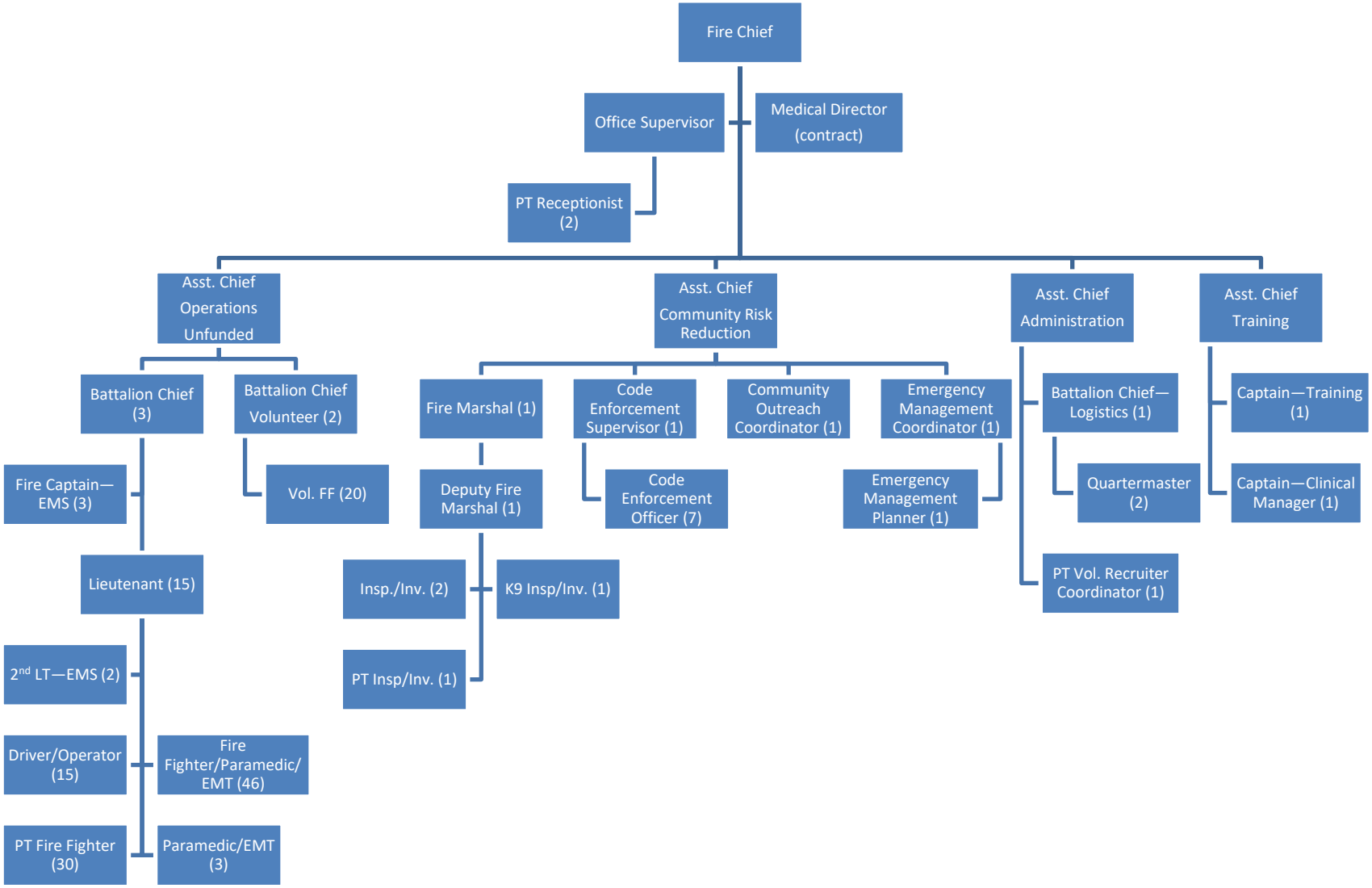


Figure 14 depicts the Department's current organizational structure as an effective chain of command and manageable span of control. However, since the Assistant Chief of Operations position is not funded, this shortage negatively impacts the Fire Chief's leadership time.

Citygate has determined that the management consisting of the Fire Chief and four Assistant Chiefs is currently, and will continue to be, appropriate to meet mandated responsibilities when all members gain additional knowledge and skills in their positions, and all positions are filled and staffed. An appropriate organizational chart and structure was developed with the merger between the previous EMS Department and the Fire Department; however, the experience, breadth, and depth of the personnel in the Fire Department are not at the optimal level. The City and Fire Chief recognize this, and are developing the knowledge and skills of the Department's personnel.

There is sufficient structural capacity and depth to conduct organizational performance benchmarking / ongoing evaluation, long-term strategic planning, risk analysis, and related effective community risk reduction measures, along with more effective community engagement.

Qualifications for chief officers are consistent with recognized best practices, including a combination of undergraduate, college-level education; organizational experience; and professional training and certifications.

7.3 Operations Division

The Operations Division is the largest division in the Department. It consists of three Battalion Chiefs (one for each shift), two Volunteer Battalion Chiefs, three Fire Captain—EMSs (one per shift), 15 Lieutenants (Company Officers), one Second Lieutenant (Field Training Officer for Paramedics), 15 Driver/Operators, 46 Firefighter/Paramedics, 30 Part-time Firefighters, 20 Volunteer Firefighters, and three Paramedic/EMTs. The part-time and volunteer Firefighter positions are trained and certified firefighters that assume roles on each shift to augment station staffing as needed.

The Division's responsibilities include responding to emergent and non-emergent incidents, and assisting the community in mitigating the incidents. During fire station tours and community events, the Division has limited opportunity to meet with the public.

The Fire Captain—EMS assigned to each shift performs a variety of duties including narcotics delivery, a limited number of incident responses, report reviews and Quality Assurance, and conducts limited EMS training of personnel as needed. Some Fire Captain—EMS position requirements are duplicative with the Clinical Manager position in the Training Division, especially the Quality Assurance and Continuous Quality Improvement of all personnel.

The Fire Chief currently assumes the unfunded Operations Chief position role. Operations Chiefs are typically very busy, assuring continuity between shifts, performing shift training, leadership training for Battalion Chiefs, and with the overall, daily leadership and direction of the Department. This detail and coordination work currently falls to the Fire Chief, leaving him far too little time to work on planning, future growth, budgeting, and multiple-agency working relationships.

Three Shift Battalion Chiefs lead and manage their individual shifts and assure shift cohesiveness and operations. The Shift Battalion Chiefs are responsible for incident command, safety and training on each of their shifts, as well as daily operations and scheduling. The Battalion Chiefs provided Citygate with a daily timetable of their tasks. It appears that the Battalion Chiefs are so busy with administrative requirements that they only have time to minimally assure that the needed shift training and supervision of their shifts are completed.

During emergency incidents, the Battalion Chief assumes incident command and is responsible for firefighter and scene safety. These two tasks are not completed well by one individual. The Department does not have a dedicated Safety Officer for incident responses or for the overall Department Health and Safety Program. At present, a Fire Captain—EMS or a chief officer from headquarters will respond to partially fill the safety role.

The Operations Division, like all other divisions, has numerous data to monitor its performance. Important data include incident locations, type of incident, alarm processing time, unit response times, turnout times, and travel times for all units. The Division has access to this data through their Records Management System (RMS), the Dispatch Center, and the PSAP.

Finding #17: The Department's Operations Chief position is unfunded and its role is currently assigned to the Fire Chief. With the leadership responsibilities of the Fire Chief, the continued effort to blend the Fire and EMS organizations into one cohesive department, and to implement the Strategic Plan, the added responsibility of the Operations Chief is an impediment to accomplishing the Department's goals.

7.3.1 Part-time and Volunteer Staffing Costs

The Department's daily staffing is accomplished by using a combination of full-time and part-time personnel and volunteers. Part-time personnel and volunteers are required to work a certain number of shifts per year. Managing the scheduling of these personnel and assuring proper shift staffing is a large undertaking.

The Department uses part-time employees to augment on-duty daily staffing by using these employees to serve as the fourth person on each fire engine. Additionally, part-time employees are used when daily staff are on vacation, sick, or other types of leave. These part-time employees typically come from other local fire departments (volunteer and career) that have the requisite Texas Commission on Fire Protection (TCFP) Certifications. Although this program is important to daily staffing, it also creates additional burdens and costs for the City and the Department.

Each part-time and volunteer employee is required to have a complete set of uniforms and the Personal Protective Equipment (PPE) required for fire combat and other emergency situations. Even though Pearland's part-time employees come from other local career and volunteer fire agencies, they cannot use their home department's PPE for Pearland. Instead, they must use Pearland's PPE, as their home departments do not want their expensive and annually inspected PPE used elsewhere.

The requirements of the NFPA and the Federal Occupational Safety and Health Administration (OSHA) require that all personnel have PPE sized to fit each individual. The cost for one complete set of PPE is approximately $3,000 per set plus an additional $500 for the individually sized Self Contained Breathing Apparatus masks. The additional PPE for technical rescues, hazardous materials responses, etc., required for Pearland, costs an additional $1,000 per set. Total PPE cost per employee is approximately $4,500. There also must be spare PPE that can be worn when a contaminated PPE is out of service for cleaning or inspection. The total cost for two sets of PPE is approximately $9,000. When a part-time employee leaves Pearland, his/her PPE is taken out of service. When a new staff member is hired, he/she must be correctly fitted for PPE, which creates another new expense. For senior, part-time firefighters, the PPE also must be continually inspected and repaired as needed. Currently, Pearland has approximately 27 active, part-time firefighters and another 27 volunteers. For just one new set of issued PPE per part-time firefighter, the total new equipment cost would be $243,000 not including repair costs.

PPE costs are not the only costs to the City for part-time and volunteer personnel. The Battalion Chief must create the shift schedule utilizing the various part-time and volunteer firefighters. Because scheduling these "variable" staff positions is logistically more difficult than scheduling traditional full-time positions, the Battalion Chief may sometimes spend several hours per shift just to schedule personnel. The 54 supplemental employees serve the City of Pearland as their second job, and thus it can be presumed that Pearland is not their primary work commitment. If other issues arise for them, they may choose to miss a Pearland shift, which will require more time and energy resources from the Battalion Chief to amend.

In addition to scheduling complications caused by part-time personnel, as illustrated in Section 7.6.3 to follow in this report, the number of hours for training part-time and volunteer employees are extremely low and non-compliant with Texas and ISO requirements. This has much to do

with the part-time and volunteer employees' other work schedules. For example, they work Pearland shifts when they are available, and not working their normal shift at another Fire Department. As a result, they are missing the required training for Pearland and the ISO.

In a rapidly growing community and Fire Department, it is a challenge to prepare qualified staff for a new fire station. The time it takes to recruit, train, and educate employees specifically for Pearland is significant. Because of this, the Department must begin recruiting staff well before the station is ready to open.

To assist in the rapid opening of newly authorized fire stations, the City should consider hiring full-time firefighters a year before a new station opens. Doing so would lessen the burden of scheduling part-time employees, and allow firefighters to be trained and pass probation before the new station opens.

Finding #18: To assure minimum daily shift staffing, the Department uses several part-time and volunteer positions on each shift. The Department needs to prepare a detailed cost analysis to compare all of the part-time program costs including equipment, training, and scheduling time against slowly increasing the number of full-time employees.

7.3.2 Firefighter Health, Safety, and Risk Management

A formal Health, Safety, and Risk Management Program that ensures the safety and health of personnel is imperative. A complete set of Administrative Policies/Procedures and Standard Operating Guidelines for Firefighter safety, both in-station and on-scene of an emergency, is required to assure firefighter health and wellness, cohesive operations between shifts, and safety of all personnel. In the document review process for this study, Citygate found no formal Health and Safety Program, Department Risk Management Program, or complete set of Standard Operating Procedures/Guidelines (SOP/SOG) for emergency incidents or daily routines.

The fire service has improved firefighter safety and continues to do so. A Fire Department is required to have a complete Health and Safety Program to assure firefighter health and safety not only on the incident scene but also in daily activities. The program is also impacts fire station design, apparatus design and construction. Healthy living, exercise, medical exams, and proper use of protective equipment limit the exposure to injury and illness during firefighting and EMS calls.

The Department has contracted with a physician to perform annual employee physicals. The physical is based on NFPA 1582 requirements. In addition to being medically fit, firefighters must also be physically fit to perform their duties on emergency incidents, which are very

strenuous on their bodies and minds. To ensure physical stamina and well-being, the Department permits each firefighter to exercise every shift in the station to maintain their fitness for firefighting duties.

Integral to any Health and Safety program are the written employee directives, policies, procedures, and guidelines that detail how each should operate during an emergency incident and in performing daily routines. With three daily duty shifts totaling 32 daily personnel, consistent Department safety and service are imperative. Proper and detailed policies, procedures, and guidelines, together with their enforcement, provide this consistency. Citygate's documentation review showed a small number of existing Department personnel safety and health policies.

On an incident scene, safety of personnel and accountability for their locations and tasks is a primary concern and task for the Incident Commander. Citygate's review of the organizational chart and the on-scene organizational structure for fire ground operations showed that there is no dedicated Safety Officer assigned to responses.

Part of a progressive Health and Safety program is assuring that personnel have the correct PPE for fire, EMS, and specialized responses as well as daily station wear (uniforms). The firefighter PPE ensemble for fire suppression incidents includes station wear, protective coats, pants, helmets, gloves, and protective hoods as well as Self-Contained Breathing Apparatus (SCBA). OSHA for the federal government mandates employee safety with regard to SCBA use and testing for chemical exposures, technical rescue responses, and hazardous material responses. Other standard-making organizations such as the American National Standards Institute (ANSI), National Institute of Occupational Safety and Health (NIOSH), National Institute of Standards and Testing (NIST), the NFPA, and the TCFP also have an impact on firefighter safety and health.

The PPE that firefighters wear for both normal station wear and on emergency incidents are valuable safety equipment. Each firefighter PPE is sized and fitted to the individual, assuring the best protection from contaminants, heat, and smoke. During fire combat, firefighters are exposed to numerous chemicals and toxic smoke from the off-gassing of the materials on fire. Many of these gases are extremely harmful to personal health.

TCFP requires all PPE to be inspected annually, and cleaned and decontaminated after each use. All PPE must be inspected annually, and cleaned and decontaminated after each use to comply with NFPA and NIOSH standards. The typical life for PPE gear in Pearland is 5 years.

To preclude firefighters' continuous exposure to the harmful contaminants, NFPA and NIOSH require that, until cleaning/decontamination after the exposure is complete, personnel should not use that PPE. This mandate significantly precludes the chances of continuous exposure to contaminants. To accomplish this, firefighters perform what is referred to as "Gross Decon" while still on the emergency scene. Gross decon is the process of removing contaminants

resulting from fire and smoke from the firefighters' PPE while still on the incident scene. Following gross decon, the PPE is then bagged and thoroughly cleaned at a fire station before its next use. In the City, this cleaning is conducted in several, but not all fire stations. PPE is washed using a special extraction-type washing machine, and then the ensemble is air dried. This process usually takes 24 hours. Annual PPE inspections and repairs are conducted off site and by a private vendor.

While the PPE is either being cleaned after an incident, or off site with the inspection vendor, on-duty employees will still require correct fitting PPE to continue their duties.

Department staff states that there are spare sets of PPE available for approximately three to five crews (12-20 personnel). On-duty staffing for each shift is 32 personnel. The spare sets of turnout gear are older pieces of gear that were replaced by newer firefighter PPE. Staff also states that the spare PPE is reaching the end of its useful life and code requirements for disposal. As the gear continues to age, the number of available spare sets in inventory will decrease.

Finding #19: The Department does not have a dedicated Health and Safety Officer to immediately respond to all emergency incidents and monitor the Department's Health and Safety Program on scene and during normal daily operations.

Finding #20: Citygate commends the Department for having a required Employee Medical Exam program, and for facilitating the ability of staff to exercise on shift.

Finding #21: The Department does not have a fully completed set of policies, procedures, or standard operating guidelines for daily routines or emergency incidents. Given the time since the EMS merger, and the hiring of new firefighters, this is understandable.

Finding #22: There is an overlap in job duties between the Clinical Manager and the on-shift Fire Captain—EMS for Quality Assurance and Continuous Quality Improvement, training, and performance monitoring. Typically, in a department this size, the Clinical Manager would perform all EMS Quality Assurance and Continuous Quality Improvement.

Finding #23: The Department does not have an adequate number of spare Personal Protective Equipment (PPE) sets for all employees during the required PPE cleaning after fire combat, nor when the gear is unavailable due to annual inspections.

7.4 COMMUNITY RISK REDUCTION DIVISION

The Community Risk Reduction (CRR) Division staff consists of:

- 1 Assistant Chief
- 1 Fire Marshal
- 1 Deputy Fire Marshal
- 1 K9 Handler Fire Inspector/Investigator
- 2 Fire Inspectors/Investigators
- 1 part-time Fire Inspector/Investigator
- 1 Code Enforcement Supervisor
- 7 Code Enforcement Officers

These personnel are responsible for health code and municipal code compliance. In addition, the Division also has an Emergency Management Planner responsible for the City's Emergency Management Plan and Procedures. As of 2017, the Division also includes an Emergency Management Coordinator to assist in emergency planning. In addition to normal fire prevention duties, the Division is also tasked with health and safety code inspections for foster homes and restaurants, as well as other municipal code enforcement actions.

The CRR Division provides a variety of services; some are atypical of an urban Fire Department. The programs normally associated fire prevention duties include development/building plan review; construction/occupancy inspections, fire protection systems plan review, and related inspections; and fire and life safety inspections in non-residential occupancies. In addition, the Division is also responsible for all inspections required by the state of Texas for food preparation facilities. This includes all kitchens in foster homes, restaurants, and food trucks, as well as fairs and community events where food is available for consumption.

The Division is tasked with municipal code enforcement including weed abatement, property line encroachment issues, illegal dumping, and storm water runoff. The Division issues all citations for any violation of the municipal code that were witnessed by any City employee.

The Division recently conducted an analysis to determine fire inspection frequency for specific occupancies in the community. The assessment reviewed risk severity, probability of an occurrence in the specific type of occupancy, and demographics. The analysis determined that certain occupancy types and inspection frequencies should be adjusted. This has already begun.

There are approximately 4,200 businesses within the City. In FY 2015/2016, the Division accomplished inspections for 50 percent of those businesses. Additionally, Division personnel

inspected 832 buildings for a Certificate of Occupancy, 344 fire suppression and detection systems, and 126 hazard complaints. The Department Operations personnel (line firefighters) conducted 286 annual occupancy inspections for primarily low-hazard businesses. Between the Division and the Fire Operations personnel, they noted and corrected inspections 3,393 violations.

The Division's inspection staff is assigned specific geographical areas for their duties. These geographical areas consist of a myriad of occupancy types and classifications. The staff does not currently rotate geographic areas to improve their knowledge and abilities, or to reduce burnout and complacency.

The Division performs all new construction plan and tenant improvement plan reviews for the City's buildings and occupancies. New construction/development and plan review is the responsibility of the three Fire Inspector/Investigators that are each assigned to a separate geographical area. Based on Citygate's review, the Division performed 648 plan checks for FY 2015/2016.

The Department does not collect fees or issue operating permits for occupancies that create a significant hazard to the citizens and occupants, as permitted by the Fire Code. The permit would include an annual fire safety inspection by either the Division or the on-shift engine companies. The permits would allow the CRR Division to more effectively manage the facilities and assure compliance with codes while improving citizen and firefighter safety.

Public education is a required and necessary tool to help reduce death and injury to the City's citizens. Pearland has the potential to suffer serious damage and life loss from natural disasters such as hurricanes and flooding. The Division has, for many years, spent the entire month of October visiting public and private schools. Annually, the Division typically educates over 5,000 adults and over 11,000 children, including car seat installation days, impaired and distracted driving events, CPR classes, smoke alarm installations, Knapp Senior Center events, local hurricane preparedness presentations, and a Countywide hurricane preparedness event. In FY 2015/2016, the Division accomplished 83 public education outreaches reaching 7,611 children and 8,757 adults.[16]

Fire investigation also falls under the purview of the Division. The initial investigation for fire cause and origin is conducted by the on-scene apparatus company officer. If additional assistance is required, the company officer requests the Fire Investigator's involvement. In FY 2015/2016, the CRR Division conducted 26 fire investigations and, in all cases, the cause was determined. There were also six arson cases; four of which were determined, and two are still undetermined.

[16] Data derived from Pearland Fire Department Records Management System

The City's environmental and health inspections, and municipal code compliance inspections, fall under the responsibility of the CRR Division. Included are all health and safety inspections for foster homes for children, restaurant inspections for health code compliance, and restaurant kitchen inspections for health code compliance.

In FY 2015/2016, the Division completed 4,596 facility inspections for health and environmental codes. The Division found 4,603 violations; 3,983 were brought into voluntary compliance. The Inspectors also responded to seven environmental crimes, five of which the staff cleared.

Finding #24: The CRR Division has excellent data collection system to track and review all performance measures for the Division.

Finding #25: The CRR Division does not issue permits or collect fees for occupancy use or inspections. Doing so would help recover some of the expense for those services.

Finding #26: The CRR Division does not rotate plan check or inspection geographical areas between the three Fire Inspectors, which would allow for professional growth and area cross-training for the employees.

Finding #27: The CRR Division could develop a more formalized Fire and Life Safety Education program for the community, using emergency incident data and known risks, to set measurable goals and design education programs to reduce fire loss and life loss, and prevent injuries to the residents.

7.5 ADMINISTRATION DIVISION

The Administration Division is responsible for all Department budgeting and finance; logistics; volunteer, part-time, and full-time recruitment; information technology; communications repair; vehicle, equipment, and station maintenance; facility maintenance; and administrative offices cleaning.

The Division is staffed with an Assistant Chief, Battalion Chief of Logistics, two Quartermasters, and a part-time Recruit Coordinator. The Assistant Chief of Administration is responsible for managing the day-to-day operations and activities of the Division, as well as the sections, programs, resources, and personnel.

The Administration Battalion Chief functions as the Manager of Logistics in addition to other duties assigned by the Fire Chief or Assistant Chief.

The two Quartermasters perform a variety of tasks associated with the maintenance of Fire Department facilities, equipment, office furniture, and uniforms, in addition to delivering supplies and vehicles for maintenance to the contracted locations and assuring the firefighters' PPE is cleaned and inspected as needed.

The Recruit Coordinator performs administrative and technical work in the Pearland Fire Department. It is the Recruit Coordinator's responsibility to coordinate the overall volunteer firefighter recruitment program for the Department, and to facilitate the recruitment and retention of volunteer firefighters. The position also assists with other administrative tasks.

The Division has no performance measures that track productivity or help determine the validity of the programs within the Division. In order for any fire department to operate efficiently, it is crucial for all divisions to enact performance measures and perform effective data collection and analysis.

Finding #28: The City Information Technology Department, in conjunction with the Department, has recently located a Technology Specialist in Fire Administration to assist with information technology and computers in the Department.

Finding #29: The current Battalion Chief in the Administration Division functions as the Manager of Logistics. The majority of work for the Division is related to purchasing, contract administration, and personnel functions. As the Department grows, a non-sworn Business Manager should be added to perform routine processing functions.

7.6 TRAINING DIVISION

The Training Division is responsible for all Department training and is staffed by an Assistant Chief and two Training Captains, one of whom serves as the Clinical Manager. The Division relies very heavily on the on-shift Battalion Chiefs and Lieutenants to conduct all of the necessary training of its personnel, and to ensure compliance. The Assistant Chief provides program design and overall management and Quality Assurance.

The Training Captain is responsible for analyzing individual and organizational training needs and for ensuring compliance and certification by the TCFP, Texas Department of State Health Services Emergency Medical Services, the Texas State Fireman and Fire Marshal's Association, and the limited number of Department Standard Operating Guidelines and Standard Operating Procedures. The Captain conducts a limited amount of on-shift training for personnel due to other tasks assigned to that individual.

The Clinical Manager is responsible for reviewing all EMS run reports for accuracy of documentation, appropriate clinical care, and appropriate patient disposition/transport decisions. The Clinical Manager also identifies training and community needs based on trend analysis on the types of calls and interventions performed in the field, in addition to being responsible for researching and making recommendations regarding medical protocols and types of equipment/medications used by the Department. The Clinical Manager also serves as the EMS training officer.

The Fire Captain—EMS shift positions transferred over with the merger of the EMS Department into the Fire Department. As such, they are still primarily handling oversight of patient care and assurance of paramedic training. Some of these duties are handled by the office-based Clinical Manager. In Citygate's experience, the 40-hour position is best used for overall chart review and quality of care assurance programs. The roles of the shift positions can be expanded to function as both EMS and fire suppression support and oversight.

The Clinical Manager should be reviewing all the serious cases, trending care data, and constructing continuing education offerings for skill retention. This position will also be the liaison to medical direction and hospital partners. The Clinical Manager would only respond to very serious events and occasionally ride with newer paramedics for field checks when requested/needed.

The 24-hour-based Captain—EMS positions, once certified in fire suppression, will provide quality control for **both** suppression and EMS. That said, they would oversee the provision and quality of training and the maintenance of certifications for all their personnel. They will observe field personnel in action, especially the very new and others with issues identified by their company officer, Clinical Manager, or the Training Division. They will provide broad assistance to the Battalion Chiefs in managing day-to-day, routine activities of the Division. They will respond to all Battalion-Chief-level incidents as the Safety/Communications aid.

The field EMS Captain—EMS positions, time permitting, could perform low-acuity patient chart reviews to check for completion and adherence to standards, or the Department can consider a Quality Improvement Committee of line personnel who perform low-acuity peer reviews of patient charts on a periodic basis.

Finding #30: The Clinical Manager currently only reviews high acuity and random EMS reports for Quality Assurance and Continuous Quality Improvement for all personnel. According to their position description and tracked hours, the on-shift Fire Captain—EMSs also perform the same function on all incidents.

Finding #31: Neither the Training Captain nor the Clinical Manager have adequate time to aid and deliver on-shift training for personnel due to collateral duties.

7.6.1 Training Best Practices

In general, the Training Division has established best practices for fire service education and training, including the ISO and the TCFP. The Division's goal is for all personnel to accomplish two hours of training per shift per firefighter. This goal meets best practices and equates to approximately 240 hours per year of training for each firefighter.

Each of the following NFPA standards has been reviewed by the Department and either been formally adopted, partially adopted, or not adopted. If the Department has not adopted a standard, it is because the Department uses a different standard.

- NFPA 1001 *Standard for Fire Fighter Professional Qualifications*—This standard establishes the basic qualifications for Firefighter I and II. *Partially Adopted*
- NFPA 1002 *Standard for Fire Apparatus Driver Operator Professional Qualifications*—The standard sets forth the performance objectives for driver/operators of all types of fire apparatus and emergency vehicles. *Partially Adopted.*
- NFPA 1006 *Standard for Technical Rescue Personnel Professional Qualifications*—This standard delineates the performance objectives for firefighters who perform technical rescue. *Partially Adopted.*
- NFPA 1021 *Standard for Fire Officer Professional Qualifications*—This standard covers the four levels of fire officer progression: Fire Officer I, II, III, and IV. *Partially Adopted.*
- NFPA 1031 *Standard for Professional Qualifications for Fire Inspector and Plan Examiner*—This standard describes the professional performances of the fire inspector and plan examiner. *Partially Adopted.*
- NFPA 1041 *Standard for Fire Service Instructor Professional Qualifications*—This standard guides the development of the fire-service training instructor through the three levels of advancement: Instructor I, II, and III. *Partially Adopted.*
- NFPA 1401 *Recommended Practice for Fire Service Training Reports and Records*—This standard includes all aspects of training documentation, such as training schedules, reports, records, legal characteristics of training records,

record management systems (RMS), and means to evaluate the RMS. *Partially Adopted.*

- NFPA 1403 *Standard on Live Fire Training Evolutions*—This standard outlines the procedures required for safe live fire training. *Formally Adopted*
- NFPA 1404 *Standard for Fire Service Respiratory Protection Training*—This standard covers the proper use, inspection, maintenance, and program administration of self-contained breathing apparatuses (SCBAs). *Partially Adopted.*
- NFPA 1451 *Standard for a Fire and Emergency Service Vehicle Operations Training Program*—This standard covers the minimum requirements of a vehicle operations training program. *Partially Adopted.*

7.6.2 Department Training Program Review

For fire departments to perform required tasks safely and correctly, a formal training program based on best practices should be in place. A program for the development of personnel in specialized knowledge, skills, and abilities (KSAs) is required by every fire department to ensure firefighter safety and the capability to perform all firefighter tasks.

A specific master training program for firefighters is necessary to identify and ensure personnel are maintaining and training all of the KSAs required for their positions. In documentation review, Citygate did not find a dedicated and specific Department training program for personnel.

The Department participates with and uses the guidance of the TCFP requirements, ISO guidelines, and NFPA requirements for career and volunteer personnel training. The TCFP focuses on the education and mental preparation of firefighters, company officers, and chief officers, with emphasis on the skills and abilities that can be applied directly to job performance. Both the ISO and the TCFP have identified minimum training hours and skills for annual firefighter training needs. Typically, this is two hours per shift per employee. Specialty classes for specialists, such as prevention, fire investigation, fire code enforcement, health code, and municipal code enforcement, are assigned on a case-by-case basis depending on funding and need.

Finding #32: The Department does not have a Career Development Guide specific to Pearland for employees to direct them regarding training needs and requirements for promotions and career advancement. The Department does use the Second Edition of the International Association of Fire Chiefs Officer Development Handbook as a guide.

7.6.3 Training Records Review

The Department uses FIREHOUSE Records Management System (RMS) to record personnel training. Pearland's RMS tracks the number of training hours and subject matter for each member. It is critical the Department have a system for tracking personnel training and subject matter, as well as hours devoted to that training. For management purposes, it is more important that the Division be able to track those members who are required to have training and have not yet completed it. In addition to the full-time staff, Pearland uses a combination of part-time employees and volunteers for their daily staffing requirements, while also require training and certifications.

Citygate's review of volunteers' and part-time employees' training hours found large deficiencies in the hours completed per individual. Even though most of the Department's part-time employees work as firefighters full-time in other area departments, there is no assurance that the training they have received in their home department is consistent with Pearland's requirements.

The Department's training for career members is based on compliance with the ISO, TCFP, the Texas State Fireman and Fire Marshal's Association (paid volunteers only), and Department Standard Operating Guidelines and Standard Operating Procedures. Those best practices require two hours per employee per shift, or 240 hours annually.

Citygate reviewed all full-time firefighters' training records to determine the total number of hours of annual training they received from September 1, 2015 to September 1, 2016. The results are summarized in Table 34.

Table 34—Training Hours for All Shifts

Shift	Total Annual Hours	Average Annual Hours per Employee
A	2,043	72.75
B	1,787[17]	49.59
C	2,379	87.25
Part-Time Employees	600.42	24
Volunteers	245	13.6

According to training staff, the on-shift Lieutenants are required to provide and monitor their shift training hours, and the Battalion Chiefs monitor the Lieutenants through training reports submitted by the company.

Finding #33: The Department is not meeting its goal of 240 hours of annual training for each full-time employee. According to staff, there are multiple reasons for the non-compliance.

Finding #34: Despite the requirement to complete 240 hours of training annually, total training hours for volunteer firefighters and part-time employees is extremely low.

7.6.4 Training Center

The Training Center has been in existence for several years. The center has a training tower and drafting pit for pump operations. The Department has a master plan for the development of the property over a period of time to include needed props and a safe, live fire burn building.

Finding #35: The current Training Center is a good start for future development and enhancements for future training needs for new and veteran employees.

[17] These hours include 200 hours for one employee at the National Fire Academy and are not used in the annual hours per employee

7.6.5 Succession Planning and Training Impact of New Employees

The City of Pearland Fire Department line staff is very young in service years, both in the fire service and in Pearland. Pearland Fire Department was formed as an all-volunteer fire department in 1946. The City of Pearland hired paid staff in 2007 and then merged its organizations into one cohesive fire service delivery system. Because Pearland was the second fastest growing City in Texas, it had to change rapidly to meet the needs of the community. The Fire Department is a combination type department, using full-time, part-time, and volunteer employees to staff daily for emergencies.

The average tenure of full- and part-time firefighters in Pearland is just over four years, and the average fire service tenure is 7.4 years. All of the members are certified and trained firefighters under Texas regulations. However, firefighters with only four to seven years of experience are hardly veterans. In addition, in a suburban department, firefighters are not exposed to high volumes of critical incidents. As such, training, supervision, and quality control must be nothing short of excellent.

There is also a need to promote line supervisors and Battalion Chiefs as stations are added, which sometimes means promoting an employee that has passed a test, but may not be seasoned enough in the career to train and mentor others.

As the Department grows, it will be necessary to identify which KSAs the City of Pearland requires for its Fire Department leaders for promotions, new fire stations opening, and senior employees retiring.

Succession planning is the Department's way to identify and develop Department members to fill those newly created positions and be able to perform the job correctly on the first day they are promoted. Planning for the future allows members who desire to be promoted the opportunity to prepare for that time, and it gives the City a means to help and prepare employees.

Citygate has recommended a Career Development Guide and Program, allowing all employees to know what KSAs are required for each position within the Department. The Guide is a beginning basis for succession planning.

Such training takes a robust training staff, which should be enhanced. It also takes "time in grade" to hone and practice new skills with oversight. For these reasons, Citygate has also suggested the Department overstaff and hire personnel needed for new fire stations well in advance of the need. In addition to succession training and experience, the overstaff positions will also decrease the need for part-time firefighters and their costs.

7.7 EMERGENCY MEDICAL SERVICES PROGRAM

The Department operates its EMS program via its fire apparatus and five medic transport (ambulance) units across the City, the Extra Territorial Jurisdiction (ETJ) areas, and the City of Brookside Village via annual contract.

The ambulances are staffed with two firefighters, and at least one must be a paramedic. Emergency medical training and responses has a full-time Fire Captain—EMS on each shift to assist with tracking patient care, Quality Assurance, and certification records. These positions also conduct very limited in-service training for the paramedics. In addition, there is also the Clinical Manager in the Training Division.

Each of the three engine companies and two quint companies is staffed with a minimum of four personnel per day. There is no minimum staffing for paramedics on these companies. However, the Department has eleven total paramedics per shift; potentially, there might be several additional medics on duty daily if needed. The only Department requirement is a minimum of one paramedic per ambulance on each shift. The American Heart Association recommends two paramedics operating in case of the most serious EMS emergencies.

Data analysis for the five Medic Ambulances for FY 2015/2016 indicates travel times at approximately 11:30 minutes, 90 percent of the time. Analysis also indicates that each medic unit is out of service for approximately one and a half hours per incident to which they respond. This time includes transport time to the hospital, restocking and cleaning of the unit, and wait time for patient transfer at the receiving hospital. This delay, due to travel time back and forth to the receiving hospital and wait time for patient transfer, means another unit must take any additional calls in place of the unit at the hospital.

While the goal is always to deliver the best patient care, in many instances it is not up to the Department to determine that method for providing care. Unlike other aspects of firefighting, EMS care is heavily regulated and burdened with mandated oversight requirements. All of these requirements, while medically necessary, add to the Department's overhead cost to provide EMS care. The Department has no choice but to follow laws and regulations related to training, clinical oversight, data for tracking trends in care and paramedic skills, shelf-life of medical supplies, biomedical equipment certification, controlled drug tracking, and other regulated responsibilities.

The concept of providing emphasis on Continuous Quality Improvement (CQI) in patient care delivery became a top priority in EMS in the early 1990s. EMS providers and EMS oversight agencies across the United States developed systems that guaranteed objective feedback about performance, both internally (to support CQI efforts) and externally (to demonstrate accountability to partners and oversight agencies).

An effective CQI program must be consistent and systematic, must be based on evidence, and must be free of any perceived or real punitive involvement. It will include a fact-based decision-making process that involves industry-accepted performance measures and comparison of treatment to standard protocols for patient conditions. It will foster learning and knowledge sharing, and will motivate care providers to be the best possible clinicians with every patient contact. CQI programs involve reviewing each patient care report for the agency to ensure accuracy, and coaching peers on learning points.

Clinical training, oversight, and command staff in the EMS program support the field personnel.

7.8 FLEET MANAGEMENT

The Pearland Fire Department utilizes contracted repair facilities for all vehicle maintenance. This service is scheduled and tracked in the Administration Division.

7.8.1 Fleet Maintenance and Repairs

Driver/engineers (commonly referred to as driver/operators) perform daily apparatus checks, wash and wax apparatus, clean and lube ladders, and perform limited preventive maintenance.

All apparatus maintenance is conducted by outside vendors. Ladder trucks, pumps, and ground ladders are all tested and certified by Underwriters Laboratory (UL). Fire hoses are tested by the Department on an annual basis as required by the NFPA.

7.8.2 Fire Response Apparatus

The Department's fire apparatus are listed in the table found in Appendix A.

The average front-line service of a fire engine (pumper) is thirteen years, with another five years in reserve service. Often, the mileage on fire apparatus will not be as high as might be expected from a similar commercial vehicle. However, after fifteen years, replacement parts become scarce and the wear and tear from fast starts and stops over the years is significant. None of the ten engines in Pearland's frontline fleet are over fifteen years old. Another way to evaluate the Department's apparatus is to consider the average age of the fleet. If fleet replacement has kept pace, the average age of the frontline fleet would be about seven to eight years.

Quint trucks, which are not used as frequently as fire engines (pumpers), have a life expectancy of twenty years, with five additional years of reserve service. The average age of the quint trucks should be about ten years. The average age of the two trucks is eleven years, well under the average age for replacement.

Finding #36: The average age of both the frontline and reserve engines is within the best-practice normal life expectancy of fire apparatus.

7.8.3 Emergency Medical Transport Vehicles

The Department's medic transport vehicles are listed in the table found in Appendix A.

The EMS response vehicles are used heavily in frontline service, much of which is start/stop. There is no best-practice recommendation on EMS response vehicle replacement; however, there are factors to consider:

- Proper preventative maintenance is the cornerstone for all vehicle reliability.
- While the City shop can perform necessary repairs, repairing an aging EMS vehicle that drives 24/7 through urban areas can become costly.
- Replacing vehicles is also an expensive option. Buying a new medic unit (chassis and patient compartment) costs $175,000 or more.
- Determining the time to replace a medic unit requires a constant review of the vehicle's repair history for costs incurred and repeat problems. Once a significant amount of money is spent, or there has been extended vehicle downtime, it is time to replace the unit. The most important consideration is the vehicle's reliability.
- The collected data of some EMS operations suggests that EMS vehicles should be replaced every three years or 100,000 miles, whichever comes first, since this is when reliability begins to suffer. Large rescue trucks, because of the heavier duty suspension and transmission, can easily reach 200,000 miles in service as long as the correct maintenance is performed.
- The three-year/100,000-mile mark is not an absolute. Monitoring the cost of repairing a vehicle should indicate when it is time for replacement.

7.9 Office Support Professional Positions

The Department only has three office support positions—an office supervisor and two part-time receptionist positions. For a growing highly regulated public safety agency, this is an insufficient number by any measure. Almost all mid-managers and technical staff are performing their own office support work for record keeping and processing routine information. In Citygate's experience, the Department now needs at least four full-time support professionals:

- 1 Office Supervisor
- 1 Reception, general support
- 2 Administrative Assistant positions, one in Training and one in Administration

As the Department grows, five such positions are not unreasonable. All of the office support staff should report to the Assistant Chief of Administration.

Finding #37: The Department at present has an insufficient number of office support professionals, which causes costlier mid-managers to perform their own support work, not the technical work they need to perform.

SECTION 8—HEADQUARTERS REVIEW RECOMMENDATIONS

8.1 OVERALL EVALUATION

SOC ELEMENT 8 OF 9
HEADQUARTERS RECOMMENDATIONS

Citygate's findings and recommendations for headquarters services, programs, and staffing should be taken in the context of a best-practice review. The Pearland Fire Department has made significant progress in the last 10 years. The current leadership is in the process of meeting best practices, and the community's expectations, and the Department's personnel and qualifications are outstanding.

However, the Department's organization of positions will likely continue to grow over at least the next 10 years. Therefore, headquarters services need to be scalable to manage current programs and to prepare the personnel and capital assets for the future. This is difficult for a smaller agency.

Citygate cautions the City's leadership that adding fire stations and personnel is not enough. The line personnel also have to be led, equipped, trained, and given quality oversight to comply with state and Federal requirements. This requires the same serious commitment as providing additional fire stations. Citygate advises the City that if it cannot fund both line and headquarters positions in the safe manner required, then it first focus on headquarters positions. While this seems counterintuitive, line firefighters that are not properly led, equipped, trained, and given quality oversight are a danger to themselves and the community they serve. They can also become a costly liability for accidents, injury, and apparatus loss time and claims.

Citygate does not recommend that Pearland stop adding fire stations, but Citygate recommends that, as revenues increase with growth, if the City plans to add fire stations, then it should add the appropriate balance of headquarters personnel to support line firefighters.

Citygate finds that at present the headquarters unit is at capacity and recommends Pearland consider headquarters additions *before* it hires additional personnel to staff another fire station. While at this time Citygate does not recommend adding a Planning Officer position to specifically manage new fire station and personnel growth, such a position will become necessary if the revenue projections are such that the City will continue opening new fire stations every two years until the City's desired response time goals are achieved.

Within this overall advice, Citygate offers the following specific headquarters staffing recommendations:

Recommendation #8: As soon as possible, the City should fill the vacant Operations Chief position, allowing the Fire Chief to concentrate his time on implementing strategic initiatives from the Department Strategic Plan.

Recommendation #9: The Department should dispatch the on-shift Fire Captain—EMS(s) on all Battalion Chief responses for incident safety and communication roles.

Recommendation #10: The Department should review both the Clinical Manager and Fire Captain—EMS position descriptions to reduce redundancy for clinical oversight tasks and improve training and safety oversight on shift.

Recommendation #11: As attrition allows, the Fire Captain—EMS position should change to that of a fire-suppression qualified Fire Captain, then the three Captain—EMS positions become overall shift training and Quality Assurance officers for both suppression and clinical programs. They will be shift training officers during the day and Battalion Chief aids for safety whenever needed.

Recommendation #12: The Department should complete a cost analysis of the training, safety equipment, and overhead burden for a large number of part-time employees against slowly replacing these positions with permanent, full-time employees.

Recommendation #13: The Department should begin overstaffing the personnel needed for an additional fire station at least a year before the station opens. Doing so will accommodate new recruit training and probation, staff retirements or separations, and will lessen the daily burden of scheduling so many part-time employees.

Recommendation #14: The Department should develop and adopt a formalized Risk Management Health and Safety Program for its members.

Recommendation #15: The Department should appoint a dedicated Health and Safety Officer for the organization.

Recommendation #16: The Department should develop or purchase a formal set of policies and procedures that are tailored to Pearland's needs and organizational structure.

Recommendation #17: The Department should acquire a spare set of PPE for each employee, and assure proper fit.

Recommendation #18: On an annual basis, the Community Risk Reduction (CRR) Division should monitor the workload and work hours of all fire inspection personnel to assure that all inspections are being accomplished.

Recommendation #19: The CRR Division should develop a permit and fee schedule for occupancy use to help recover cost for operating the Division.

Recommendation #20: Every two years, the CRR Division should rotate the Fire Inspectors/Investigators between areas to improve cross-training and depth in the Division.

Recommendation #21: The Department should consider adding one Business Manager position to the Administration Division.

Recommendation #22: The Department should add, as soon as practical, two Administrative Assistant positions, one in Administration and one in the Training/Clinical Oversight Division.

Recommendation #23: The Department should assign EMS patient care Quality Assurance to the Clinical Manager, relieving the on-shift Fire Captain—EMS of this responsibility unless specific training of personnel is required. Time permitting, the Fire Captain—EMS could still conduct quality assurance for low-acuity patient incident reports and to determine that all types of incident reports are completed appropriately and on time per policy.

Recommendation #24: The Department should complete the development of a Pearland specific Career Development Guide to assist employees in preparing for promotions and ensure the requirements are stipulated in the plan and policies.

Recommendation #25: The Department should develop a plan to deliver, enforce, and track its training requirements to ensure all personnel fully comply with the training goals and objectives of the Department.

SECTION 9—NEXT STEPS

9.1 NEXT STEPS

The City can continue to build on what it has accomplished to date in growing best-practices-based urban fire and paramedic services. The purpose of this deployment and headquarters assessment is to compare the City's current firefighting, emergency medical, and code enforcement abilities against the local risks to be protected, as well as to compare against nationally recognized best practices. This analysis of performance forms the basis from which to make recommendations for changes, if any, in fire station locations, equipment types, staffing, and headquarters programs.

As one step, the City Council should adopt updated and best-practices-based response time goals for the Department and provide accountability for the Department personnel to meet those standards. The goals identified in Recommendation #2 meet national best practices. As the City continues to evolve, measurement and planning will be necessary for the City to meet these goals. Citygate recommends that the City's next steps be to work through the issues identified in this study:

- Absorb the policy recommendations of this fire services study and adopt revised Fire Department performance measures to drive the deployment of firefighting and emergency medical resources.
- Develop a growth-to-revenues forecast for five years, and program dates for adding fire crews and headquarters positions.
- Implement the low- to no-cost recommendations in this study over the course of the next year.
- If the fire station growth curve is aggressive, add a Planning Officer to the Fire Department to focus just on the projects needed to accomplish the necessary growth.

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SECTION 10—FINDINGS AND RECOMMENDATIONS SUMMARY

This section presents a list of Citygate's deployment findings and recommendations, followed by a list of our headquarter programs findings and recommendations.

10.1 DEPLOYMENT FINDINGS

Finding #1: The City Council has not adopted a complete and best-practices-based deployment measure, a set of specialty response measures for all-risk emergency responses that includes the beginning time measure from the point of the Pearland Police Department Public Safety Answering Point (PSAP) receiving the 9-1-1 phone call, nor a goal statement tied to risks and outcome expectations. The deployment measure should have a second measurement statement to define multiple-unit response coverage for serious emergencies.

Finding #2: Five fire stations, along with using quints (pumper/ladders), does not provide sufficient first-due nor multiple-unit coverage to the City.

Finding #3: Traffic congestion severely limits the fire unit travel coverage and, at peak traffic hours, only 37 percent of the City's public street miles are within reach of a single fire station, and only 21 percent are covered by an effective multiple-unit force to serious emergencies.

Finding #4: At the City's current size plus the southwest Extra Territorial Jurisdictions (ETJs), a minimum of an eight-fire-station model, using eight engines and three aerial ladders, will be necessary.

Finding #5: If the City desires a best-practice recommendation of 4:00-minute travel time coverage to the urban developed neighborhoods, the City plus ETJ areas could well need 9 to 11 fire stations at final build-out.

Finding #6: The City's day-of-week and month-of-year calls for service demands are fairly consistent. This means the City needs to operate a fairly consistent 24/7/365 response system.

Finding #7: The call to arrival times, in all fire station areas, are significantly longer than best-practice and Citygate recommendations to deliver desirable urban area outcomes to serious fires and medical events.

Finding #8: The performance of the previous Communications Center, at 2:43 minutes to 90 percent of the EMS and fire emergencies, was longer than published best-practice recommendations of 1:30.

Finding #9: The City's overall turnout times are slightly longer then the Citygate recommendation of 2:00 minutes. With focus, these can be reduced.

Finding #10: The first-due unit travel times in the City are significantly longer than a positive-outcomes-based, best-practice goal of 4:00 minutes. As the geographical information systems modeling in this study also indicated, the only way to appreciably lower response times is to add more fire stations as revenues permit.

Finding #11: All Pearland ambulance travel times are slower than a desirable goal of 8:00 minutes, 90 percent of the time.

Finding #12: All Pearland ambulance units are out of service approximately 90 minutes for each response.

Finding #13: The City is too large for a single Battalion Chief / Incident Commander from one central location to reach incidents in 8:00 minutes travel time.

Finding #14: The Fire Captain—EMS response numbers are reflective of only one unit covering and backing up the paramedics across the City. However, this unit is not the initial patient care unit; its purpose is to assist and provide Quality Assurance on the most serious incidents. As such, at the current incident volumes, the Fire Captain—EMS travel times are acceptable.

Finding #15: The First Alarm travel times are significantly longer than a positive-outcome, best-practice-based recommendation of 8:00 minutes. The only solution to improve these times in all neighborhoods is to add more fire stations.

Finding #16: The City's firefighting station areas are not yet close to a recommended maximum hourly saturation for incident demand. However, four of the five ambulances have reached, or are near, hourly saturation from mid-morning to early evening. At some point in the future, if the unit-hour utilization percentages stay at 30 percent for several hours in a row, an additional daytime ambulance may be necessary.

10.2 DEPLOYMENT RECOMMENDATIONS

Recommendation #1: With the recent change in dispatch centers, the City should monitor, on a monthly basis, the dispatch processing times, including the PSAP transfer times from the Pearland Police Communications Center.

Recommendation #2: **Adopt City Council Deployment Measures Policies**: The City's elected officials should adopt updated, complete performance measures to direct fire crew planning and to monitor the operation of the Department. The measures of time should be designed to save patients where medically possible and to keep small but serious fires from becoming greater-alarm fires. With this is mind, Citygate recommends the following measures:

2.1 Distribution of Fire Stations: To treat medical patients and control small fires, the first-due unit should arrive within 7:30 minutes, 90 percent of the time, from the receipt of the 9-1-1 call in the fire dispatch center. This equates to a 1:30-minute dispatch time, a 2:00-minute company turnout time, and a 4:00-minute drive time in the most populated areas.

2.2 Multiple-Unit Effective Response Force for Serious Emergencies: To confine fires near the room of origin, and to treat up to five medical patients at once, a multiple-unit response of a minimum of two engines, one quint, one medic unit, one Fire Captain—EMS, and one Battalion Chief, totaling 16 personnel, should arrive within 11:30 minutes from the time of 9-1-1 call receipt in fire dispatch, 90 percent of the time. This equates to a 1:30-minute fire dispatch time, a 2:00-minute company turnout time, and an 8:00-minute drive time spacing for multiple units in the most populated areas.

2.3 Hazardous Materials Response: Provide initial hazardous materials response designed to protect the community from the hazards associated with uncontrolled release of hazardous and toxic materials. The fundamental mission of the City response is to protect the public by isolating them from the event and waiting for additional trained personnel for mitigation. It can achieve this with a first company capable of investigating a hazmat release at the operations level within 11:30 minutes total response time, 90 percent of the time. After assessment and scene evaluation is completed, a determination will be made whether to request additional resources from the City's multiple-agency hazardous materials response partnership.

2.4 Technical Rescue: Respond to technical rescue emergencies as efficiently and effectively as possible with enough trained

personnel to facilitate scene security and community safety until a trained Technical Rescue team from mutual aid companies can arrive. Deliver a first-due company for assessment of the rescue within 7:30 total response time minutes, 90 percent of the time. Assemble additional resources for technical rescue capable of initiating a rescue within a total response time of 11:30 minutes, 90 percent of the time. Safely complete rescue/extrication to ensure delivery of patient to a definitive care facility.

2.5 ALS Medical Services: The City should provide ALS services in all neighborhoods within 8 minutes travel time and thus 11:30 minutes total response time, 90 percent of the time.

Recommendation #3: Pearland needs three additional fire stations, with engines, as soon as funding permits in the northwest, southwest, and southeast areas of the City to better meet best outcome-based travel and response times.

Recommendation #4: To improve aerial ladder unit coverage, Pearland should convert to staffing three dedicated aerial ladder trucks over time as the City continues to grow.

Recommendation #5: To improve Battalion Chief coverage, Pearland could consider a second supervising chief unit in the western City.

Recommendation #6: As the four busiest ambulances maintain 30 percent unit-hour utilization for multiple hours during the day, the City will need a sixth ambulance on a peak-hour schedule from 10:00am to 7:00pm at least Monday through Saturday.

Recommendation #7: As the Department adds full-time firefighters, the goal should be to increase the number of paramedics to the point that every fire engine has one paramedic with equipment at all times to provide first responder paramedic care if the ambulance is not immediately available.

10.3 HEADQUARTER PROGRAMS FINDINGS

Finding #17: The Department's Operations Chief position is unfunded and its role is currently assigned to the Fire Chief. With the leadership responsibilities of the Fire Chief, the continued effort to blend the Fire and EMS organizations into one cohesive

department, and to implement the Strategic Plan, the added responsibility of the Operations Chief is an impediment to accomplishing the Department's goals.

Finding #18: To assure minimum daily shift staffing, the Department uses several part-time and volunteer positions on each shift. The Department needs to prepare a detailed cost analysis to compare all of the part-time program costs including equipment, training, and scheduling time against slowly increasing the number of full-time employees.

Finding #19: The Department does not have a dedicated Health and Safety Officer to immediately respond to all emergency incidents and monitor the Department's Health and Safety Program on scene and during normal daily operations.

Finding #20: Citygate commends the Department for having a required Employee Medical Exam program, and for facilitating the ability of staff to exercise on shift.

Finding #21: The Department does not have a fully completed set of policies, procedures, or standard operating guidelines for daily routines or emergency incidents. Given the time since the EMS merger, and the hiring of new firefighters, this is understandable.

Finding #22: There is an overlap in job duties between the Clinical Manager and the on-shift Fire Captain—EMS for Quality Assurance and Continuous Quality Improvement, training, and performance monitoring. Typically, in a department this size, the Clinical Manager would perform all EMS Quality Assurance and Continuous Quality Improvement.

Finding #23: The Department does not have an adequate number of spare Personal Protective Equipment (PPE) sets for all employees during the required PPE cleaning after fire combat, nor when the gear is unavailable due to annual inspections.

Finding #24: The Community Risk Reduction (CRR) Division has excellent data collection system to track and review all performance measures for the Division.

Finding #25: The CRR Division does not issue permits or collect fees for occupancy use or inspections. Doing so would help recover some of the expense for those services.

Finding #26: The CRR Division does not rotate plan check or inspection geographical areas between the three Fire Inspectors, which would allow for professional growth and area cross-training for the employees.

Finding #27: The CRR Division could develop a more formalized Fire and Life Safety Education program for the community, using emergency incident data and known risks, to set measurable goals and design education programs to reduce fire loss and life loss, and prevent injuries to the residents.

Finding #28: The City Information Technology Department, in conjunction with the Department, has recently located a Technology Specialist in Fire Administration to assist with information technology and computers in the Department.

Finding #29: The current Battalion Chief in the Administration Division functions as the Manager of Logistics. The majority of work for the Division is related to purchasing, contract administration, and personnel functions. As the Department grows, a non-sworn Business Manager should be added to perform routine processing functions.

Finding #30: The Clinical Manager currently only reviews high acuity and random EMS reports for Quality Assurance and Continuous Quality Improvement for all personnel. According to their position description and tracked hours, the on-shift Fire Captain—EMSs also perform the same function on all incidents.

Finding #31: Neither the Training Captain nor the Clinical Manager have adequate time to aid and deliver on-shift training for personnel due to collateral duties.

Finding #32: The Department does not have a Career Development Guide specific to Pearland for employees to direct them regarding training needs and requirements for promotions and career advancement. The Department does use the Second Edition of the International Association of Fire Chiefs Officer Development Handbook as a guide.

Finding #33: The Department is not meeting its goal of 240 hours of annual training for each full-time employee. According to staff, there are multiple reasons for the non-compliance.

Finding #34: Despite the requirement to complete 240 hours of training annually, total training hours for volunteer firefighters and part-time employees is extremely low.

Finding #35: The current Training Center is a good start for future development and enhancements for future training needs for new and veteran employees.

Finding #36: The average age of both the frontline and reserve engines is within the best-practice normal life expectancy of fire apparatus.

Finding #37: The Department at present has an insufficient number of office support professionals, which causes costlier mid-managers to perform their own support work, not the technical work they need to perform.

10.4 HEADQUARTER PROGRAMS RECOMMENDATIONS

Recommendation #8: As soon as possible, the City should fill the vacant Operations Chief position, allowing the Fire Chief to concentrate his time on implementing strategic initiatives from the Department Strategic Plan.

Recommendation #9: The Department should dispatch the on-shift Fire Captain—EMS(s) on all Battalion Chief responses for incident safety and communication roles.

Recommendation #10: The Department should review both the Clinical Manager and Fire Captain—EMS position descriptions to reduce redundancy for clinical oversight tasks and improve training and safety oversight on shift.

Recommendation #11: As attrition allows, the Fire Captain—EMS position should change to that of a fire-suppression qualified Fire Captain, then the three Captain—EMS positions become overall shift training and Quality Assurance officers for both suppression and clinical programs. They will be shift training officers during the day and Battalion Chief aids for safety whenever needed.

Recommendation #12: The Department should complete a cost analysis of the training, safety equipment, and overhead burden for a large number of part-time employees against slowly replacing these positions with permanent, full-time employees.

Recommendation #13: The Department should begin overstaffing the personnel needed for an additional fire station at least a year before the station opens. Doing so will accommodate new recruit training and probation, staff retirements or separations, and will lessen the daily burden of scheduling so many part-time employees.

Recommendation #14: The Department should develop and adopt a formalized Risk Management Health and Safety Program for its members.

Recommendation #15: The Department should appoint a dedicated Health and Safety Officer for the organization.

Recommendation #16: The Department should develop or purchase a formal set of policies and procedures that are tailored to Pearland's needs and organizational structure.

Recommendation #17: The Department should acquire a spare set of PPE for each employee, and assure proper fit.

Recommendation #18: On an annual basis, the Community Risk Reduction (CRR) Division should monitor the workload and work hours of all fire inspection personnel to assure that all inspections are being accomplished.

Recommendation #19: The CRR Division should develop a permit and fee schedule for occupancy use to help recover cost for operating the Division.

Recommendation #20: Every two years, the CRR Division should rotate the Fire Inspectors/Investigators between areas to improve cross-training and depth in the Division.

Recommendation #21: The Department should consider adding one Business Manager position to the Administration Division.

Recommendation #22: The Department should add, as soon as practical, two Administrative Assistant positions, one in Administration and one in the Training/Clinical Oversight Division.

Recommendation #23: The Department should assign EMS patient care Quality Assurance to the Clinical Manager, relieving the on-shift Fire Captain—EMS of this responsibility unless specific training of personnel is required. Time permitting, the Fire Captain—EMS could still conduct quality assurance for low-acuity patient incident reports and to determine that all types of incident reports are completed appropriately and on time per policy.

Recommendation #24: The Department should complete the development of a Pearland specific Career Development Guide to assist employees in preparing for promotions and ensure the requirements are stipulated in the plan and policies.

Recommendation #25: The Department should develop a plan to deliver, enforce, and track its training requirements to ensure all personnel fully comply with the training goals and objectives of the Department.

APPENDIX A

DEPARTMENT APPARATUS

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Table 1—Fire Response Apparatus and Staff Vehicles

Radio Number	Fire Unit Equipment Number	Chassis Make	Build-up Make	In-Service Year	Capacity	NIMS Type	Mileage	Status	Current Replacement Cost
300	U-195	Chevy Tahoe		2015			7,700	Staff car	$55,000
301	U-155	Chevy Tahoe		2012			34,000	Staff car	$55,000
303	U-146	Ford Expedition		2008			41,000	Staff car	$55,000
305	C-315	Ford Focus		2008			25,000	Staff car	$22,000
311	U-226	Ford Interceptor		2016			3,300	Staff car	$46,000
329	U-144	Ford Expedition		2008			54,900	Staff car	$55,000
Battalion 1	U-178	Chevy Tahoe		2014			28,000	Staff car	$55,000
Squad 1	U-168	Chevy Tahoe		2013			42,000	Staff car	$55,000
Engine 1	TH-140	Spartan	Crimson	2011	1500 gpm	1	33,000	Reserve pumper	$750,000
Engine 2	TH-142	Pierce	Pierce	2014	1500 gpm	1	36,000	Front line pumper	$750,000
Engine 22	TH-133	Spartan	Crimson	2006	1500 gpm	1	44,000	Reserve pumper	$750,000
Engine 3	TH-145	Pierce	Pierce	2015	1500 gpm	1	12,000	Front line pumper	$750,000
Engine 32	TH-138	Spartan	Crimson	2010	1500 gpm	1	47,000	Reserve pumper	$750,000
Engine 5	TH-141	Spartan	Spartan	2013	1500 gpm	1	33,000	Front line pumper	$750,000
Engine 52	TH-137	Spartan	Crimson	2008	1500 gpm	1	44,000	Reserve pumper	$750,000
Engine 6	TH-122	American LaFrance	ALF	2002	1500 gpm	1	32,000	Front line pumper	$750,000

Radio Number	Fire Unit Equipment Number	Chassis Make	Build-up Make	In-Service Year	Capacity	NIMS Type	Mileage	Status	Current Replacement Cost
Ladder 1	TH-143	Pierce	Pierce	2014	1500 gpm 75 ft. aerial	1	33,000	Front line ladder	$1,000,000
Ladder 4	TH-149	Pierce	Quantum	2016	1500 gpm 75 ft. aerial	1	500	Front line ladder	$1,000,000
Rescue 4	TM-114	Ford	EVI	2009	450 gpm		7,000	Light rescue	$250,000
Tanker 4	TH-131	Spartan	US Tanker	2004	1500 gpm 3000 gal	1	21,000	Front line tanker	$350,000
Brush 2	TL-174	Ford	Metro	2015	125 gpm		2,000	Front line brush truck	$160,000
Brush 3	P-257	Ford		2007	125 gpm		13,000	Front line brush truck	$160,000
FMO	P-377	Ford F-150		2016			7,593	FMO vehicle	$35,000
FMO	P-378	Ford F-150		2016			5,900	FMO vehicle	$35,000
FMO	P-290	Ford F-250		2008			118,000	FMO vehicle	$40,000
FMO	P-336	Ford F-150		2013			32,000	FMO vehicle	$35,000
FMO	P-337	Ford F-150		2013			52,000	FMO vehicle	$35,000
FMO	P-266	Ford Ranger		2007			75,000	FMO vehicle	$35,000
Support 1	TL-156	Ford F-250		2012			25,000	Support vehicle	$40,000
Code	P-280	Ford Ranger		2008			35,000	Code Enforcement	$25,000
Code	P-268	Ford Ranger		2008			52,000	Code Enforcement	$25,000
Code	P-233	Ford F-150		2005			74,000	Code Enforcement	$25,000
Code	P-331	Ford F-150		2013			32,000	Code Enforcement	$25,000

Radio Number	Fire Unit Equipment Number	Chassis Make	Build-up Make	In-Service Year	Capacity	NIMS Type	Mileage	Status	Current Replacement Cost
Code	P-244	Ford F-150		2006			70,000	Code Enforcement	$25,000
Code	P-332	Ford F-150		2013			12,000	Code Enforcement	$25,000
Code	P-367	Ford F-150		2016			1,000	Code Enforcement	$25,000

Table 2—Emergency Medical Transport Vehicles

Radio Number	Fire Unit Equipment Number	Chassis Make	Build-up Make	In- Service Year	NIMS Type	Mileage	Status	Current Replacement Cost
Medic 1	TL-167	Ford	Frazer	2013	2	67,000	Front-line medic	$175,000
Medic 2	TL-166	Ford	Frazer	2013	2	33,000	Front-line medic	$175,000
Medic 3	TL-175	Chevy	Frazer	2016	2	2,000	Front-line medic	$175,000
Medic 4	TL-165	Ford	Frazer	2013	2	61,000	Front-line medic	$175,000
Medic 5	TL-168	Chevy	Frazer	2015	2	28,000	Front-line medic	$175,000
Medic 6	TL-160	Ford	Frazer	2012	2	96,000	Reserve medic	$175,000
Medic 7	TL-161	Ford	Frazer	2012	2	84,000	Reserve medic	$175,000

VOLUME 3 OF 3 - MAP ATLAS

FIRE DEPARTMENT STANDARDS OF COVER AND STAFFING UTILIZATION STUDY

APRIL 4, 2017

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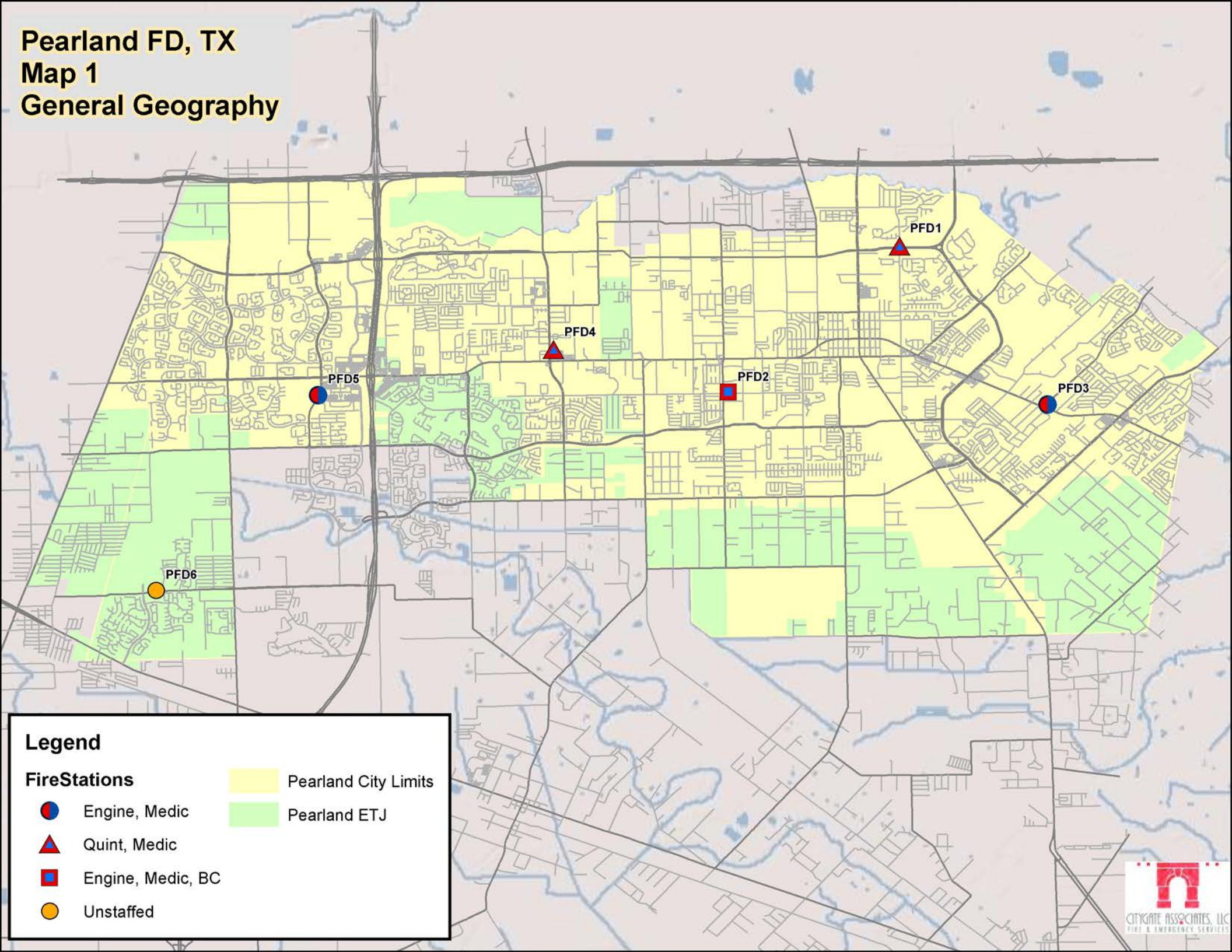
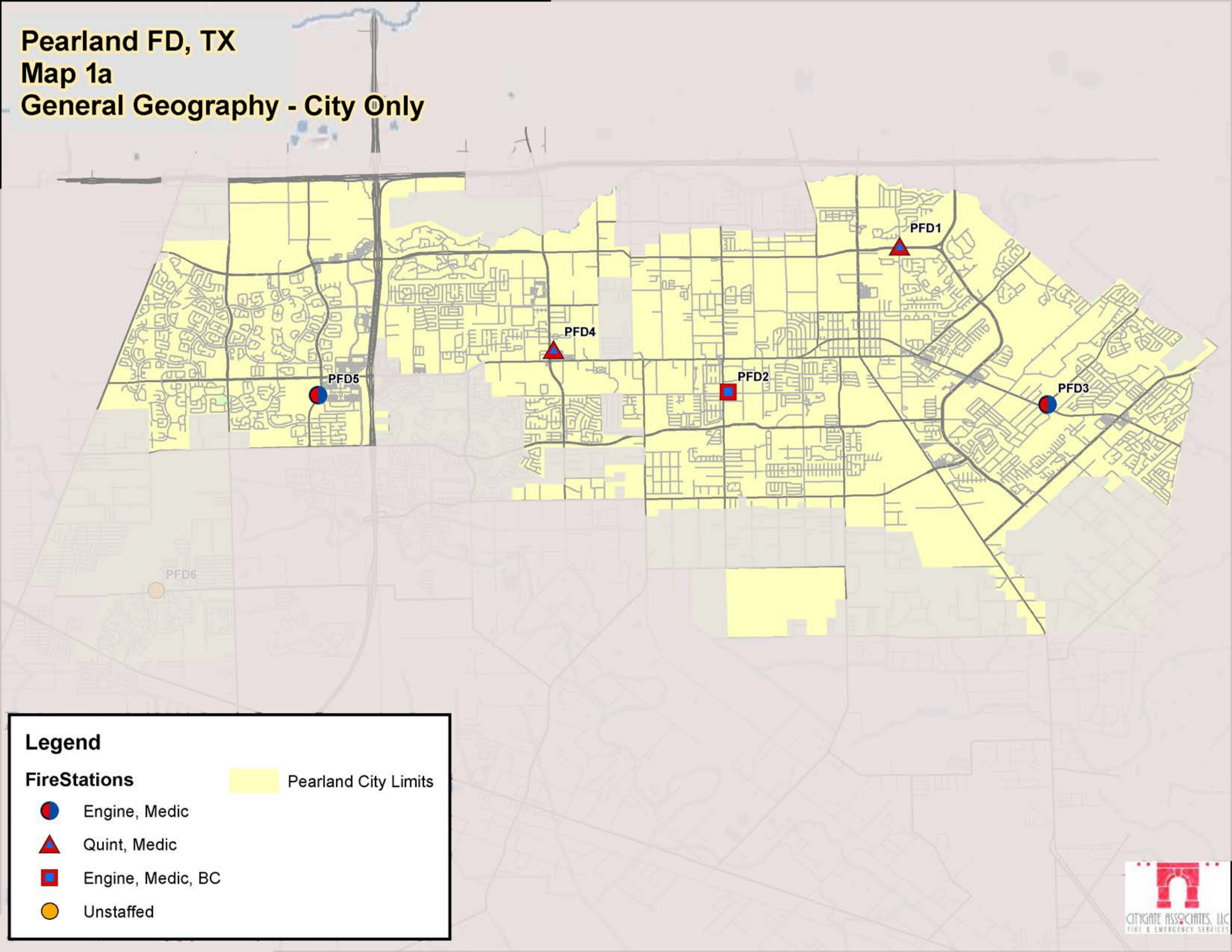
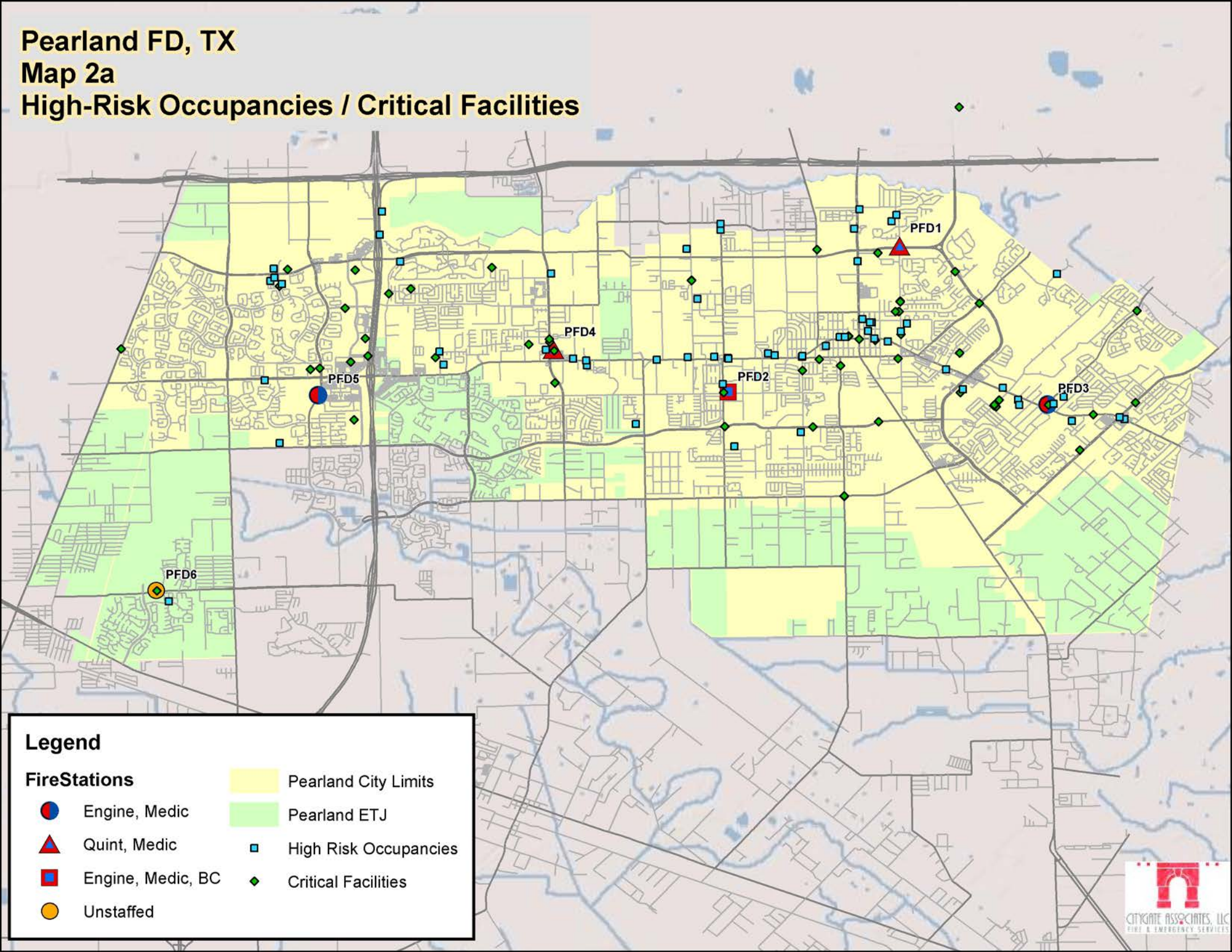
Pearland FD, TX
Map 1
General Geography



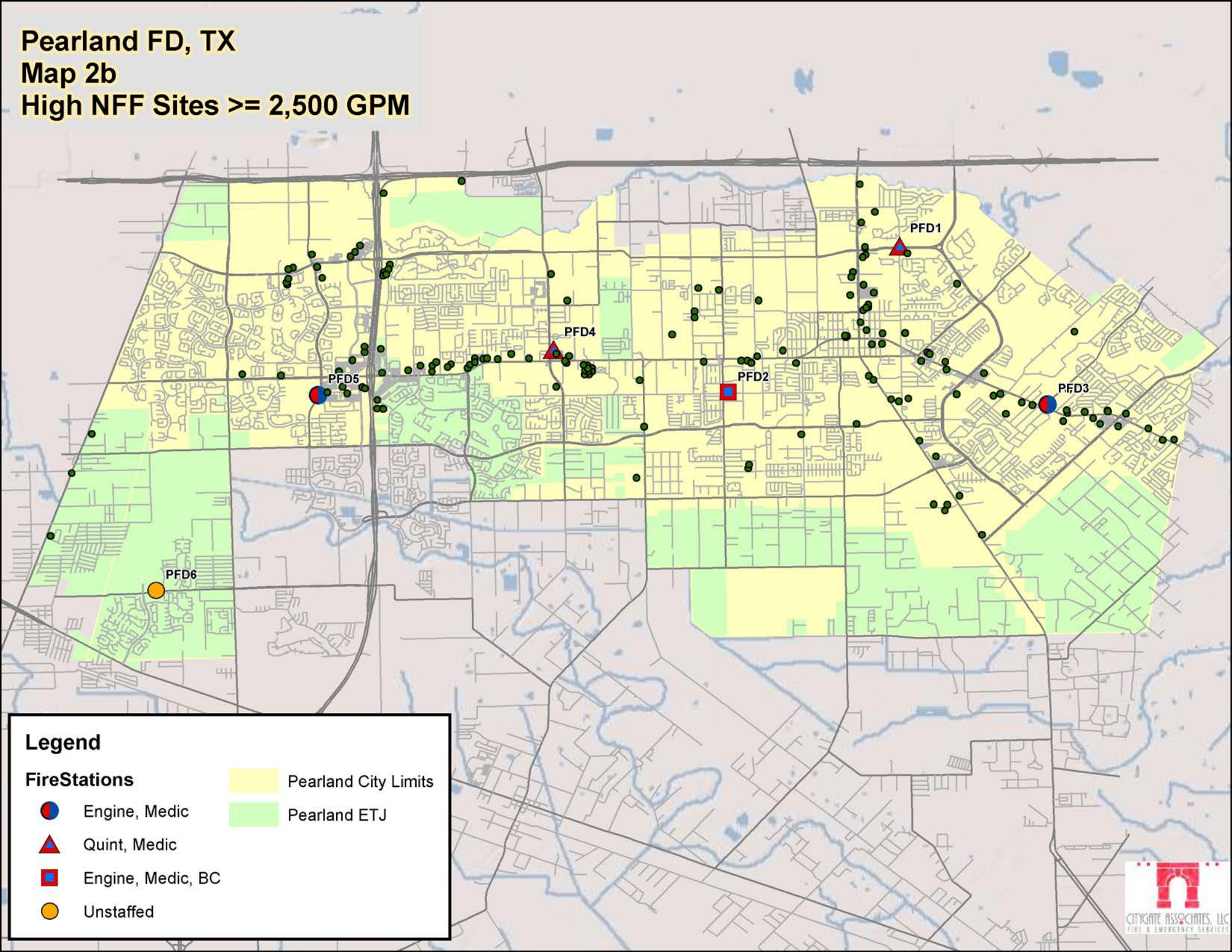
Pearland FD, TX
Map 1a
General Geography - City Only



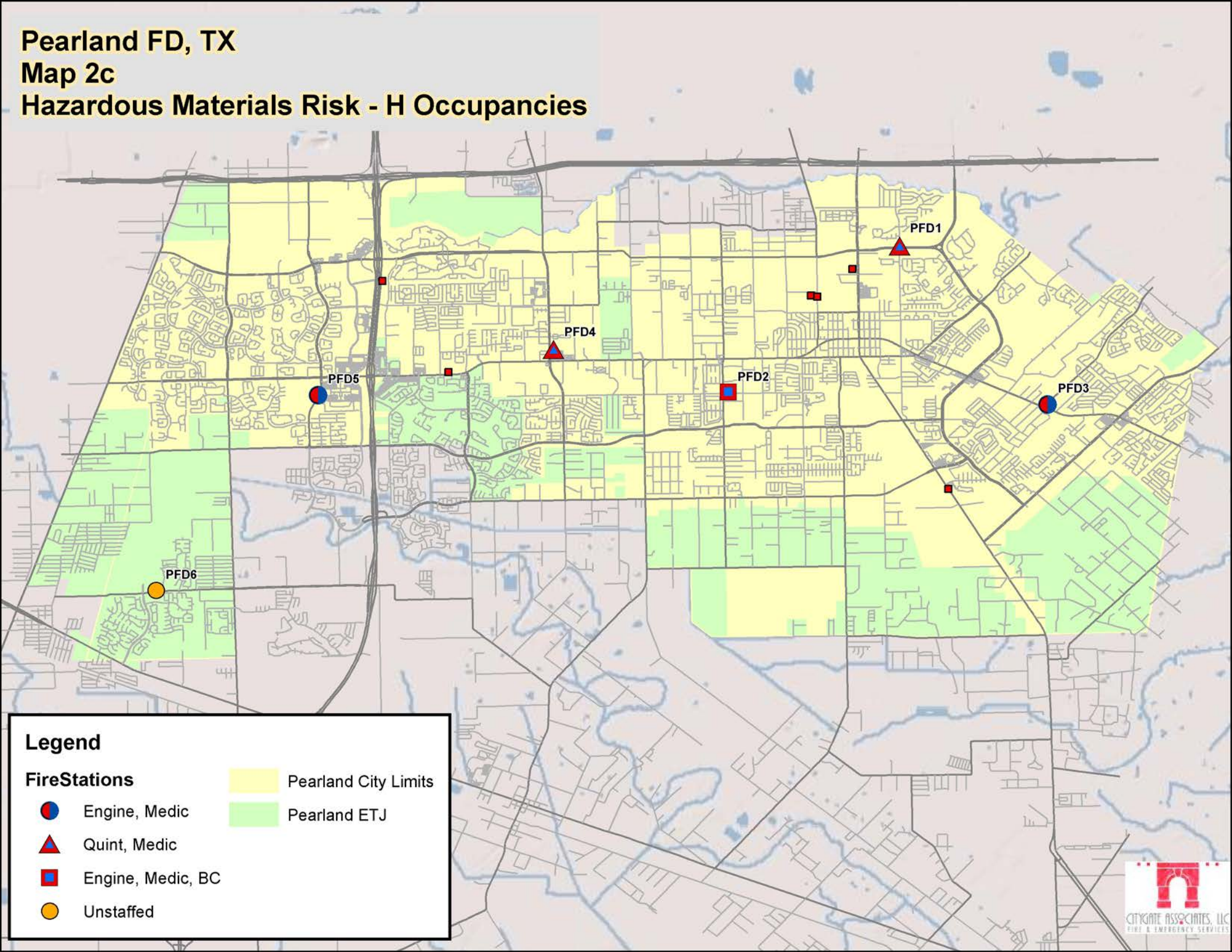
Pearland FD, TX
Map 2a
High-Risk Occupancies / Critical Facilities

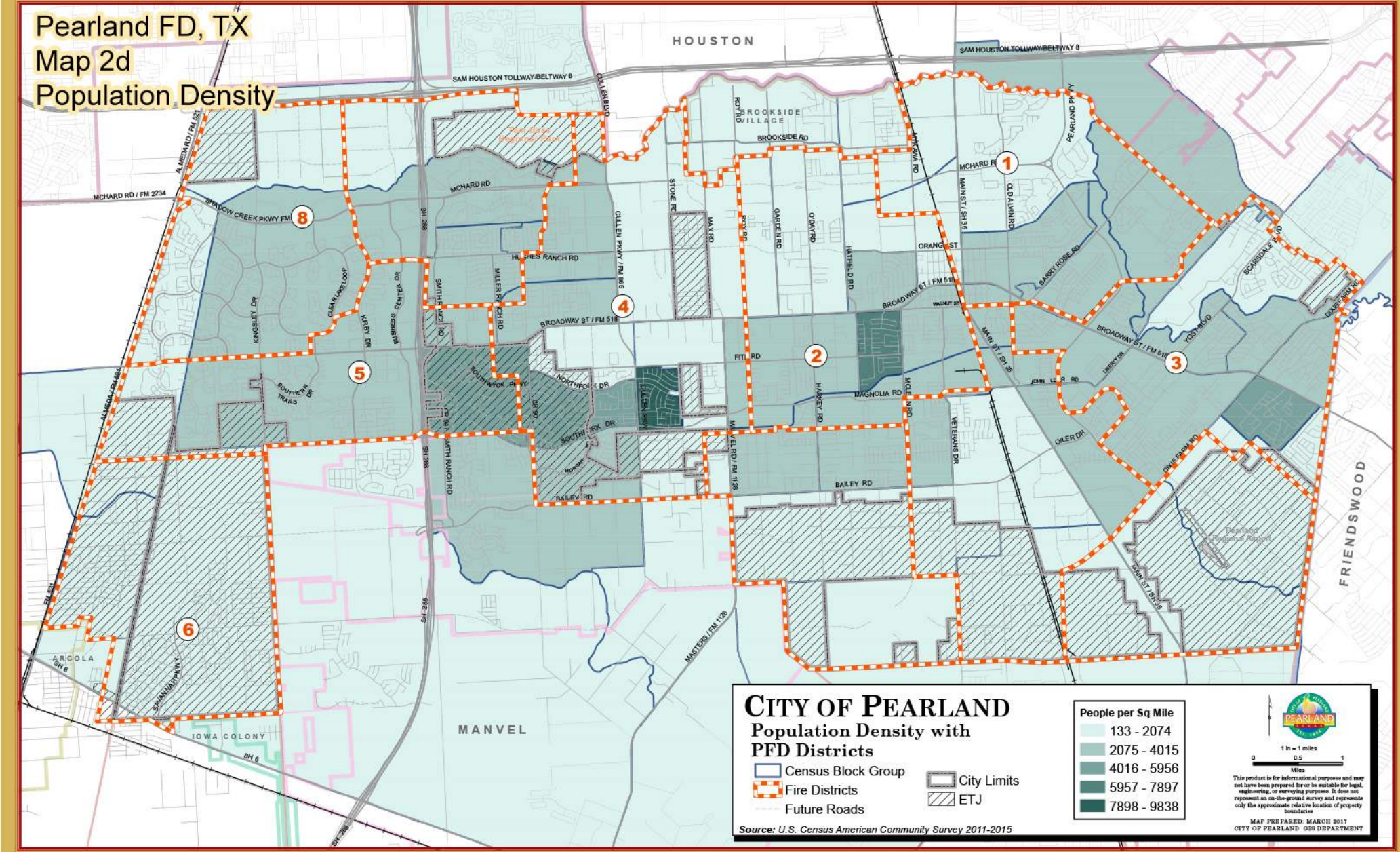


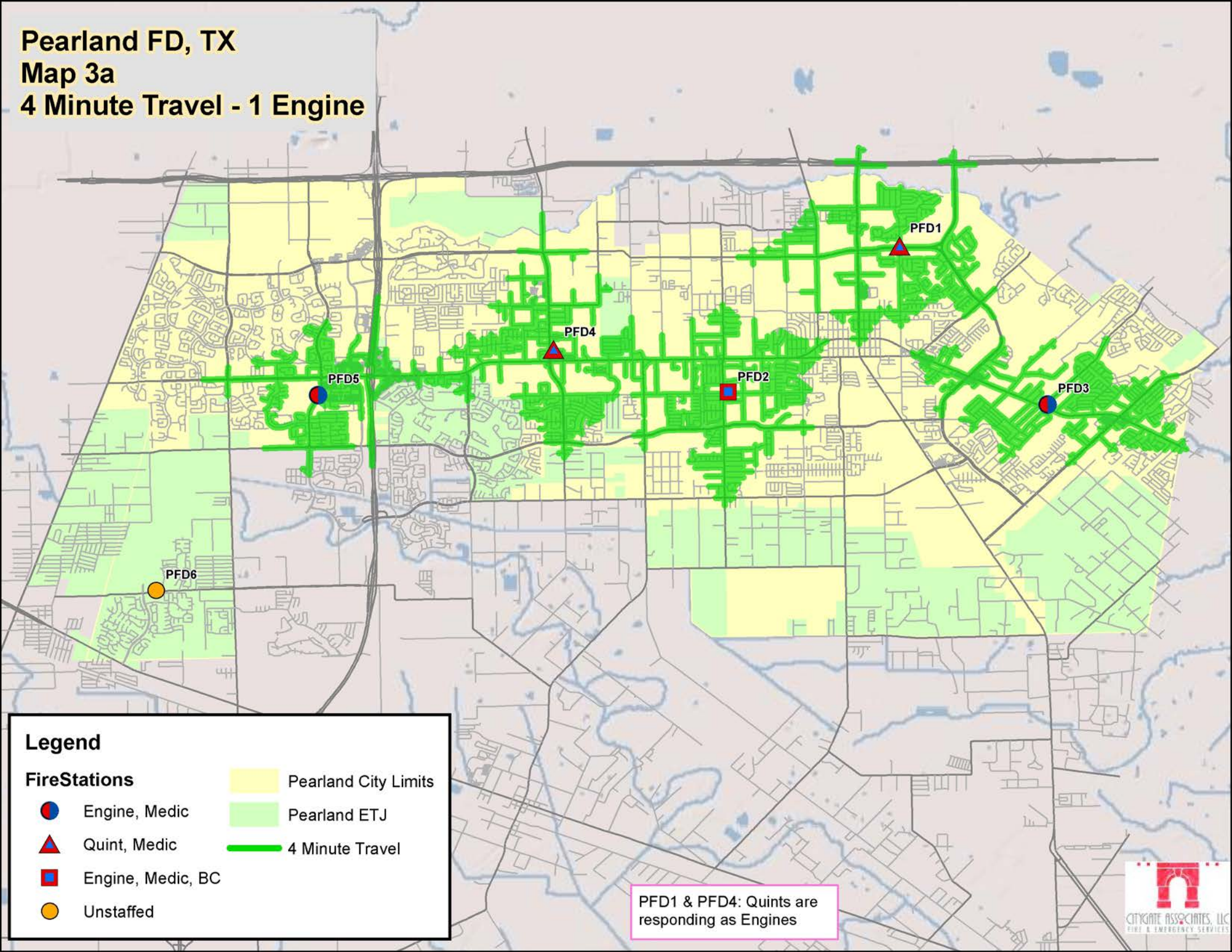
Pearland FD, TX
Map 2b
High NFF Sites >= 2,500 GPM



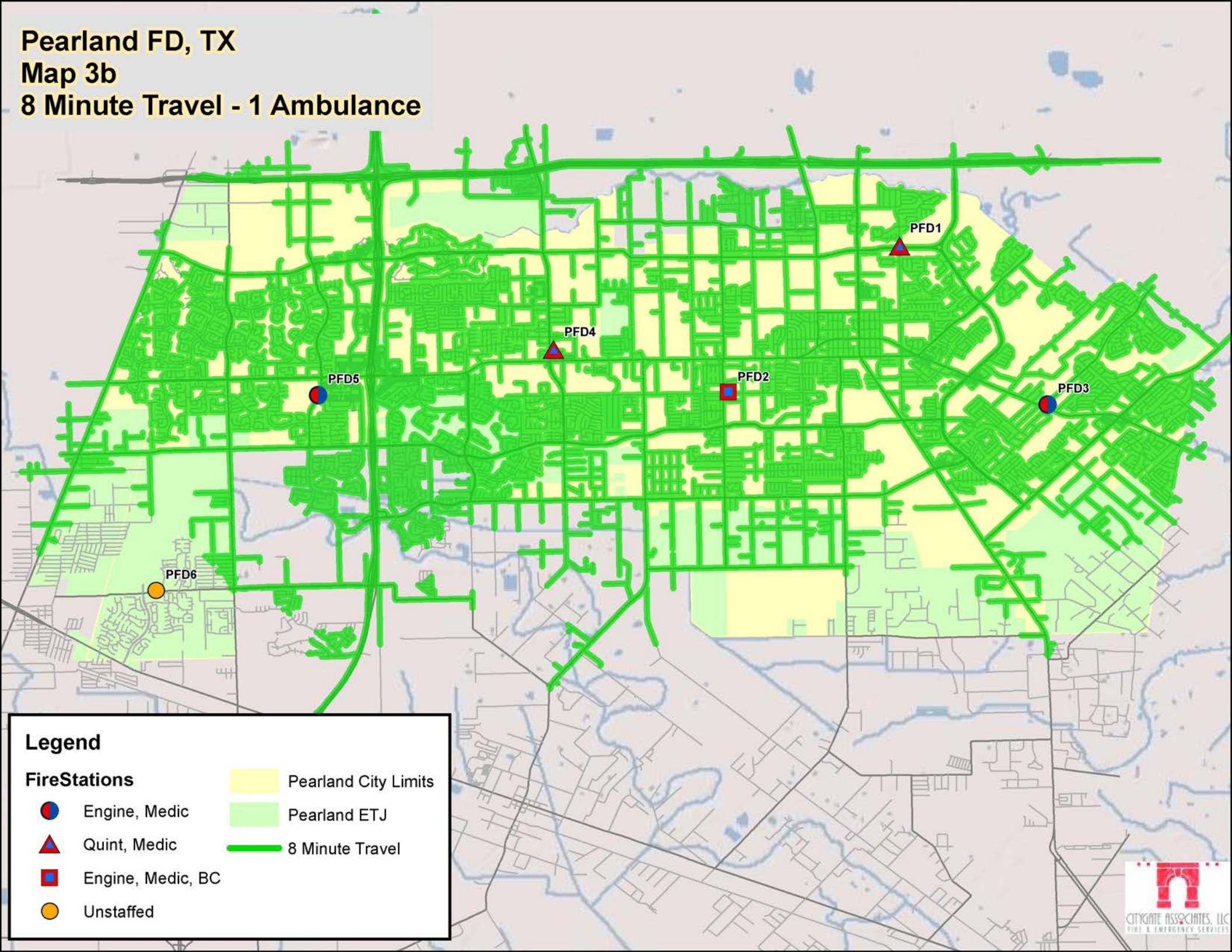
Pearland FD, TX
Map 2c
Hazardous Materials Risk - H Occupancies



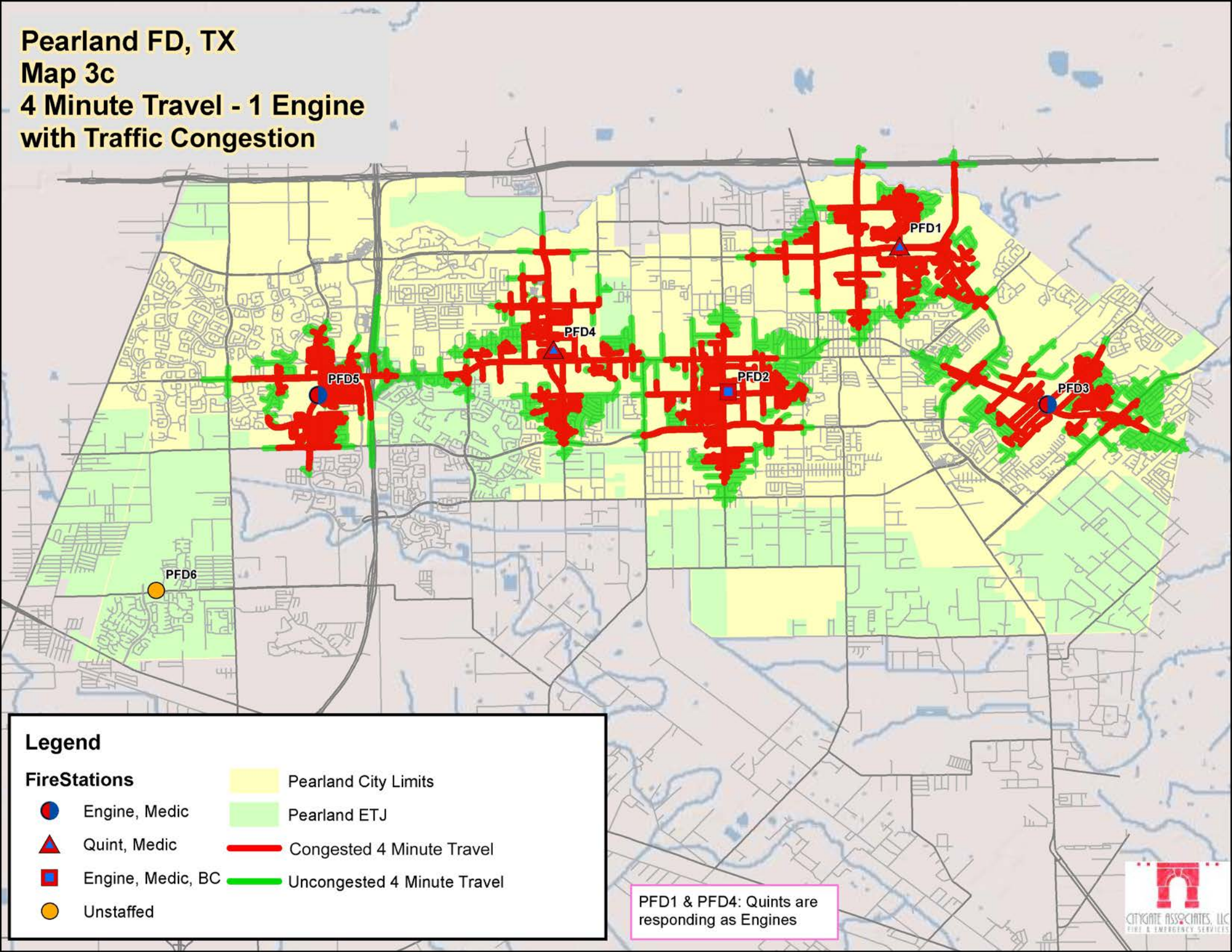

Pearland FD, TX
Map 2d
Population Density
HOUSTON
SAM HOUSTON TOLLWAY/BELTWAY 8
MCHARD RD / FM 2234
SHADOW CREEK PKWY FM
MCHARD RD
BROOKSIDE VILLAGE
BROOKSIDE RD
CULLEN BLVD
CULLEN PKWY / FM 865
HUGHES RANCH RD
BROADWAY ST / FM 518
ORANGE ST
MAIN ST / SH 35
PEARLAND PKWY
OLD ALVIN RD
J. BARRY ROSE RD
SCARSDALE BLVD
DIXIE FARM RD
YOST BLVD
LIBERTY DR
JOHN LEE RD
FITE RD
MAGNOLIA RD
MCLEAN RD
HARKEY RD
VETERANS DR
OILER DR
BAILEY RD
MASTERS / FM 1128
SMITH RANCH RD
SH 288
SOUTHWYCK PKWY
NORTHFORK DR
SOUTH FORK DR
KINGSLEY DR
KIRBY DR
SOUTHERN TRAILS DR
SPANISH CENTER DR
CLEAR LAKE LOOP
STONE RD
MAY RD
ROY RD
GARDNER RD
O'DAY RD
HATFIELD RD
MYKAWA RD
PEARLAND PKWY
ALMEDA RD / FM 521
ALMEDA GENOA RD
BLACKHAWK BLVD
SHANNAH PKWY
ARCOLA
SH 6
IOWA COLONY
MANVEL
FRIENDSWOOD
Pearland Regional Airport
1
2
3
4
5
6
8
CITY OF PEARLAND
Population Density with
PFD Districts
Census Block Group
Fire Districts
Future Roads
City Limits
ETJ
Source: U.S. Census American Community Survey 2011-2015
People per Sq Mile
133 - 2074
2075 - 4015
4016 - 5956
5957 - 7897
7898 - 9838
1 in = 1 miles
0
0.5
1
Miles
This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries
MAP PREPARED: MARCH 2017
CITY OF PEARLAND GIS DEPARTMENT


Pearland FD, TX
Map 3a
4 Minute Travel - 1 Engine
PFD1
PFD2
PFD3
PFD4
PFD5
PFD6
Legend
FireStations
Engine, Medic
Quint, Medic
Engine, Medic, BC
Unstaffed
Pearland City Limits
Pearland ETJ
4 Minute Travel
PFD1 & PFD4: Quints are responding as Engines
CITYGATE ASSOCIATES, LLC
FIRE & EMERGENCY SERVICES

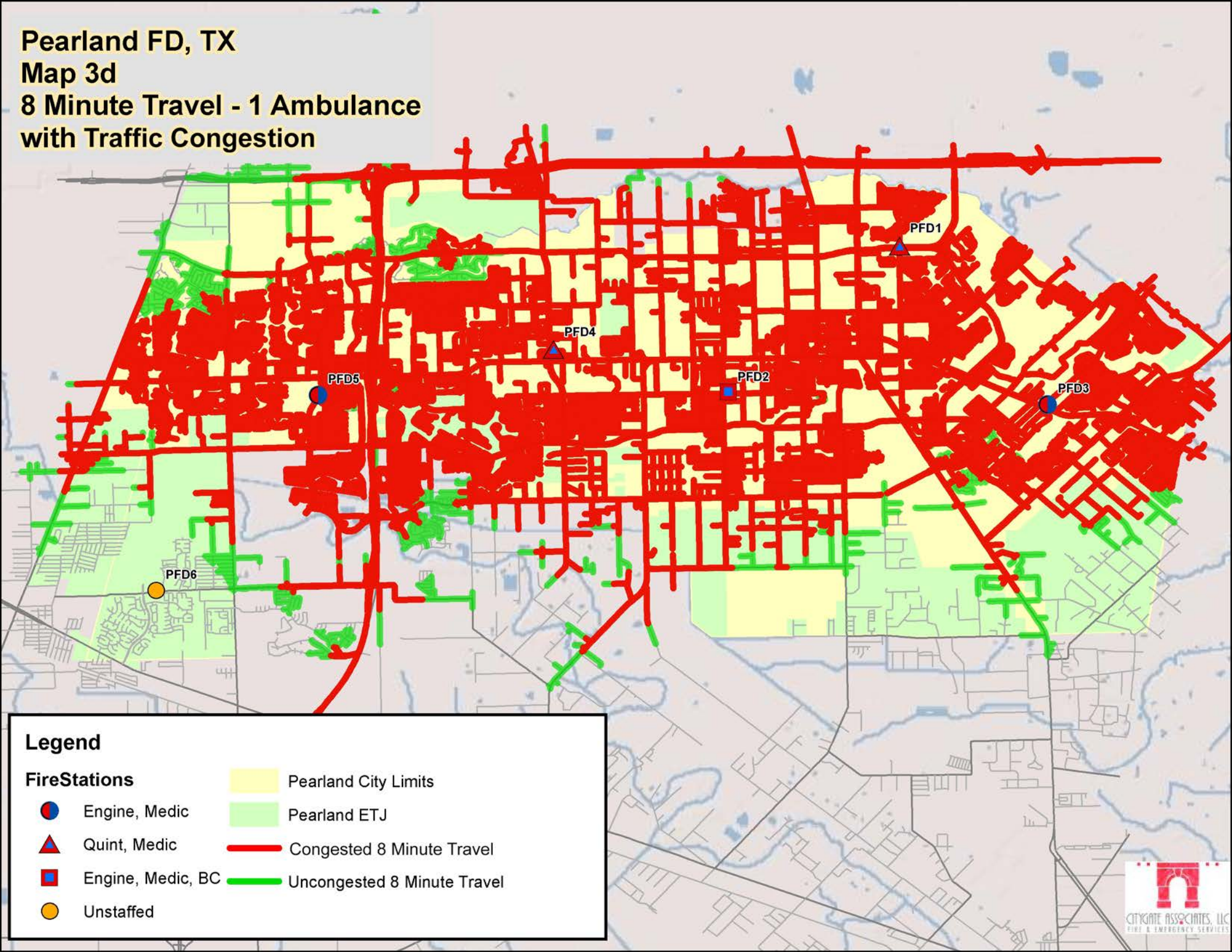
Pearland FD, TX
Map 3b
8 Minute Travel - 1 Ambulance



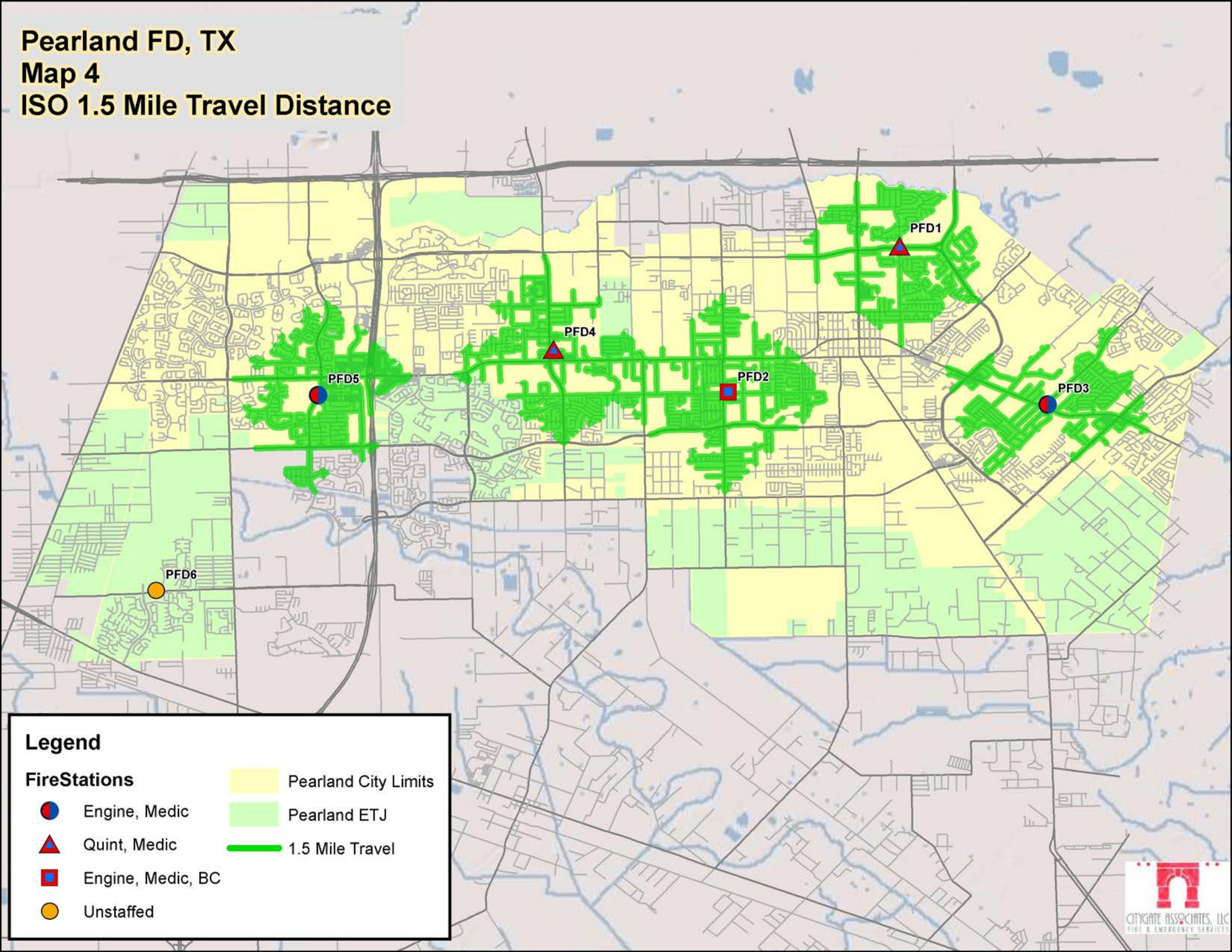
Pearland FD, TX
Map 3c
4 Minute Travel - 1 Engine with Traffic Congestion



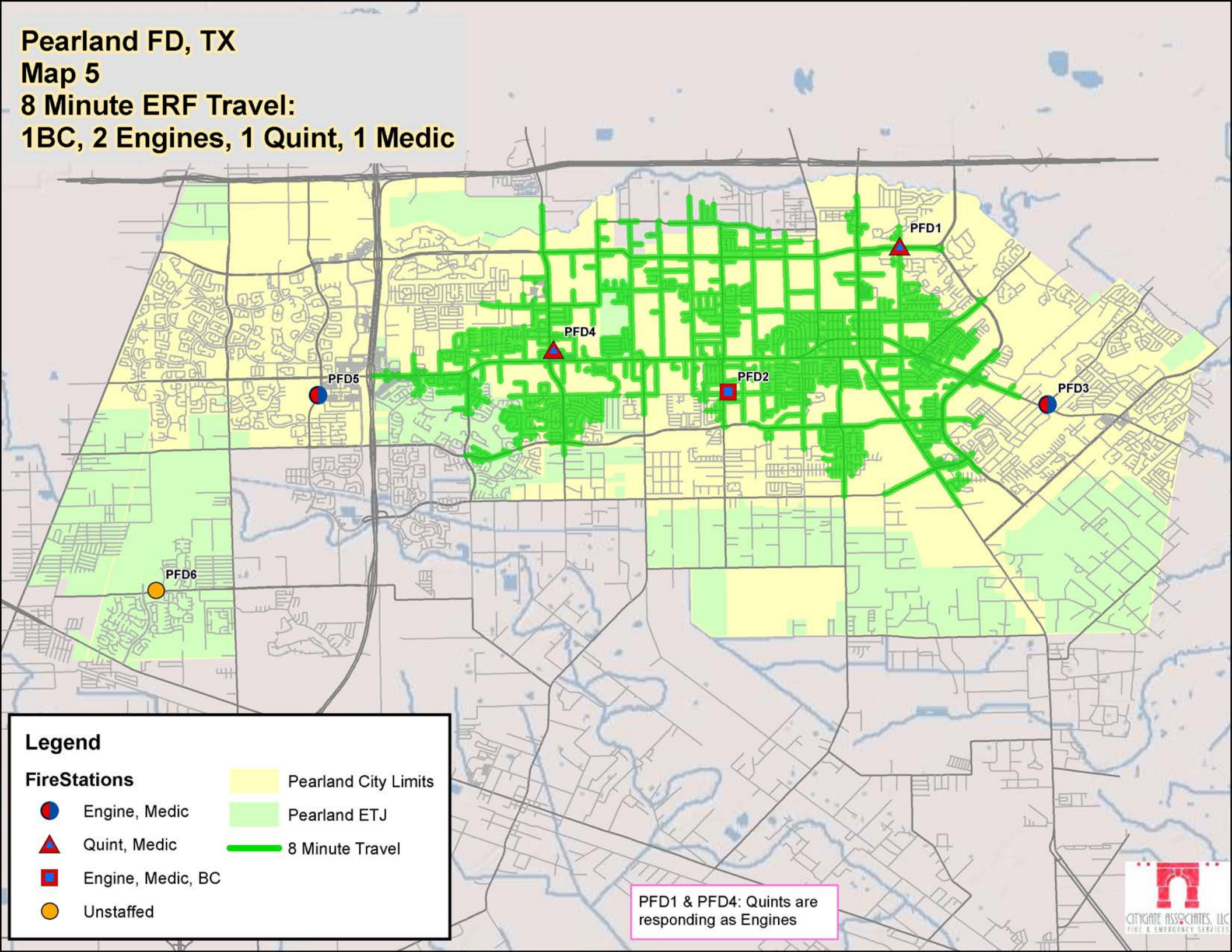
Pearland FD, TX
Map 3d
8 Minute Travel - 1 Ambulance with Traffic Congestion



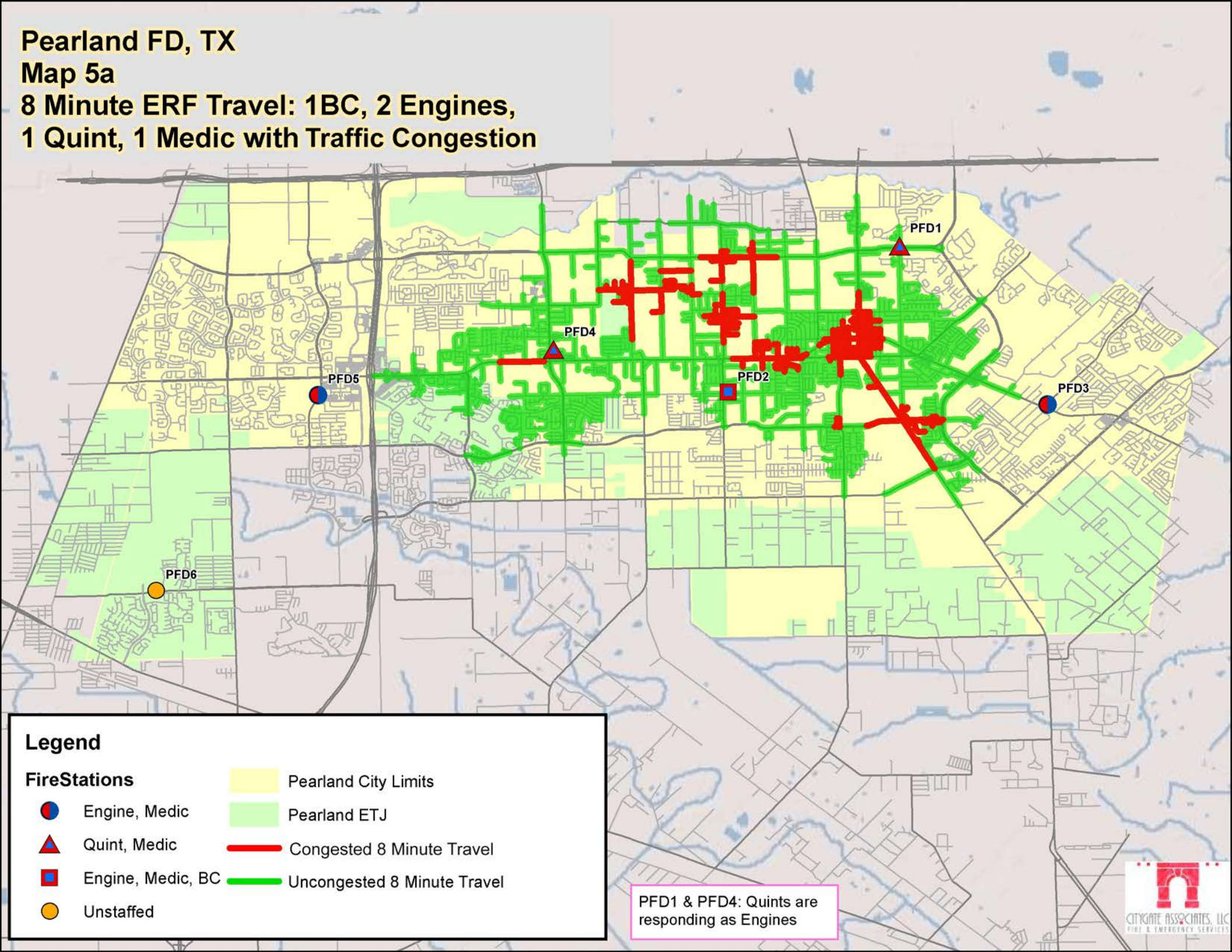
Pearland FD, TX
Map 4
ISO 1.5 Mile Travel Distance



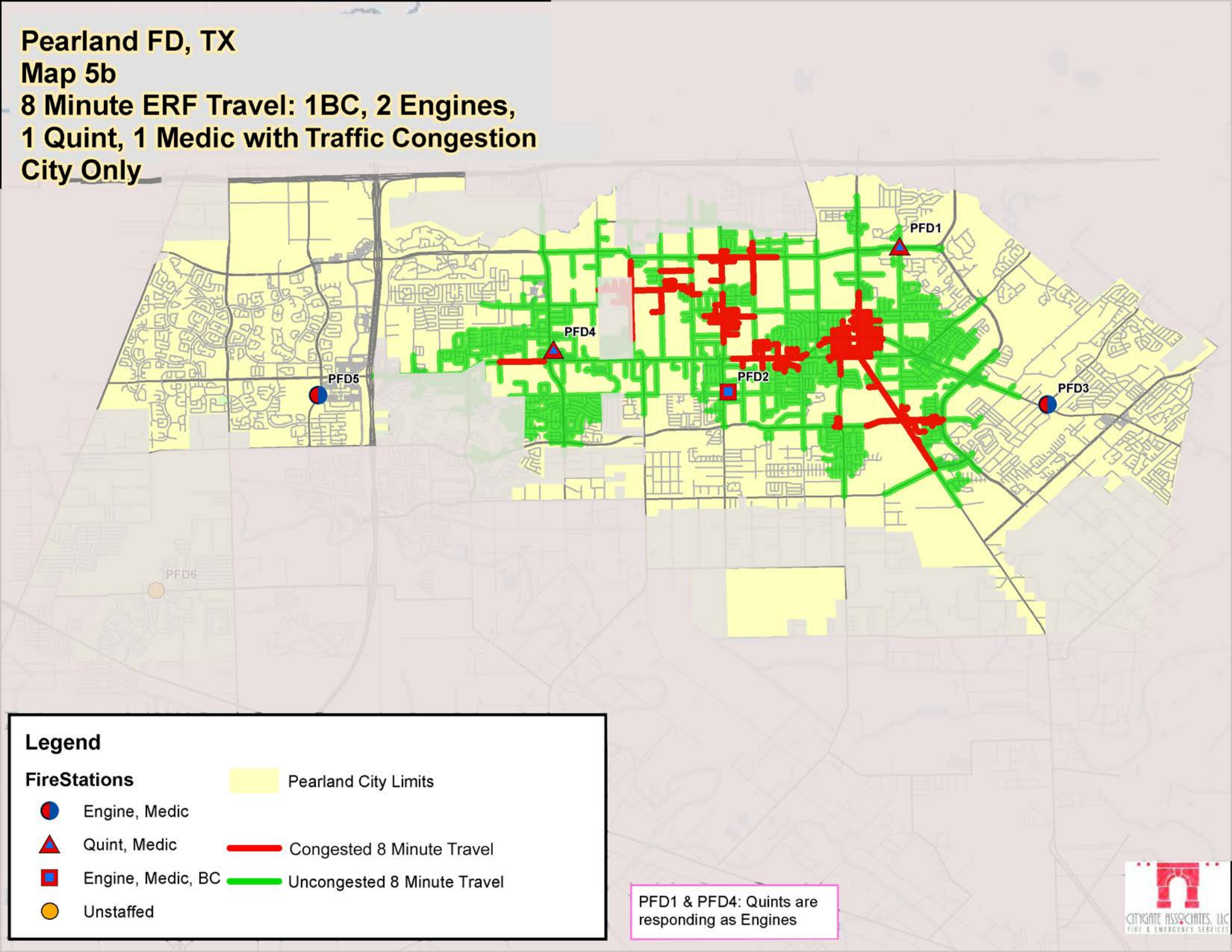
Pearland FD, TX
Map 5
8 Minute ERF Travel:
1BC, 2 Engines, 1 Quint, 1 Medic



Pearland FD, TX
Map 5a
8 Minute ERF Travel: 1BC, 2 Engines, 1 Quint, 1 Medic with Traffic Congestion



Pearland FD, TX
Map 5b
8 Minute ERF Travel: 1BC, 2 Engines, 1 Quint, 1 Medic with Traffic Congestion City Only



Legend

FireStations

- Engine, Medic
- Quint, Medic
- Engine, Medic, BC
- Unstaffed

- Pearland City Limits
- Congested 8 Minute Travel
- Uncongested 8 Minute Travel

PFD1 & PFD4: Quints are responding as Engines

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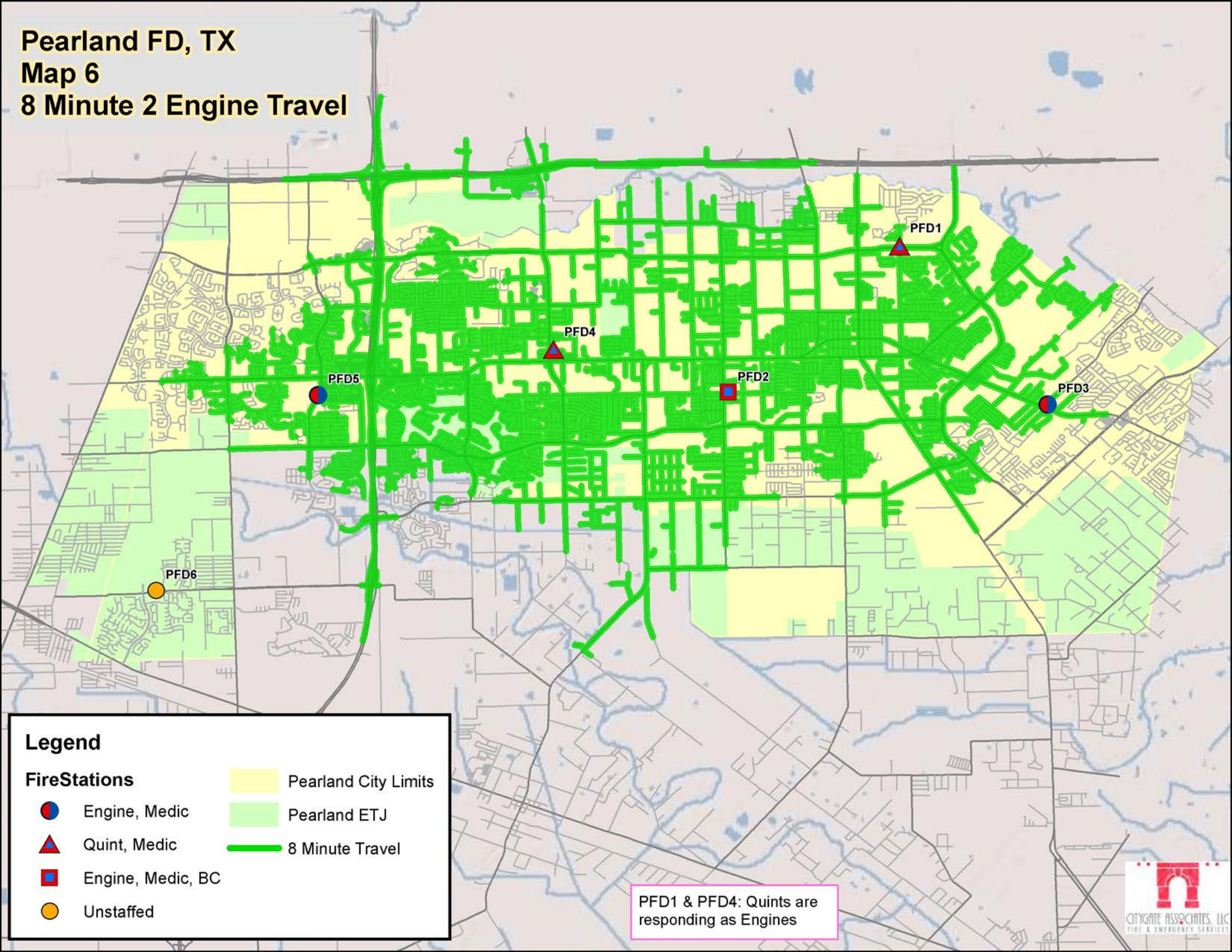
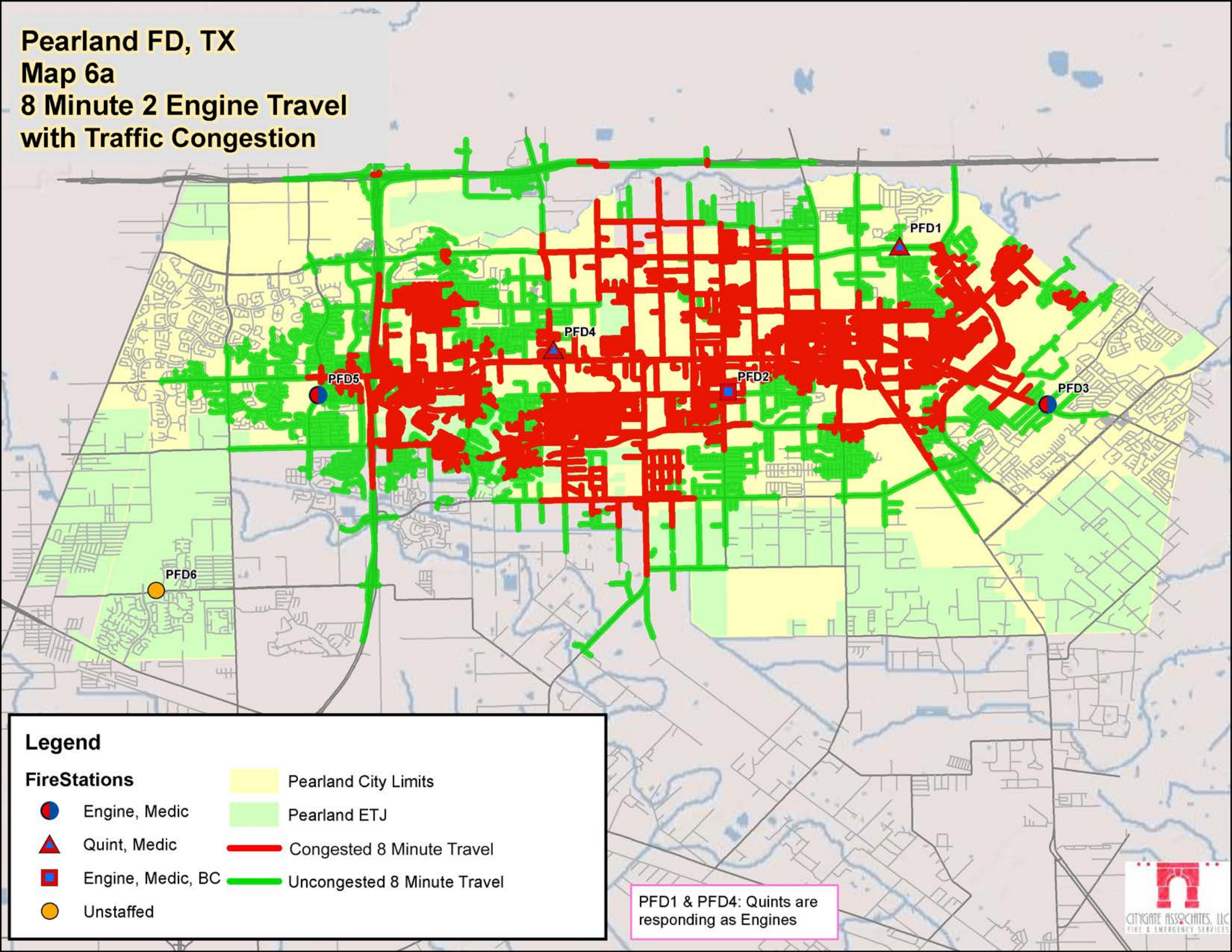
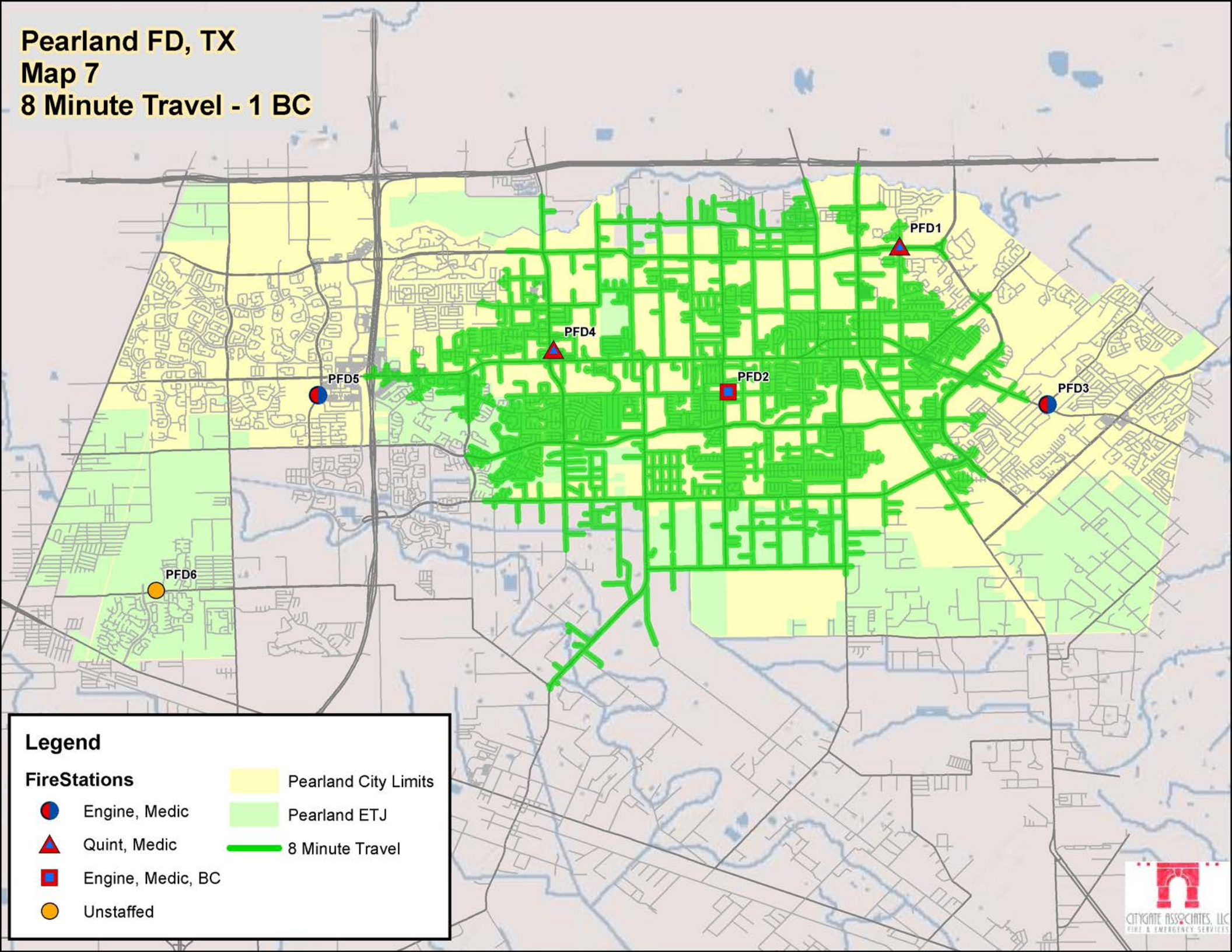
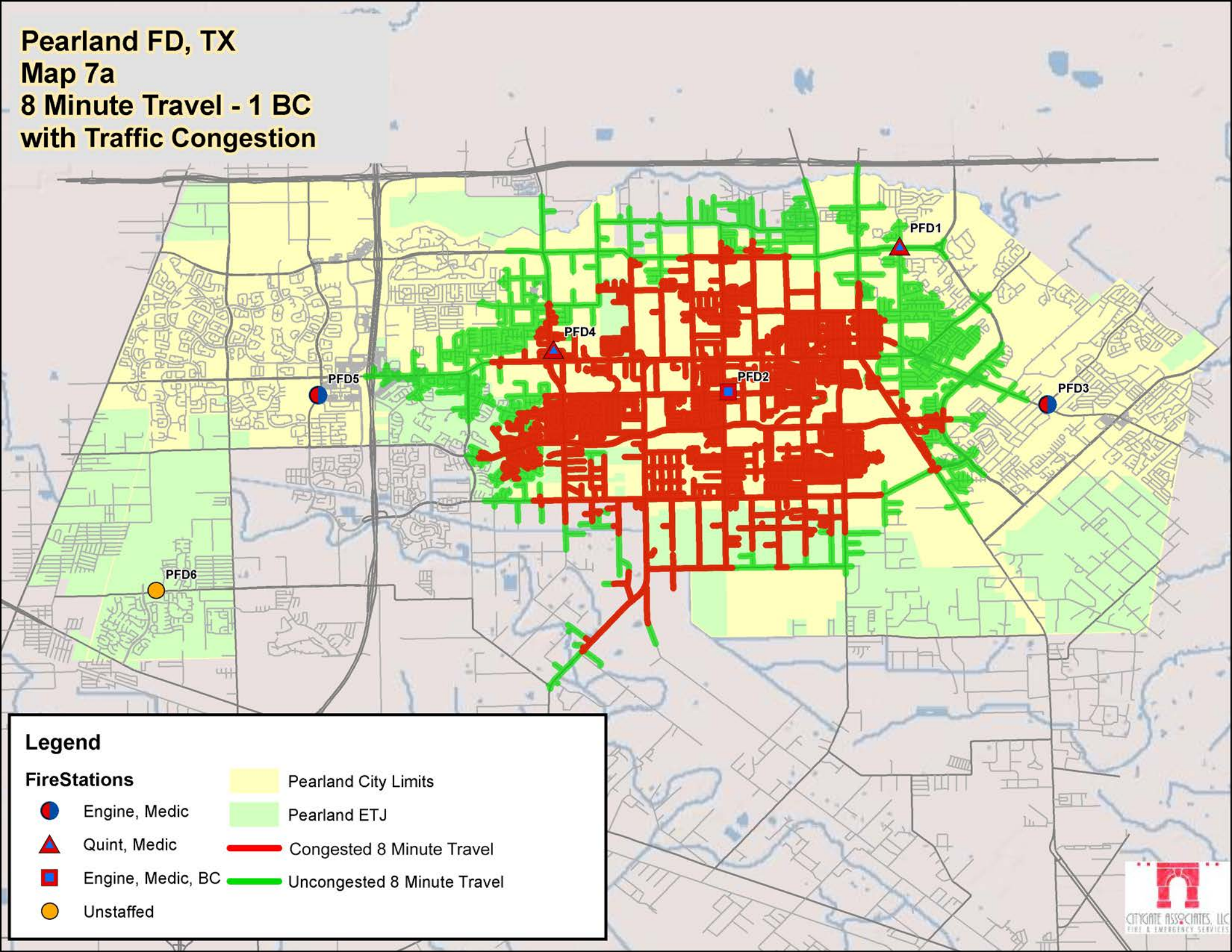

Pearland FD, TX
Map 6
8 Minute 2 Engine Travel
PFD1
PFD2
PFD3
PFD4
PFD5
PFD6
Legend
FireStations
Engine, Medic
Quint, Medic
Engine, Medic, BC
Unstaffed
Pearland City Limits
Pearland ETJ
8 Minute Travel
PFD1 & PFD4: Quints are responding as Engines
CITYGATE ASSOCIATES, LLC
FIRE & EMERGENCY SERVICES

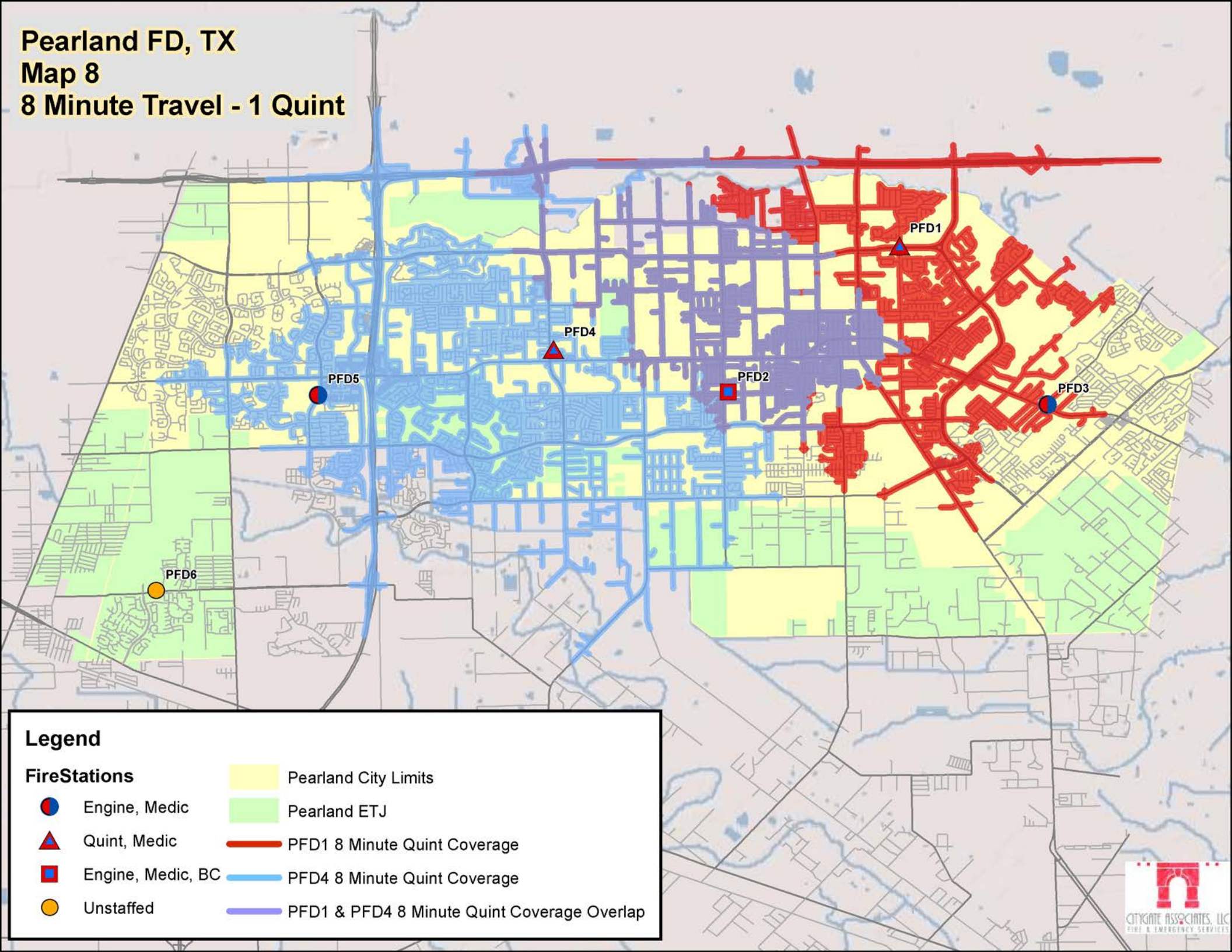
Pearland FD, TX
Map 6a
8 Minute 2 Engine Travel with Traffic Congestion




Pearland FD, TX
Map 7
8 Minute Travel - 1 BC
PFD1
PFD2
PFD3
PFD4
PFD5
PFD6
Legend
FireStations
Engine, Medic
Quint, Medic
Engine, Medic, BC
Unstaffed
Pearland City Limits
Pearland ETJ
8 Minute Travel
CITYGATE ASSOCIATES, LLC
FIRE & EMERGENCY SERVICES

Pearland FD, TX
Map 7a
8 Minute Travel - 1 BC
with Traffic Congestion




Pearland FD, TX
Map 8
8 Minute Travel - 1 Quint
PFD1
PFD2
PFD3
PFD4
PFD5
PFD6
Legend
FireStations
Engine, Medic
Quint, Medic
Engine, Medic, BC
Unstaffed
Pearland City Limits
Pearland ETJ
PFD1 8 Minute Quint Coverage
PFD4 8 Minute Quint Coverage
PFD1 & PFD4 8 Minute Quint Coverage Overlap
CITYGATE ASSOCIATES, LLC
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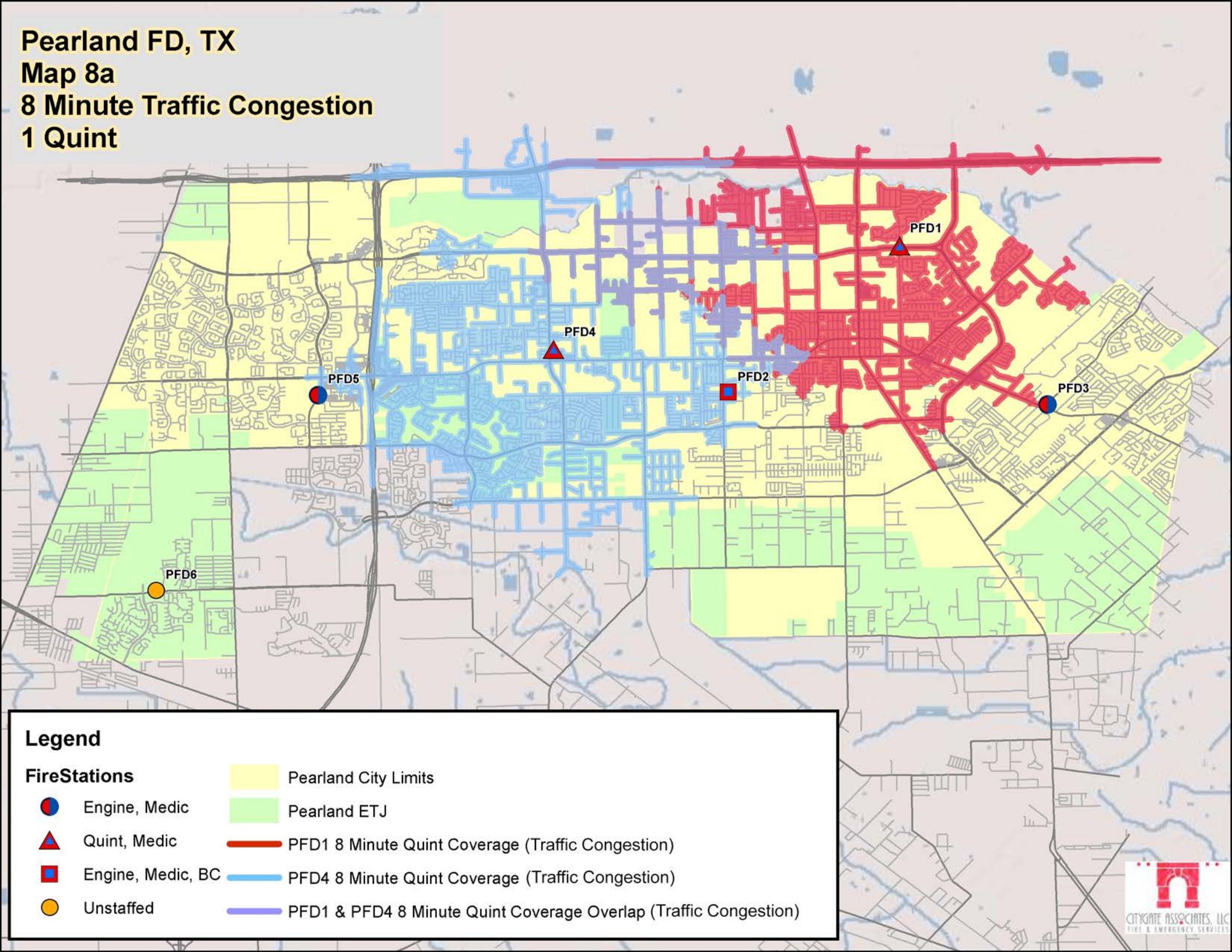
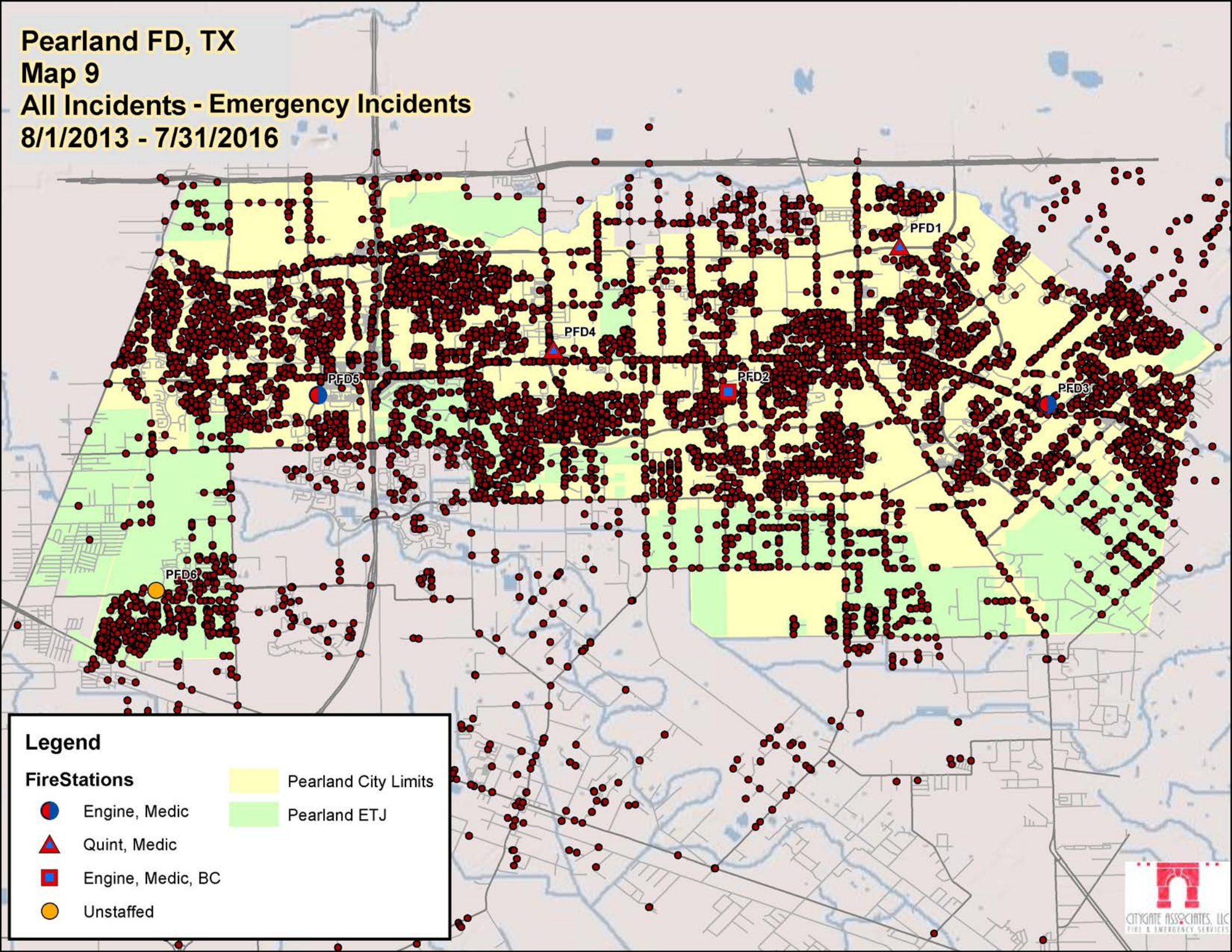
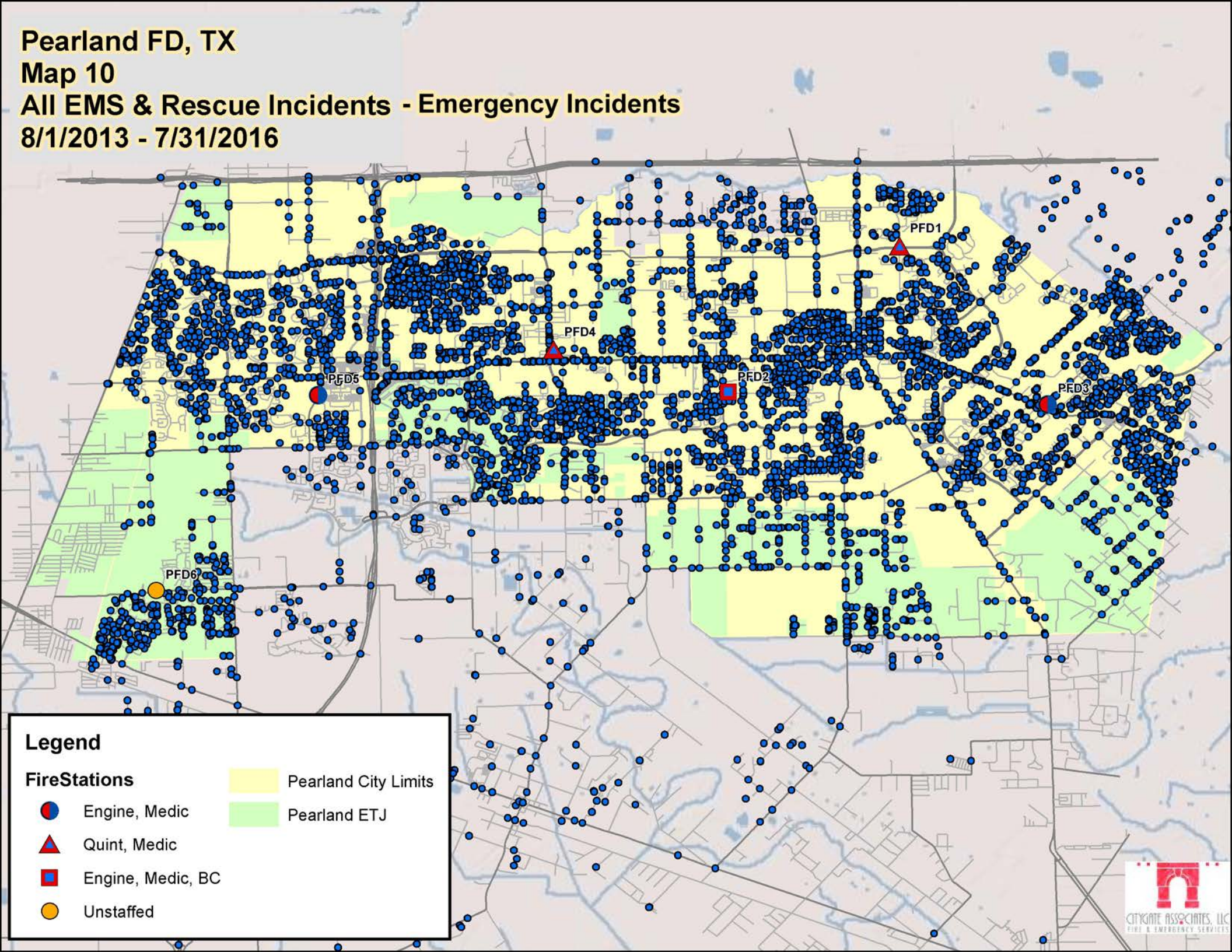
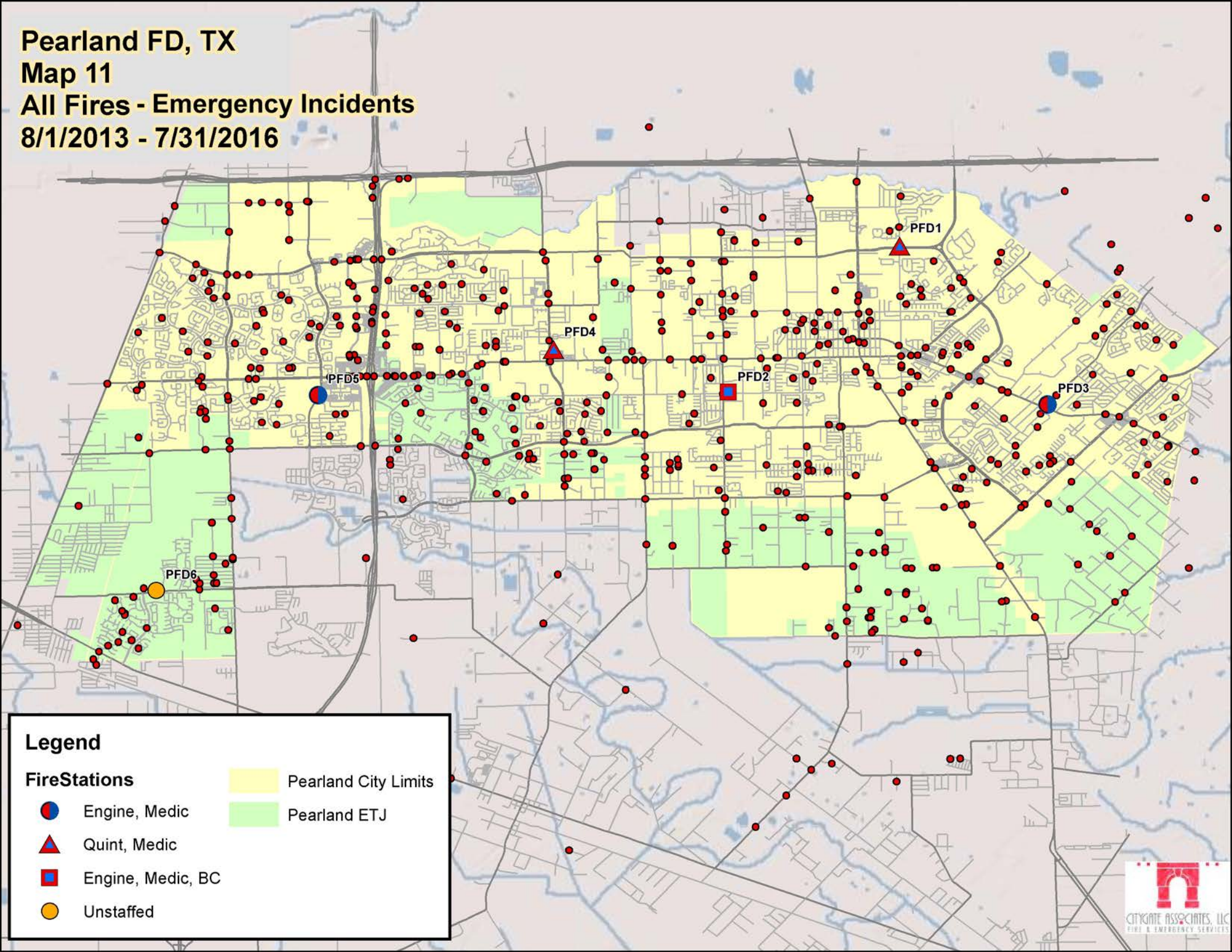
Pearland FD, TX
Map 8a
8 Minute Traffic Congestion
1 Quint




Pearland FD, TX
Map 9
All Incidents - Emergency Incidents
8/1/2013 - 7/31/2016
PFD1
PFD2
PFD3
PFD4
PFD5
PFD6
Legend
FireStations
Engine, Medic
Quint, Medic
Engine, Medic, BC
Unstaffed
Pearland City Limits
Pearland ETJ
CITYGATE ASSOCIATES, LLC

Pearland FD, TX
Map 10
All EMS & Rescue Incidents - Emergency Incidents
8/1/2013 - 7/31/2016




Pearland FD, TX
Map 11
All Fires - Emergency Incidents
8/1/2013 - 7/31/2016
PFD1
PFD2
PFD3
PFD4
PFD5
PFD6
Legend
FireStations
Engine, Medic
Quint, Medic
Engine, Medic, BC
Unstaffed
Pearland City Limits
Pearland ETJ
CITYGATE ASSOCIATES, LLC
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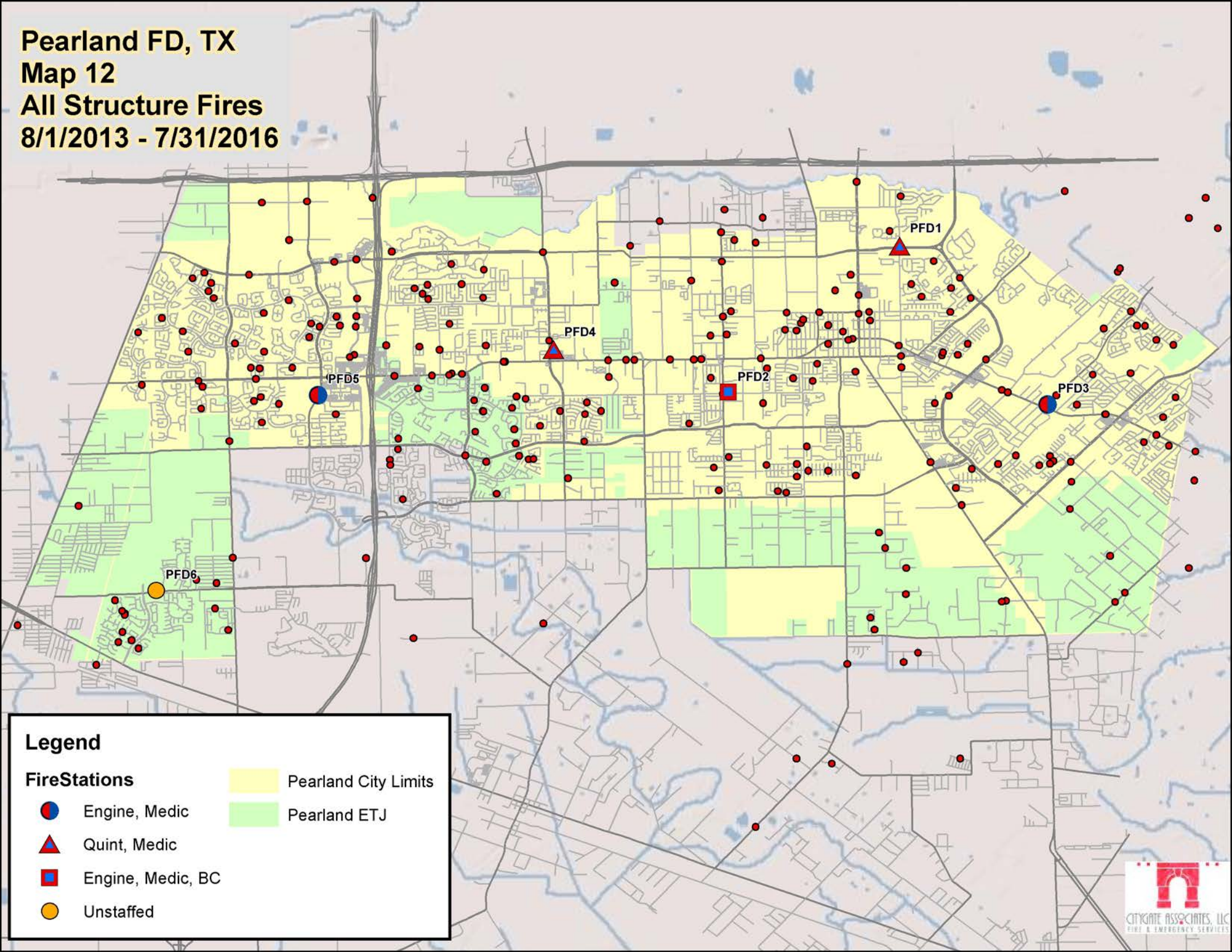
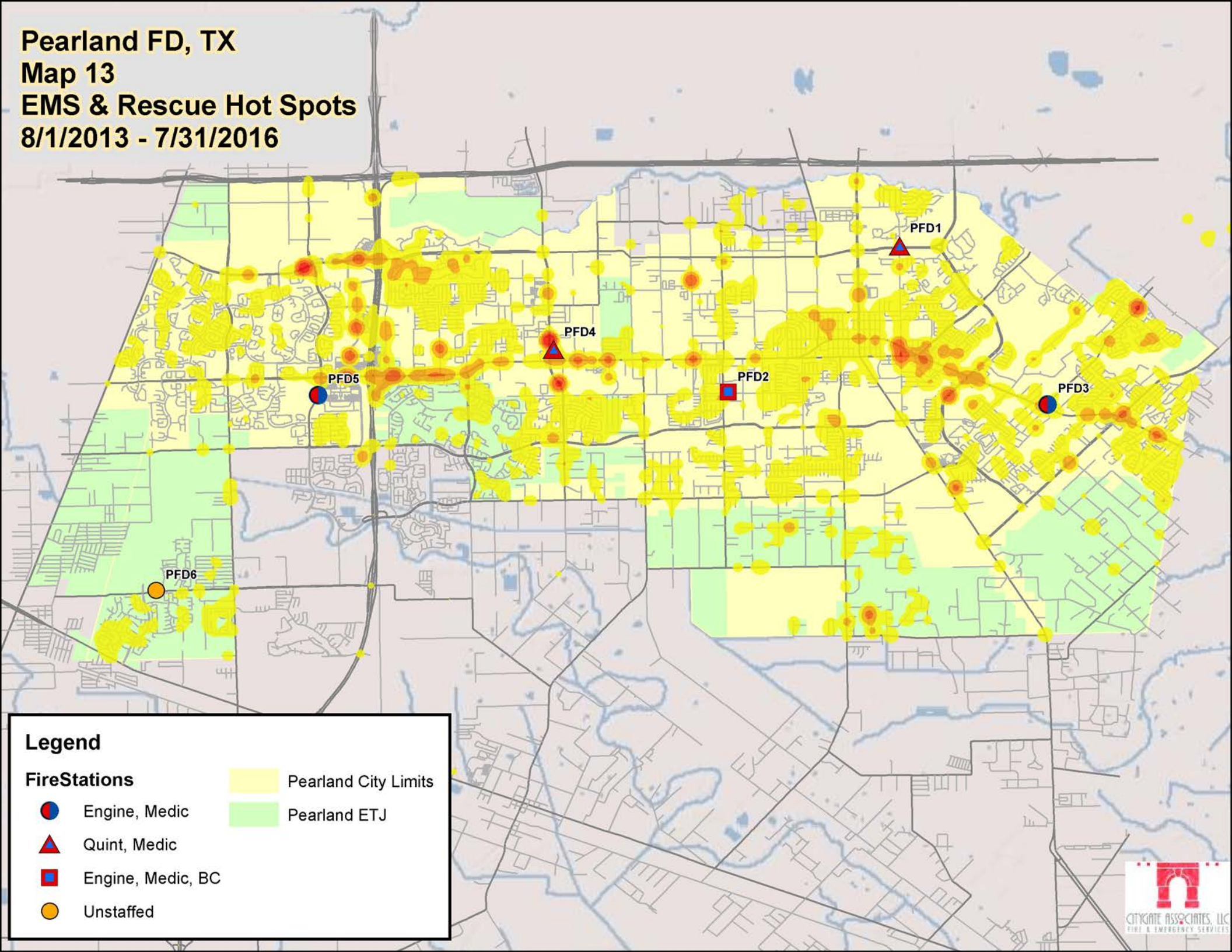
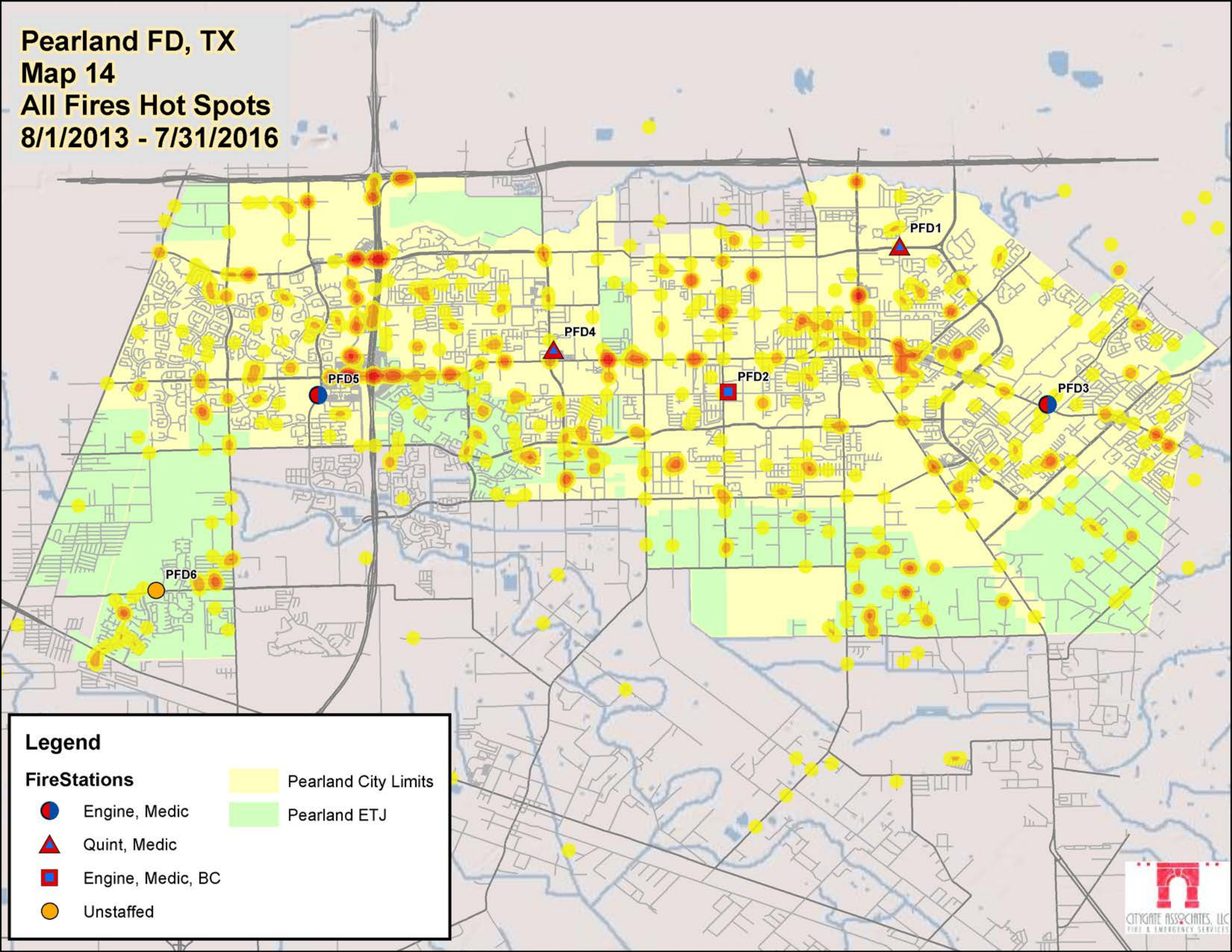

Pearland FD, TX
Map 12
All Structure Fires
8/1/2013 - 7/31/2016
PFD1
PFD2
PFD3
PFD4
PFD5
PFD6
Legend
FireStations
Engine, Medic
Quint, Medic
Engine, Medic, BC
Unstaffed
Pearland City Limits
Pearland ETJ
CITYGATE ASSOCIATES, LLC
FIRE & EMERGENCY SERVICES

Pearland FD, TX
Map 13
EMS & Rescue Hot Spots
8/1/2013 - 7/31/2016




Pearland FD, TX
Map 14
All Fires Hot Spots
8/1/2013 - 7/31/2016
PFD1
PFD2
PFD3
PFD4
PFD5
PFD6
Legend
FireStations
Engine, Medic
Quint, Medic
Engine, Medic, BC
Unstaffed
Pearland City Limits
Pearland ETJ
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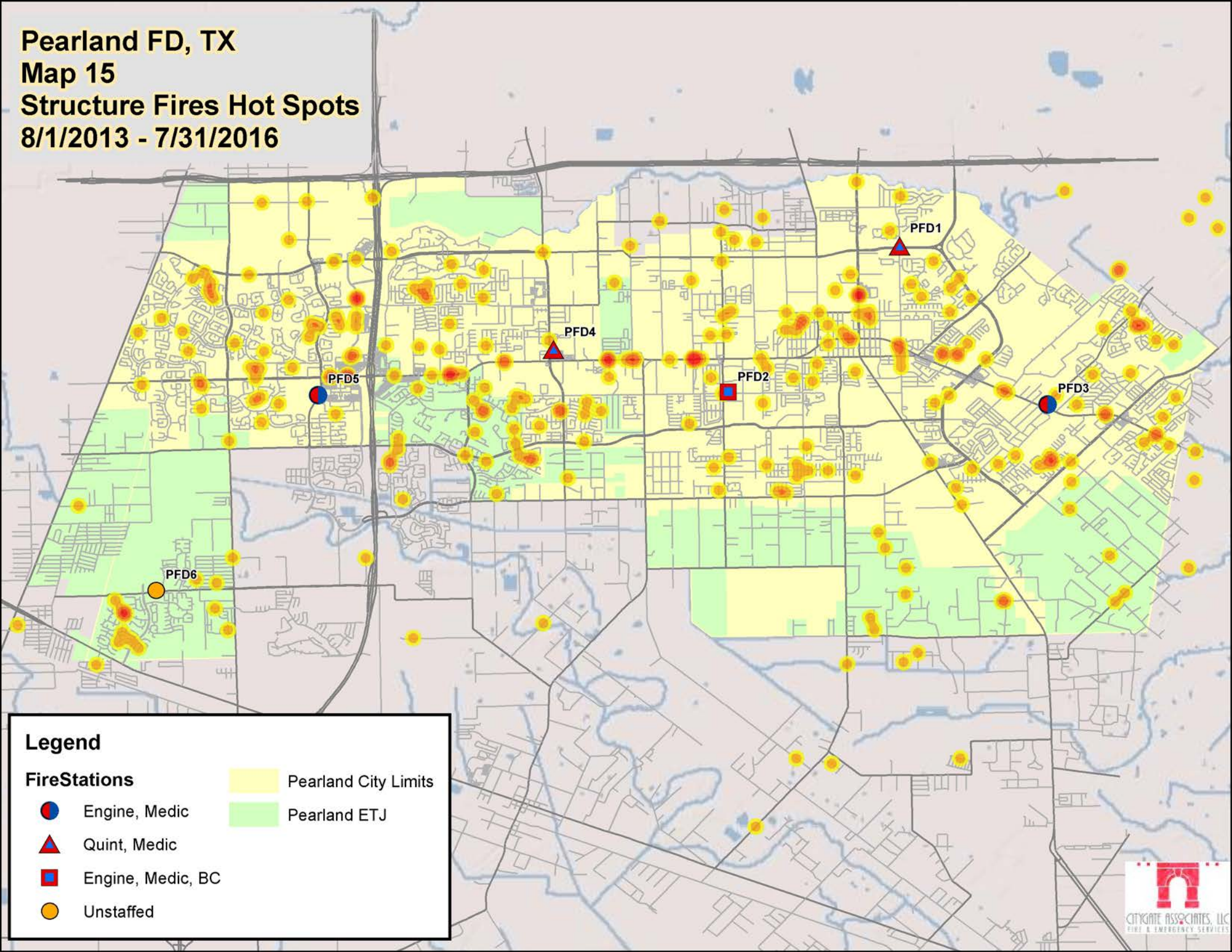
Pearland FD, TX
Map 15
Structure Fires Hot Spots
8/1/2013 - 7/31/2016
PFD1
PFD2
PFD3
PFD4
PFD5
PFD6
Legend
FireStations
Engine, Medic
Quint, Medic
Engine, Medic, BC
Unstaffed
Pearland City Limits
Pearland ETJ
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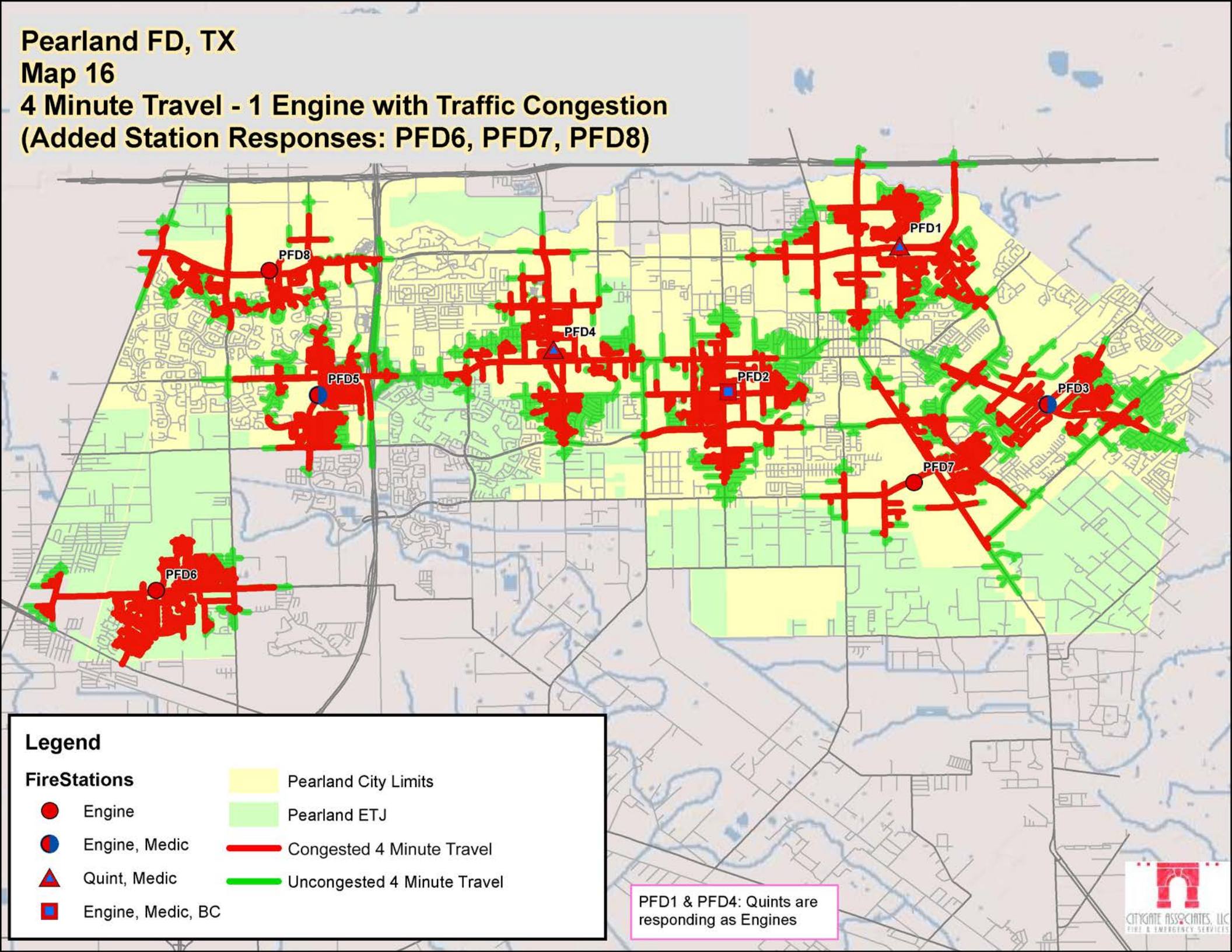
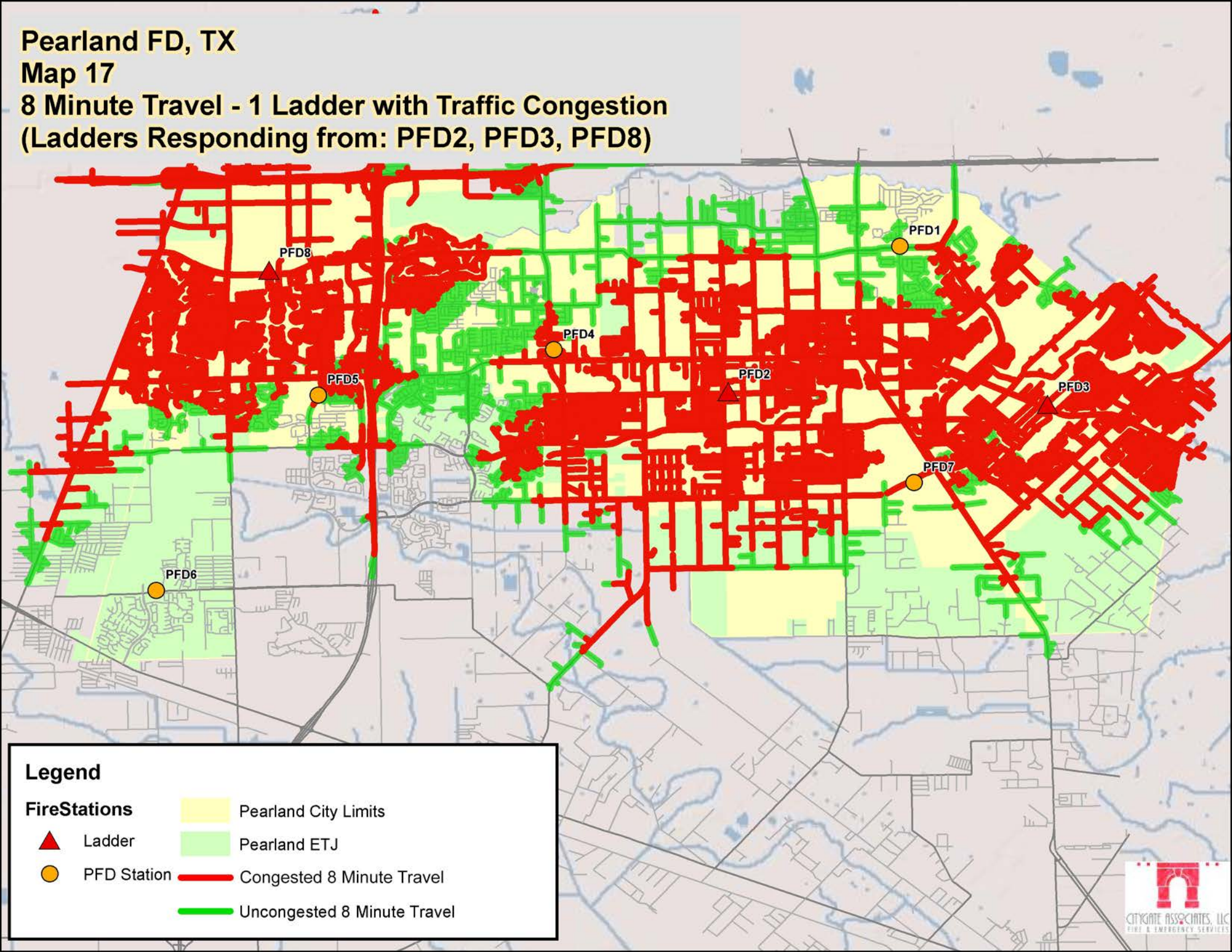
Pearland FD, TX
Map 16
4 Minute Travel - 1 Engine with Traffic Congestion
(Added Station Responses: PFD6, PFD7, PFD8)



Pearland FD, TX
Map 17
8 Minute Travel - 1 Ladder with Traffic Congestion
(Ladders Responding from: PFD2, PFD3, PFD8)



Pearland FD, TX
Map 18
8 Minute ERF Travel: 1BC, 2 Engines, 1 Quint, 1 Medic with Traffic Congestion
(Added Station Responses: PFD6, PFD7, PFD8)