TABLE OF CONTENTS

VOLUME 2 of 4 – Technical Report (this volume)

Section **Page**

Standards of Cover—Deployment Summary 1

Response Performance Summary 1
Overall Summary of the Department's Deployment 2
Findings and Recommendations 3
Overall Deployment Findings 4
Overall Deployment Recommendations 5

Section 1—Introduction and Background 9

1.1 Report Organization 9
1.1.1 Goals of the Report 9
1.1.2 Limitations of Report 10
1.2 Project Approach and Scope of Work 10
1.2.1 Project Approach and Methodology 10
1.2.2 Project Scope of Work 11
1.3 Department Overview 11
1.3.1 Service Capacity 14

Section 2—Standard of Cover Analysis 17

2.1 Standard of Cover Process Overview 17
2.2 Current Deployment 19
2.2.1 Current Deployment Model 21
2.3 Outcome Expectations 23
2.4 Community Risk Assessment 25
2.4.1 Risk Assessment Methodology 25
2.4.2 Values to Be Protected 26
2.4.3 Hazard Identification 28
2.4.4 Risk Assessment Summary 30
2.5 Critical Task Time Measures—What Must Be Done over What Time Frame to Achieve the Stated Outcome Expectation? 32
2.5.1 Critical Firefighting Tasks 32
2.5.2 Critical Medical Emergency Tasks 34
2.5.3 Critical Task Analysis and Effective Response Force Size 35
2.6 Distribution and Concentration Studies—How the Location of First-Due and First Alarm Resources Affects Emergency Incident Outcomes 36
2.6.1 Deployment Baselines 36
2.6.2 Travel Timer Road Mile Coverage Measures 41
2.7 Statistical Analysis 42
2.7.1 Service Demand by Property Use 49
2.7.2 Simultaneous Incident Activity 51
2.7.3 Station Area Demand by Hour 53

2.7.4 Unit-Hour Utilization 55
2.7.5 Hospital Offload Time 60
2.7.6 Response Time Performance 61
2.8 Overall Evaluation 69
2.8.1 Overall Deployment Recommendations 70

Section 3A—Headquarters Services Review: Introduction 73

3A.1 Headquarters Services Overview 73
3A.2 Methodology 74
3A.3 District Management Organization 75
3A.4 Office of the Fire Chief 80
3A.4.1 Office of the Fire Chief Findings and Recommendations 81

Section 3B—Headquarters Services: Administration Division 83

3B.1 Administration Division Overview 83
3B.1.1 Administration Division General Findings and Recommendations 84
3B.2 Dispatch Services 85
3B.2.1 Personnel 86
3B.2.2 Operations 88
3B.2.3 Dispatch Services Findings and Recommendations 89
3B.3 Human Resources 89
3B.3.1 Typical Fire/EMS Human Resource Functions 90
3B.3.2 Resources 91
3B.3.3 Human Resources Findings and Recommendations 93
3B.4 Information Technology 93
3B.4.1 Information Technology Findings and Recommendations 95
3B.5 Public Information 96
3B.5.1 Public Information Recommendation 97
3B.6 Finance Operations 97
3B.6.1 Fiscal Policies and Procedures 97
3B.6.2 Systems Technology 100
3B.6.3 Performance Measures 101
3B.6.4 Finance Staffing and Workload Capacity 103
3B.6.5 Fiscal Services Evaluation 105

Section 3C—Headquarters Services: Operations Division 107

3C.1 Operations Division Overview 107
3C.2 Chief of Operations Office 108
3C.2.1 Chief of Operations Office Finding and Recommendation 108
3C.3 EMS Section Operations and Clinical Oversight 108
3C.3.1 EMS Training 110
3C.3.2 Personnel Credentialing 110
3C.3.3 Quality Oversight Programs 111
3C.3.4 Overall EMS Section Observations 112
3C.3.5 EMS Section Findings and Recommendations 113
3C.4 Suppression Section 114
3C.4.1 Suppression Assistant Chief Office 114

3C.4.2 Health and Safety 115
3C.4.3 Special Operations 119
3C.4.4 Suppression Training 124
3C.5 Community Risk Reduction 131
3C.5.1 Overview 131
3C.5.2 Community Risk Reduction Findings and Recommendations 133

Section 3D—Headquarters Services: Resource and Logistics Division 135

3D.1 Resource and Logistics Division Overview 135
3D.2 Resource and Logistics Assistant Chief's Office 136
3D.2.1 Resource and Logistics Assistant Chief's Office Finding and Recommendation 136
3D.3 Facilities Section 136
3D.3.1 Overview 136
3D.3.2 Review 137
3D.3.3 Facilities Section Findings and Recommendations 138
3D.4 Fleet Services 139
3D.4.1 Introduction and Background 139
3D.4.2 Overview 139
3D.4.3 Responsibilities and Services 140
3D.4.4 Fleet Summary 142
3D.4.5 Vehicle Replacement 144
3D.4.6 Shop Capacity and Operations 146
3D.4.7 Fleet Services Evaluation 149
3D.5 Quartermaster 150
3D.5.1 Overview 150
3D.5.2 Best Practice References 151
3D.5.3 Supplies and Equipment 152
3D.5.4 Staffing Capacity 154
3D.5.5 Quartermaster Section Review 155
3D.5.6 Quartermaster Section Findings and Recommendations 155

Section 3E—Overall Headquarters Services Assessment and Personnel Recommendations 157

3E.1 Headquarters Services Assessment 157
3E.1.1 Headquarters Programs: Positives 157
3E.1.2 Headquarters Programs: Issues in Need of Additional Attention (Not by Priority) 157
3E.1.3 Additional Staffing Capacity Needed 157

Section 4—Strategic Fiscal Review 159

4.1 Introduction 159
4.2 Budget Process 159
4.2.1 Budget Process Findings and Recommendations 163
4.3 Fiscal Policies and Procedures 163
4.3.1 Fiscal Policies and Procedures Findings and Recommendations 165
4.4 Revenues 166
4.4.1 Revenues Findings and Recommendations 171
4.5 Expenditures 173
4.5.1 Personnel Costs 173

4.5.2 Services and Supplies Costs 173
4.5.3 Capital Expense 174
4.6 Revenues versus Expenditures 176
4.6.1 Revenues versus Expenditures Findings and Recommendations 176
4.7 Fiscal Reserves 177
4.7.1 Fiscal Reserves Findings and Recommendations 178
4.8 Debt 181
4.9 Unfunded or Underfunded Fiscal Liabilities 181
4.9.1 Unfunded or Underfunded Fiscal Liabilities Findings and Recommendations 181
4.10 Fiscal Planning 181
4.10.1 Fiscal Planning Findings and Recommendations 182
4.10.2 Additional Facility Costs 182
4.11 Overall Fiscal Evaluation 184
4.11.1 Initial Fiscal Forecast Model Assumptions 184

Appendix A—Risk Assessment 189

A.1 Community Risk Assessment 189
A.1.1 Risk Assessment Methodology 189
A.1.2 Risk Assessment Summary 190
A.1.3 Risk Planning Zones 191
A.1.4 Values at Risk to Be Protected 192
A.1.5 Hazard Identification 198
A.1.6 Service Capacity and Capabilities 200
A.1.7 Probability of Occurrence 201
A.1.8 Impact Severity 201
A.1.9 Building Fire Risk 203
A.1.10 Vegetation/Wildfire Risk 207
A.1.11 Medical Emergency Risk 211
A.1.12 Hazardous Material Risk 214
A.1.13 Technical Rescue Risk 217
A.1.14 Aviation Incident Risk 219
A.1.15 Marine Incident Risk 221

Table of Tables

Table 1—90th Percentile Response Performance Summary 2
Table 2—Cy-Fair Fire Department Staffing Summary 12
Table 3—Response Facilities, Response Resources, and Minimum Daily Response Staffing 13
Table 4—Standard of Cover Process Elements 18
Table 5—Fire Service Deployment Paradigm 19
Table 6—Response Performance Goals (Minutes: Seconds) 20
Table 7—Response Plan by Type of Emergency 22
Table 8—Overall Risk by Hazard and Station Area 31
Table 9—First Alarm Residential Fire Critical Tasks – 17–22 Personnel 33
Table 10—Cardiac Arrest Critical Tasks – 6–7 Personnel 34
Table 11—Service Area Travel Time Coverage Summary 41
Table 12—Incidents: Quantity – Incident Type by Year (at Least 50 Total) – 2018–2022 46

Table 13—Service Demand by Property Use (at Least 50 Total) – 2018–2022 49
Table 14—Simultaneous Incident Activity (2022) 51
Table 15—Station Demand by Hour (2022) 54
Table 16—Unit-Hour Utilization – Engines (2022) 56
Table 17—Unit-Hour Utilization – Truck Companies (2022) 58
Table 18—Unit-Hour Utilization – Medic/EMS (2022) 59
Table 19—90th Percentile Dispatch Performance from Call Receipt (2018–2022) 62
Table 20—90th Percentile Turnout Performance (2018–2022) 63
Table 21—90th Percentile First-Unit Travel Time Performance (2018–2022) 64
Table 22—90th Percentile First-Unit Travel Time Performance – In-Station Area (2018–2022) 65
Table 23—90th Percentile First-Unit Call-to-Arrival Performance (2018–2022) 66
Table 24—Full Box – 90th Percentile ERF Response Group Travel Performance (2018–2022) 68
Table 25—Staffing Summary by Division 79
Table 26—Operations Division Administrative Support Staffing Summary 107
Table 27—Full-Time Firefighter Training Academy Summary 127
Table 28—Volunteer Firefighter Training Academy Summary 127
Table 29—Suppression Training Summary 129
Table 30—Resource and Logistics Division Staffing Summary 135
Table 31—Fleet Summary 142
Table 32—Recommended Reserve-to-Front-Line-Vehicle Ratio 143
Table 33—Expected Useful Service Life 144
Table 34—Additional Recommended HQ FTE Summary 158
Table 35—General Fund Revenue Summary (CY 2021) 167
Table 36—Recent Revenue Summary (2019–2023) 167
Table 37—Property Tax Levy History (2017–2022) 169
Table 38—Sales and Use Tax History 170
Table 39—Recent EMS Fee Revenue History 172
Table 40—Expenditure History 173
Table 41—Capital Expenditure History 175
Table 42—Revenue versus Expenditure History 176
Table 43—Audited Fund Balance/Reserve History 179
Table 44—Unassigned Fund Balance Allocations 180
Table 45—Estimated Cost for a +/- 10,000 SF 2-Bay Facility 183
Table 46—Estimated Cost for a +/- 15,000 SF 3-Bay Facility 183
Table 47—Estimated Cost for a +/- 20,000 SF 4-Bay Facility 183
Table 48—Estimated Annual Staffing and Operations & Maintenance Costs 184
Table 49—Five-Year Operational Forecast 186
Table 50—Five-Year Fund Balance Forecast 186
Table 51—Overall Risk Template 190
Table 52—Overall Risk by Hazard and Station Area 191
Table 53—Key Demographic Data – Cy-Fair, TX 194
Table 54—Building Occupancy Inventory by Risk Category 196
Table 55—Critical Facilities 197
Table 56—Probability of Occurrence Categories 201
Table 57—Consequence Severity Categories 202
Table 58—Building Fire ERF Resources 204
Table 59—Building Fire Service Demand 205

Table 60—Building Fire Risk Assessment....206
Table 61—Vegetation/Wildfire ERF....209
Table 62—Vegetation/Wildfire Service Demand....210
Table 63—Vegetation/Wildfire Risk Assessment....211
Table 64—Medical Emergency Service Demand....213
Table 65—Medical Emergency Risk Assessment....214
Table 66—Hazardous Material Service Demand....216
Table 67—Hazardous Material Risk Assessment....217
Table 68—Technical Rescue Service Demand....218
Table 69—Technical Rescue Risk Assessment....219
Table 70—Aviation Incident Service Demand....220
Table 71—Aviation Incident Risk Analysis....221

Table of Figures

Figure 1—Fractile versus Average Response Time Measurements....24
Figure 2—Building Fire Progression Timeline....29
Figure 3—Survival Rate versus Time of Defibrillation....30
Figure 4—Total Service Demand by Year....43
Figure 5—Annual Service Demand by Incident Type....43
Figure 6—Number of Incidents by Month by Year....44
Figure 7—Number of Incidents by Day of Week by Year....44
Figure 8—Service Demand by Hour of Day and Year....45
Figure 9—Service Demand by Station Area by Year....45
Figure 10—Number of Incidents by Station by Year....46
Figure 11—Number of Single-Station Simultaneous Incidents by Year....52
Figure 12—Number of Single-Station Simultaneous Incidents by Station by Year....52
Figure 13—Fractile for Incidents Call Processing (CAD) – 2022....62
Figure 14—Fractile for Incidents Turnout (CAD) – 2022....64
Figure 15—Fractile for Incidents Travel (CAD) – 2022....65
Figure 16—Fractile for Incidents Call to First Arrival – 2022....67
Figure 17—District Organizational Chart....77
Figure 18—Administration Division Organization....83
Figure 19—Dispatch Center Organization....85
Figure 20—Information Technology Section Organization....94
Figure 21—Finance Section Organization....104
Figure 22—Operations Division Administrative Support Organization....107
Figure 23—Operations Division – EMS Section Organization....109
Figure 24—Special Operations Organization....121
Figure 25—Suppression Training Section Organization....125
Figure 26—Resource and Logistics Division Organization....135
Figure 27—Facilities Section Organization....137
Figure 28—Fleet Services Organization....140
Figure 29—Quartermaster Section Organization....151
Figure 30—Recent Revenue Trend (2019–2023)....168
Figure 31—Property Tax Levy History (2017–2022)....169
Figure 32—Recent Sales Tax Revenue History....170

Figure 33—Recent EMS Fee Revenue History 172
Figure 34—Risk Planning Zones 192
Figure 35—Commission on Fire Accreditation International Hazard Categories 199
Figure 36—Building Fire Progression Timeline 203
Figure 37—Wildland-Urban Interface (WUI) Housing Densities 207
Figure 38—Potential Wildfire Impact 208
Figure 39—Survival Rate versus Time to Defibrillation 212

Separately Bound

VOLUME 1 – Executive Summary

VOLUME 3 – Map Atlas

VOLUME 4 – 2023–2028 Strategic Plan

STANDARDS OF COVER—DEPLOYMENT SUMMARY

RESPONSE PERFORMANCE SUMMARY

Citygate finds that the District is well organized to accomplish its mission to serve a diverse urban population across a varied municipal land-use pattern. The District is using best practices and is data driven in its approach to deployment, as necessary.

Fire service deployment, simply summarized, is about the *speed* and *weight* of response. *Speed* refers to initial (first-due) response of all-risk resources (engines, ladder trucks, rescues, and ambulances) strategically deployed across a jurisdiction for response to emergencies within a time interval to achieve desired outcomes. *Weight* refers to multiple-unit (Effective Response Force or ERF) responses to more serious emergencies such as building fires, multiple-patient medical emergencies, vehicle collisions with extrication required, or technical rescue incidents. In these situations, enough firefighters and paramedics must be assembled within a time interval to safely control the emergency and prevent it from escalating into a more serious event.

In urban population areas, if desired outcomes include limiting building fire damage to only part of the inside of an affected building and/or minimizing permanent impairment from a medical emergency, then initial units should arrive within 8:30 minutes and a multiple-unit ERF should arrive within 11:30 minutes of 9-1-1 answer at the District's 9-1-1 Dispatch Center, all at 90 percent or better reliability. Total response time to emergency incidents includes three separate components:

- 9-1-1 call processing / dispatch time
- Crew turnout time
- Travel time.

Recommended best practice times for these response components are 1:30 minutes, 2:00 minutes, and 4:00 to 5:00 / 8:00 minutes respectively for first-due and multiple-unit ERF responses in urban areas.

The District's fire and EMS unit dispatch, turnout, and travel times are all longer than best practice recommendations. In summary, the District's total response time for a first-due unit to a fire or EMS emergency is 4:22 minutes *longer* than best practice.

The following table reflects a summary of overall response performance.

Table 1—90th Percentile Response Performance Summary

Response Component	Best Practice		90th Percentile Performance (2022)	Performance Versus Best Practice and Current Goal
	Time	Reference		
Call Processing / Dispatch	1:30	NFPA Citygate	**2:13**	**+ 0:43**
Crew Turnout	2:00	Citygate	**3:19**	**+ 1:19**
First-Unit Travel	4:00	NFPA	**8:07**	**+ 4:07**
First-Unit Call to Arrival	7:30	Citygate	**11:52**	**+ 4:22**
ERF Travel	8:00	Citygate	**18:23**	**+ 10:23**

The above measures are for *District-wide* performance. Some areas perform better than others for two principal reasons this study will discuss in depth:

1. There are not enough fire stations in some areas.
2. The impact of a non-grid, curvilinear street network with open spaces between some clusters of development.

Overall Summary of the Department's Deployment

The Department serves a diverse urban population with a mixed residential and non-residential land-use pattern typical of Harris County.

If the District Commissioners' desired emergency outcomes in urban population areas include limiting building fire damage to only part of the inside of an affected building or minimizing permanent impairment resulting from a medical emergency, or both, then the District will need to provide both first-due unit and multiple-unit Effective Response Force (ERF) coverage in similar-risk neighborhoods consistent with Citygate's best practices-based response performance recommendations.

Citygate finds the Department's response apparatus to be appropriate to protect against the hazards likely to impact the District's fire service areas. Daily staffing per unit provides for at least two Effective Response Forces sufficient for one to two emerging or serious fires while maintaining engine and ambulance emergency responses.

As the response performance summary table shows, the total response time of 11:52 minutes from Fire Dispatch Center answer to first-unit arrival to significant fire and EMS emergencies is significantly longer than a typical, best practice-based, and Citygate-recommended goal of 7:30 to 8:30 minutes in urban areas. Given the road network design and growth areas around still-undeveloped open spaces, as in other urban areas with similar challenges, Citygate is recommending the District use a 5:00-minute travel time measure for future fire station spacing. Thus, a total response time goal would be first-unit arrival within 8:30 minutes and ERF arrival within 11:30 minutes of call receipt at Fire Dispatch, all at 90 percent or better reliability.

In terms of emergency incident workload per unit, no single firefighting unit or station area is approaching workload saturation. However, during long hours of the day, the ambulance system is at saturation due to total and simultaneous incident demand, which is further compounded and worsened further by long patient transfer times at hospitals. This means units are crossing sections of the District to cover other units' incident requests, which creates a cascade of longer response times.

Improving response times will not be easy or quick given the circumstances in the District's service area. There will need to be a multiple-issue, multiple-year effort to improve. Current staff and technology resources can be applied to improving turnout times. Over time, adding three stations will assist underserved infill areas. The growth areas—principally on the western and northern edges of the District—will need at least five additional stations. In addition to at least one fire engine per station, additional ambulances and ladder trucks will also be necessary.

The ambulance system is at capacity for personnel assigned on 24-hour shifts. At some point, after too many incidents over the course of a long shift, patient care could degrade. As soon as possible, multiple peak-hour ambulances are needed seven days a week.

Given the diversity of needs within its service area, the District should adopt multiple response time goals to drive planning for and the monitoring of fire and EMS service performance. The District should also focus on *equity of access* to a first responder. Stated this way, for areas with similar risk, one neighborhood should receive help in about the same time (and with the same outcome goal) as another across the District. In summary, the District's response times cannot materially improve closer to best practices for positive outcomes without adding a significant number of resources.

FINDINGS AND RECOMMENDATIONS

Based on the technical analysis contained in our deployment study, Citygate offers the following findings and recommendations.

Overall Deployment Findings

Finding #1: The Department's response unit types are appropriate to protect against the hazards likely to impact the service area.

Finding #2: The Department's management team uses response performance goals consistent with best practice recommendations as published by the CFAI and NFPA; however, those performance goals have not been formally adopted by the District Board of Commissioners consistent with recommended best practice.

Finding #3: The Department has a standard response plan that considers types of emergency risks and establishes an appropriate initial response for each incident type; each type of call for service receives the combination of engines, trucks, specialty units, and command officers customarily needed to effectively control that type of incident based on Department experience.

Finding #4: Geographic coverage models indicate the need to plan for three additional infill fire stations and at least five fire stations in the western and northern growth areas for a total of eight more stations than at present.

Finding #5: With five or more simultaneous incidents occurring 40.29 percent of the time, more so in Station areas 1, 2, 5 and 8 at peak hours of the day, the District must plan to meet this surge of demand.

Finding #6: None of the primary firefighting units have hourly workload utilization that is high enough to be of concern in the next few years.

Finding #7: Medic ambulances are very busy, and 10 of the 14 medic units on a 24-hour-per-day schedule are overloaded at present according to a unit-hour utilization (UHU) measure over many consecutive hours. The 90th percentile hospital offload delays are 90 minutes. The Department should seek immediate relief via the use of peak hour of the day medic ambulances during peak hours of the day and a second 24-hour medic ambulance in Station 8's area.

Finding #8: Dispatch processing times to all serious requests are 30 seconds longer than a best practice time of 1:30 minutes. However, the District does not track call-processing time related to life-threatening EMS and fire events. These are processed much faster and can be separately reported.

Finding #9: Historic turnout times are sluggish and require education, training, and time reporting back to the crews to bring this measure down. Reducing this measure by 60 seconds is not impossible.

Finding #10: First-unit travel time performance for Fire and EMS incidents District-wide in 2022 ranges from 6:27 to 8:07 minutes at the 90th percentile. This is significantly *slower* than the 4:00-minute best practice goal for urban areas. None of the station areas come close to a 4:00-minute travel time.

Finding #11: At 11:52 minutes in 2022, the 90th percentile call-to-arrival time District-wide is significantly *slower* than a 7:30- to 8:30-minute best practice goal for urban areas. None of the station areas come close to a 7:30-minute call-to-arrival time.

Finding #12: At 18:23 minutes in 2022, the 90th percentile Effective Response Force (ERF or First Alarm) *travel* time for the last unit to arrive District-wide is significantly *slower* than an 8:00-minute best practice goal in urban areas. None of the station areas come close to an 8:00-minute ERF travel time measure. There are too few units spread across too large a road network to quickly deliver six units to an incident.

Overall Deployment Recommendations

Recommendation #1: Ensure that Dispatch is staffed and has the procedures in place to rapidly dispatch life-threatening emergencies and keep urgent incident processing to 90 seconds where language or location barriers do not exist.

Recommendation #2: Through feedback and training, decrease crew turnout times to 2:00 minutes over a 24-hour day.

Recommendation #3: Adopt Updated Deployment Policies: The District's Commissioners should adopt complete performance measures to aid deployment expansion and to monitor equity of performance across the diverse District. Measures should be for both urban areas and areas of emerging growth. The measures of time should be designed to deliver outcomes that will save patients upon arrival when possible and keep small and expanding fires from becoming more serious. With this is mind, Citygate recommends the following measures.

3.1 Urban Areas – Distribution of Fire Stations: To treat pre-hospital medical emergencies and control small fires, the first-due unit should arrive within 8:30 minutes, 90 percent of the time, from receipt of the 9-1-1 call at Fire Dispatch. This equates to a 90-second dispatch time, a 2:00-minute company turnout time, and a 5:00-minute travel time.

3.2 Urban Areas – Multiple-Unit Effective Response Force (ERF) for Serious Emergencies: To confine building fires near the room of

origin, keep vegetation fires under one acre in size, and treat multiple medical patients at a single incident, a multiple-unit ERF of at least 17 personnel, including at least one Chief Officer, should arrive within 11:30 minutes from the time of 9-1-1 call receipt at the Fire Dispatch Center, 90 percent of the time. This equates to a 90-second dispatch time, a 2:00-minute company turnout time, and an 8:00-minute travel time.

3.3 **Medic Ambulances** – To provide paramedic-level patient care along with first responder engines or ladders, deploy ambulances based on an 8:00- to 10:00-minute travel time for a total response time of no more than 13:30 minutes.

3.4 Adopt a medic ambulance workload measure of a Unit-Hour Utilization (UHU) rate saturation point of no more than 35 percent over eight consecutive hours.

3.5 **Urban Areas – Hazardous Materials Response:** To protect the District's service area from the hazards associated with uncontrolled release of hazardous and toxic materials, send the nearest first-response fire unit to assess the situation, isolate and deny entry, and determine the need for the Hazardous Materials Response Team from Cy-Fair, the County Fire Marshal, and/or Houston.

3.6 **Urban Areas – Technical Rescue:** To provide technical rescue services as needed with enough trained personnel to facilitate a successful rescue, a multiple-unit ERF of at least 17 personnel, including on-duty technical rescue specialists and at least one Chief Officer, should be capable of responding throughout the District's service area to facilitate safe rescue/extrication and delivery of the victim to the appropriate emergency medical care facility.

3.7 **New Growth Areas** – Adopt tiered deployment measures based on population density and community risks to control building fires from spreading to other buildings or to the wildland, controlling wildland fires from spreading to inhabited buildings, and minimizing permanent impairment from a medical emergency. The response time goals could be as follows:

3.7a When there are more than 10,000 residents in a contiguous area beyond a 5:00-minute travel time from a station, at that point have a fire station and crew operational.

3.7b In commercial-only areas, if there are more than 5,000 employees (or others) in a contiguous area beyond an 8:00-minute travel time from a station, at that point have a fire station and crew operational.

SECTION 1—INTRODUCTION AND BACKGROUND

1.1 REPORT ORGANIZATION

The Harris County, Texas Emergency Services District #9 (District), providing services as the Cy-Fair Fire Department (Department), retained Citygate Associates, LLC (Citygate) to conduct a Fire Services Master Plan, Community Risk Assessment, Standard of Cover, and Compliance Audit focused on positioning the District to meet current and future fire and emergency medical service (EMS) needs. The study includes a comprehensive review of all services provided—both internal and customer-facing—to evaluate the necessity for each service to be provided; whether each service is being provided in the most efficient manner; service measure expectations; and the District's overall organizational structure, communications, staffing levels, management practices, training, and regulatory framework and compliance.

Citygate's evaluation provides recommendations relative to the organization and deployment of fire suppression and EMS operations and the associated administrative, logistical, and fiscal support services. The results serve as a foundation for future fire service planning, including a preliminary five-year Strategic Plan. This report identifies both current services and desired service levels, and then describes the District's ability to provide them considering significant ongoing and anticipated population growth and related development.

Citygate's scope of work and corresponding Work Plan were developed consistent with Citygate's Project Team members' experience in fire administration and deployment. Citygate utilizes various industry-recognized best practice guidelines and criteria in the field of deployment analysis, including National Fire Protection Association (NFPA) standards, the self-assessment criteria of the Commission on Fire Accreditation International (CFAI), Insurance Services Office (ISO) schedules, and federal and state mandates relative to emergency services including the Texas Commission on Fire Protection (TCFP) and the Texas Department of State Health Services (DSHS).

1.1.1 Goals of the Report

Citygate cites findings and makes recommendations as appropriate related to each finding. Findings and recommendations throughout this report are sequentially numbered. A complete list of the same findings and recommendations is provided in the Executive Summary.

This document provides technical information related to how fire services are provided and legally regulated and the way the Department currently operates. This information is presented in the form of recommendations and policy choices for consideration by the District's Board of Commissioners and leadership team.

The result is a strong technical foundation upon which to understand the advantages and disadvantages of the choices facing the District related to the provision of fire and EMS services, and more specifically, at what level of desired outcome and expense.

1.1.2 Limitations of Report

In the United States, there are no federal or state regulations requiring a specific minimum level of fire services. Each community, through the public policy process, is expected to understand the local fire and non-fire risks and its ability to pay, and then choose its level of fire services. *If* fire services are provided at all, federal and state regulations specify how to safely provide them for the public and for the personnel providing the services.

While this report and technical explanation can provide a framework for the discussion of services, neither this report nor the Citygate team can make the final decisions, nor can they cost out every possible alternative in detail. Once recommendation implementations receive policy approval, Department staff can conduct any final costing and fiscal analyses as typically completed in the normal operating and capital budget preparation cycle.

1.2 Project Approach and Scope of Work

1.2.1 Project Approach and Methodology

Citygate utilized multiple sources to gather, understand, and model information about the District and Department. Citygate requested and reviewed relevant background data and information to better understand current costs, service levels, and the history of service level decisions, including prior studies.

Citygate subsequently reviewed demographic information about the District service area and the potential for future growth and development. Citygate also obtained map and response data from which to model current and projected fire service and EMS deployment, with the goal to identify the location(s) of stations and crew quantities required to best serve the District service area as it currently exists and to facilitate future deployment, fleet and facility planning.

Once Citygate understood the District service area and its fire and non-fire risks, the Citygate team then tested deployment model revisions against the travel time mapping and prior response data to ensure an appropriate fit. Citygate also evaluated future service area growth and service demand by risk type. This resulted in Citygate proposing an approach to address current and longer-range needs with effective and efficient use of Department and District resources. The result is a framework for enhancing services while meeting reasonable community expectations and fiscal realities.

1.2.2 Project Scope of Work

Citygate's approach to this operational enhancement update involved:

- Reviewing relevant information provided by the District and Department.
- Interviewing internal study stakeholders.
- Conducting separate online surveys for District staff and service area residents and businesses.
- Conducting a comprehensive analysis of the fire and non-fire hazards likely to impact the service area.
- Utilizing Esri ArcGIS, a geographic mapping software program, to model fire station travel time coverage.
- Using StatsFD™, an incident response time analysis program, to analyze the statistics of prior incident performance and plot the results on graphs and geographic mapping exhibits.
- Identifying and evaluating future service area population and related development growth.
- Reviewing service demand by risk type.
- Recommending appropriate, risk-specific response performance goals.
- Identifying a long-term strategy, including incremental short- and mid-term goals, to achieve desired response performance objectives.
- Conducting a comprehensive review of all Department support functions.
- Conducting a comprehensive fiscal review and analysis.

1.3 Department Overview

The Department provides fire and EMS transport ambulance services to a 164-square-mile service area with a population of more than 525,000 residents and a Fiscal Year (FY) 2023 budget totaling $108.25 million. The all-risk, all-hazard services provided include fire suppression, Basic Life Support (BLS) and Advanced Life Support (ALS) paramedic pre-hospital emergency medical and ambulance transportation, initial hazardous material release/spill response, and other related services. As summarized in the following table, the Department operates with a staff of 560

personnel. *[For a full organizational chart visualizing the structure of the District/Department, see Figure 17.]*

Table 2—Cy-Fair Fire Department Staffing Summary

Division / Section	Personnel			Total
	Full-time	Part-Time	Volunteer	
Administration	**45**	**7**	**0**	**52**
Executive Team	6	0	0	**6**
Dispatch	20	4	0	**24**
Finance	6	0	0	**6**
Human Resources	1	0	0	**1**
Information Technology	10	2	0	**12**
PIO	2	1	0	**3**
Operations	**280**	**74**	**128**	**482**
EMS	140	7	0	**147**
Suppression	140	67	128	**335**
Resource & Logistics	**22**	**4**	**0**	**26**
Facilities	4	0	0	**4**
Fleet	10	3	0	**13**
Quartermaster	8	1	0	**9**
Total	**347**	**85**	**128**	**560**

The Department utilizes a unique deployment model—with single-role EMS personnel on a 40-hour workweek providing EMS services only (no fire suppression or rescue tasks), and suppression personnel on a 53-hour workweek providing suppression and rescue services—all from 13 strategically located fire stations, as summarized in the following table.

Table 3—Response Facilities, Response Resources, and Minimum Daily Response Staffing

Station / Facility	Address	Response Resources	Minimum Daily Staffing
1	9202 Rodney Ray Blvd.	**E-1** **Medic 1** Booster 1	**3** **2**
2	13040 Wortham Center Dr.	**E-2*** **Ladder 2*** **Medic 2** Medic 502 **EMS Supervisor**	* **3*** **2** ** **1**
3	11827 Telge Rd.	**E-3** **Medic 3** **Rescue 3**** Rescue Boat 3	**3** **2** **3****
4	18006 Huffmeister Rd.	**E-4** **Medic 4** Tanker 4 Booster 4 Fire Gator 4	**3** **2**
5	17819 Kieth Harrow Blvd.	**E-5** **Medic 5** Medic 505 **Rescue 5**** Transporter 5	**3** **2** **** **3****
6	6404 North Eldridge Pkwy.	**E-6** **Medic 6** Booster 6 EVAC Boat 6 EVAC Boat 506	**3** **2**
7	20444 Cypresswood Dr.	**E-7*** **Medic 7** Booster 7 **Tower 7*** EVAC Boat 7 EVAC Boat 507	* **2** **3***
8	18210 FM 529	**E-8** **Medic 8** **Rescue 8**** Booster 8 Rescue Boat 8	**3** **2** ****
9	7188 Cherry Park Dr.	**District Chief 9** **E-9*** **Tower 9*** **Medic 9** **Medic 509** **EMS Supervisor**	**1** **3*** * **2** **2** **1**
10	11310 Steeplecrest Dr.	**E-10** **Medic 10** Transporter 10	**3** **2**
11	18132 West Rd.	**E-11** **Medic 11** Booster 11 Fire Boat 11 EMS Gator 11	**3** **2**

Station / Facility	Address	Response Resources	Minimum Daily Staffing
12	19780 Kieth Harrow Blvd.	**E-12** **Medic 12** Tanker 12 Booster 12 EVAC Boat 12 EVAC Boat 512	**3** **2**
13	10222 Westgreen Blvd.	**E-13*** **Medic 13** **Ladder 13*** Transporter 13 **EMS District Chief**	**3*** **2** * **1**
98	11631 Yearling Dr.	Rehab 1	***
Admin.	10710 Telge Rd.	**District Chief**	**3**
		Suppression Subtotal	**48**
		EMS Subtotal	**31**
		Total Daily Response Staffing	**77**

Bold font denoted staffed units; non-bold font units are cross staffed as needed based on incident type/need
Blue font denotes single-role EMS resource (EMS services only)
* Only the engine or aerial apparatus staffed on any given day; staffed unit rotates by shift
** Only two of the three rescues are staffed daily; staffed units rotate by shift schedule
*** Staffed by volunteers as available
**** Flex-staffed unit as scheduled staffing is available

As the table shows, the Department staffs 11 engines, two rescue units, two aerial apparatus, and 14 ambulances daily with seven wildland engines (boosters), two tankers, six evacuation boats, two rescue boats, one fire boat, and three high-profile evacuation transporters that can be staffed by on-duty, off-duty, and/or volunteer personnel as needed.

1.3.1 Service Capacity

All paid suppression response personnel are trained and certified to the Emergency Medical Technician Basic (EMT-B) level, capable of providing Basic Life Support (BLS) pre-hospital emergency medical care. All EMS division providers are trained and certified to the Paramedic 1, Paramedic 2, or Paramedic 3 level, capable of providing Advanced Life Support (ALS) pre-hospital emergency medical care. The Department also provides ALS ground ambulance services.

All suppression personnel are also trained to the U.S. Department of Transportation Hazardous Materials First Responder Operational level to provide initial hazardous material incident assessment, hazard isolation, and support for a technical Hazardous Materials Response Team from either the Harris County Fire Marshal's Office or Houston Fire Station 66.

Suppression personnel are further trained to the confined space awareness level, and the Department provides technical rescue services, including surface and swift water, with three heavy rescue companies at stations 3, 5, and 8.

The Department has an automatic aid agreement with the adjacent Rosehill Fire Department and is also a participating agency in the Harris County Mutual Aid Fire Protection Agreement.

Finding #1:	The Department's response unit types are appropriate to protect against the hazards likely to impact the service area.

SECTION 2—STANDARD OF COVER ANALYSIS

This section provides a detailed analysis of the Department's current ability to deploy and mitigate hazards within its service area. The response analysis uses prior response statistics and geographic mapping to help the Department and stakeholders visualize what the current response system can and cannot deliver.

2.1 STANDARD OF COVER PROCESS OVERVIEW

The core methodology used by Citygate in the scope of its deployment analysis work is *Standards of Cover*, fifth and sixth editions, which is a systems-based approach to fire department deployment published by the Commission on Fire Accreditation International (CFAI). The SOC method evaluates deployment as part of a fire agency's self-assessment process. The approach uses local risks, demographics, and community expectations regarding outcomes to determine the level of protection best fitting a community's needs and to help elected officials make informed decisions regarding fire and EMS deployment levels.

Citygate has adopted this multiple-part systems approach as a comprehensive tool for evaluation. The SOC approach uses multiple factors such as response capacity related to staffing, types of needed apparatus, design challenges/benefits of the road network, and station locations and area coverage. Depending on the needs of the study, the depth of the components may vary.

In contrast to a one-size-fits-all, prescriptive formula, such a systems approach to deployment allows for local determination. In this comprehensive 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, 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 following table describes the eight elements of the SOC process.

Table 4—Standard of Cover Process Elements

SOC Element		Description
1	**Existing Deployment System**	Overview of the community served, authority to provide services, and current deployment model and performance metrics
2	**Community Outcome Expectations**	Review of the community's expectations relative to response services provided by the agency
3	**Community Risk Assessment**	Description of the values to be protected within the service area, and analysis of the fire and non-fire risks likely to impact the community served
4	**Critical Task Analysis**	Review of the essential tasks that must be performed and the personnel required to deliver a stated outcome for an Effective Response Force (ERF)
5	**Distribution Analysis**	Review of the spacing of initial response (first due) resources (typically engines) to control routine emergencies to achieve desired outcomes
6	**Concentration Analysis**	Review of the spacing of fire stations so that larger or more complex emergencies receive sufficient resources in a timely manner (ERF) to achieve desired outcomes
7	**Reliability and Historical Response Effectiveness Analysis**	Using recent prior response statistics, determining the percentage of conformance to established response performance goals the existing deployment system delivers
8	**Overall Evaluation**	Proposing Standards of Coverage statements by risk type as appropriate

Source: CFAI "Standards of Cover," Fifth Edition

Fire service deployment, simply summarized, is about the ***speed*** and ***weight*** of response. *Speed* refers to initial response (first due) of all-risk intervention resources (engines, ladder trucks, rescues, and ambulances) strategically deployed across a jurisdiction for response to emergencies within a travel time interval sufficient to control routine to moderate emergencies without the incident escalating to greater size or severity. *Weight* refers to multiple-unit responses for more serious emergencies such as building fires, multiple-patient medical emergencies, vehicle collisions with extrication required, or technical rescue incidents where enough firefighters must be assembled within a time interval to safely control the emergency and prevent it from escalating into an even more serious event.

The following table illustrates this deployment paradigm.

Table 5—Fire Service Deployment Paradigm

Element	Description	Purpose
***Speed** of Response*	Response time of initial all-risk intervention units strategically located across a jurisdiction	Controlling routine to moderate emergencies without the incident escalating in size or complexity
***Weight** of Response*	Number of firefighters in a multiple-unit response for serious emergencies	Assembling enough firefighters within a reasonable time frame to safely control a more complex emergency without escalation

Thus, smaller fires and less complex emergencies require a single- or two-unit response (engine and/or specialty resource) within a relatively short response time. Larger or more complex incidents require more units and personnel to control. In either case, if the crews arrive too late or the total number of personnel is too few for the emergency, they are drawn into an escalating and more dangerous situation. The science of fire crew deployment is to spread crews out across a community or jurisdiction for quick response to keep emergencies small with positive outcomes without spreading resources so far apart that they cannot assemble quickly enough to effectively control more serious emergencies.

2.2 CURRENT DEPLOYMENT

SOC ELEMENT 1 OF 8
EXISTING DEPLOYMENT POLICIES

Nationally recognized standards and best practices suggest using several incremental measurements to define response time. Ideally, the clock starts when the Department's communications center dispatcher receives the emergency call. Response time increments include 9-1-1 call processing / dispatch, crew response unit boarding (commonly called crew turnout), and actual driving (travel) time. Response performance best practices include specific time goals for each of these three increments, which combined equal total response time, or call-to-arrival time, which is a fire agency's true customer service metric. Response performance goals should also address response performance to other risks within the service area, such as hazardous materials and technical rescue, as recommended by the CFAI.

While the Department's management team uses the following response time goals, they have not been formally adopted by the Board of Commissioners in conformance with recommended best practice.

Table 6—Response Performance Goals (Minutes:Seconds)

Response Component	Current Department Goal	NFPA-Recommended Goal	Citygate-Recommended Goal
Call Processing / Dispatch	1:00	1:00	1:30
Crew Turnout – EMS	1:00	1:00	2:00
Crew Turnout – Fire	1:20	1:20	2:00
First Unit Travel – All Calls	4:00	4:00	4:00
First BLS Unit Travel	4:00	4:00	
First ALS Unit Travel	8:00	8:00	
First Unit Call to Arrival – EMS	6:00	6:00	7:30
First Unit Call to Arrival – Fire	6:20	6:20	7:30
ERF Travel	8:00	8:00	8:00
ERF Call to Arrival	10:20	10:20	11:30

Currently, National Fire Protection Association (NFPA) Standard 1710—a recommended deployment standard for career fire departments in urban/suburban areas—recommends initial (first-due) intervention unit arrival within a 4:00-minute travel time and arrival of all resources comprising a multiple-unit First Alarm within an 8:00-minute travel time, all at 90 percent or better reliability.[1]

The most recently published NFPA best practices have *decreased* recommended dispatch / call processing time to 1:00 minute for events with an imminent threat to life or significant property damage and 1:30 minutes for hazardous materials or technical rescue incidents, for joint response with law enforcement involving weapons, or for incidents involving language barriers.[2] However, the prior edition of NFPA Standard 1221—and Citygate's experience across many systems—finds 1:30 minutes for dispatch to be a safe and effective goal to all serious events that are not identified as life or death within the first few seconds of a dispatcher listening to the call.

If the travel time measures recommended by the NFPA and Citygate are added to the dispatch processing and crew turnout times recommended by Citygate and best practices, then a realistic 90 percent first-due unit total response performance goal *for an urban* area is 7:30–8:30 minutes from the time of the Cy-Fair Dispatch Center receiving the call. This includes 1:30 minutes for

[1] Source: NFPA 1710 – Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments (2020 Edition).

[2] NFPA 1221 – Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems (2019 Edition).

call processing / dispatch time, 2:00 minutes for crew turnout time, and 4:00 or 5:00 minutes for travel time.

Finding #2:	The Department's management team uses response performance goals consistent with best practice recommendations as published by the CFAI and NFPA; however, those performance goals have not been formally adopted by the District Board of Commissioners consistent with recommended best practice.

2.2.1 Current Deployment Model

Resources and Staffing

The Department's current deployment model consists of 11 engines staffed with three or four personnel each, two aerial ladder/tower trucks staffed with three or four personnel, two heavy rescue units staffed with three or four personnel, 14 paramedic ambulances staffed with two personnel, two advanced practice paramedic supervisors, one EMS District Chief and one suppression District Chief for a total (minimum) year-round daily staffing of 77 personnel operating from 13 fire stations and the administration facility. Both EMS and suppression personnel work a 24-hour shift schedule.

This deployment model meets the minimum staffing standards for building fires as recommended by NFPA 1710 for career fire departments and provides sufficient personnel for serious fire incidents or other emergencies requiring a multiple-unit response with additional response capacity for simultaneous incidents.

Response Plan

The Department is an all-risk fire agency providing the population it protects with services that include fire suppression and pre-hospital BLS and ALS paramedic emergency medical services including ground ambulance transportation, rescue, and initial hazardous material response. Given these risks, the Department utilizes a tiered response plan calling for different types and numbers of resources depending on incident/risk type. The Department's dispatch center CAD system selects and dispatches the closest and most appropriate resource(s) pursuant to the Department's response plan as summarized in the following table.

Table 7—Response Plan by Type of Emergency

Incident Type	Response	Minimum Total Staffing
Building Fire		
Modified Box Alarm	2 Engines or Engine + Aerial, DC, Safety	**8**
Full Box Alarm	3 Engines, 1 Aerial, 1 Rescue, DC, Safety	**17**
Heavy Box Alarm	4 Engines, 1 Aerial, 1 Rescue, 2 DCs, Safety	**21**
High Rise	5 Engines, 2 Aerials, 1 Rescue, 3 DCs, Safety	**28**
1-11 Response	2 Engines, 1 Medic, 1 EMS Sup., Rehab, 1 DC (all working fires)	**12**
2-11 Response	3 Engines, 1 Aerial or Rescue, 1 Medic, Mobile Command, 1 Maintenance Officer	**15**
Medical Emergency		
Low Priority	1 Medic	**2**
High Priority	1 Medic + EMS Sup., Engine, Aerial, or Rescue	**6**
Vegetation/Wildland Fire		
Grass	1 Engine, 1 Booster	**5**
Brush	2 Engines, 1 Booster, DC, Safety	**10**
Wildland	2 Engines, 2 Booster, 2 Tankers, DC, Safety	**14**
Vehicle Fire		
Surface Streets	1 Engine or Aerial	**3**
Freeway	1 Engine or Aerial + 1 Engine or Aerial (blocker)	**6**
Commercial Vehicle	2 Engines or 1 Engine + 1 Aerial, DC, Safety	**8**
Vehicle Collision		
Surface Streets	1 Engine, Aerial, or Rescue, 1 Medic	**5**
Freeway	1 Engine/Aerial/Rescue, 1 Engine/Aerial/Rescue (blocker), Medic	**8**
With Hazard	1 Engine/Aerial + Medic	**5**
Hazardous Materials	1 Engine/Aerial, 1 Rescue, DC, Safety, Rescue/HazMat Coord.	**9**
High Life Threat	1 Engine, 1 Aerial, 1 Rescue, DC, Safety, Rescue/HazMat Coord.	**12**
Technical Rescue		
Light Rescue	1 Engine/Aerial, 1 Rescue, 1 Medic, DC, Safety, EMS Sup., Rescue Coord.	**12**
Boat Rescue	1 Engine, 1 Aerial, 2 Rescues, 1 Boat, 1 Medic, DC, Safety, EMS Sup., Rescue Coord.	**15**
Heavy Rescue	1 Engine, 1 Aerial, 2 Rescues, 1 Medic, DC, Safety, EMS Sup., Rescue Coord.	**18**

Finding #3:	The Department has a standard response plan that considers types of emergency risks and establishes an appropriate initial response for each incident type; each type of call for service receives the combination of engines, trucks, specialty units, and command officers customarily needed to effectively control that type of incident based on Department experience.

2.3 Outcome Expectations

SOC Element 2 of 8
Community Outcome Expectations

The Standard of 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 it has, the time measures used must be understood and sound data must be available to evaluate performance.

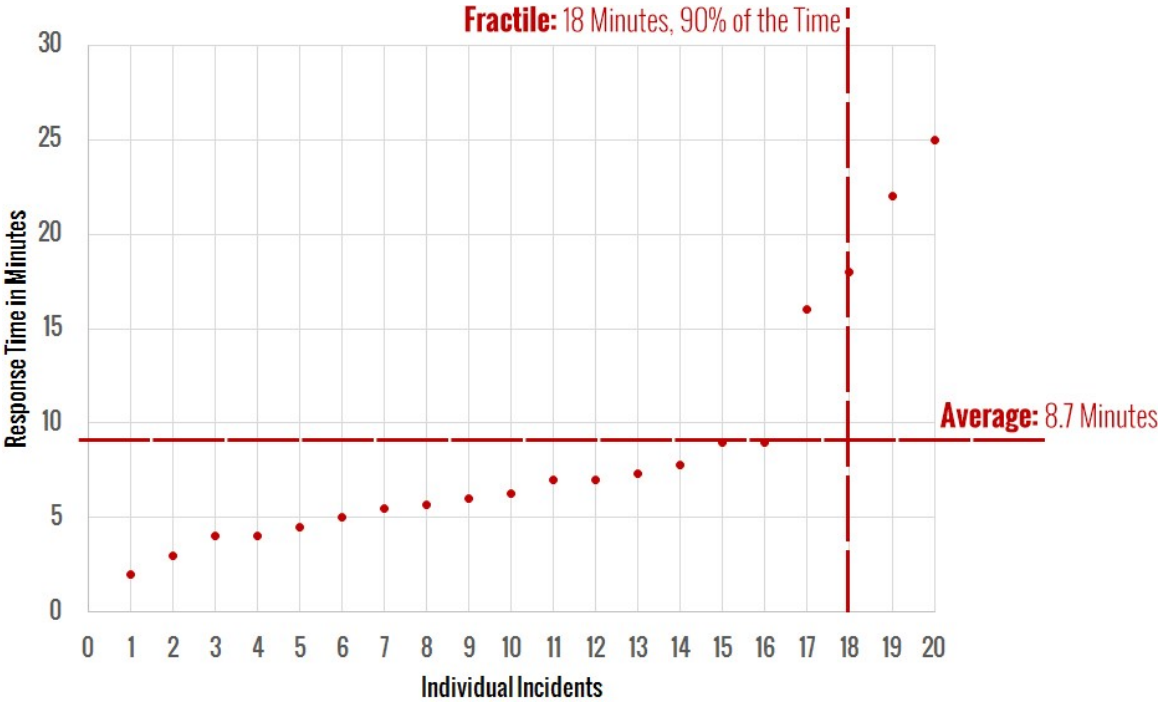
Current national best practice is to measure percent completion of a goal (e.g., 90 percent of responses) instead of an average measure. Mathematically, this is called a fractile measure.[3] This is because measuring the average only identifies the central or middle point of response time performance 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 far above the average or just above.

For example, the following figure shows response times for a **fictitious** small fire department that receives 20 calls for service each month. Each response time has been plotted on the graph from shortest response time to longest response time. The figure shows a *sample average* response time of 8:07 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 the figure that 20 percent of responses are far too slow, and that this hypothetical jurisdiction has a potential life-threatening service delivery problem. *Average* response time as a fire service delivery measurement 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 jurisdiction has a response time of 18:00 minutes, 90 percent of the time. Stated another way, 90 percent of all responses are 18:00 minutes or less. This fractile measurement is far more accurate at reflecting the service delivery situation of this small, fictitious agency.

[3] 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 SOC process, positive outcomes are the goal. From that, crew size and response time can be calculated to provide appropriate fire station spacing (distribution and concentration) to achieve the desired goal. Emergency medical incidents include situations with the most severe time constraints. The brain can only survive 4:00 to 6:00 minutes without oxygen. Cardiac arrest and other events can cause oxygen deprivation to the brain. Cardiac arrests make up a small percentage, with drowning, choking, trauma constrictions, or other similar events having 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 time frame. 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 spreads beyond 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 7:30- to 8:30-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 spreading beyond the room of origin and becoming very serious. Thus, the Department 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 that the fire or medical emergency continues to deteriorate from the time of inception, not from 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. Upon arrival, the crew must approach the patient or emergency, assess the situation, and appropriately deploy its skills and tools. Even in easy-to-access situations, this step can take 2:00 minutes or more. This time frame may be increased considerably due to long driveways, apartment buildings with limited access, multiple-story buildings or office complexes, shopping centers, rural highways, or recreation areas.

Unfortunately, there are times when 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 deployment system, then only anomalies like bad weather, poor traffic conditions, or multiple emergencies slow down the response system. 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 call processing / dispatch, crew turnout, and travel times, which is consistent with NFPA and CFAI best practice recommendations.

2.4 COMMUNITY RISK ASSESSMENT

SOC ELEMENT 3 OF 8
COMMUNITY RISK ASSESSMENT

The third element of the SOC process is a community risk assessment. Within the context of an SOC study, the objectives of a community risk assessment are to:

- Identify the values at risk to be protected within the community or service area.
- Identify the specific hazards with the potential to adversely impact the community or service area.
- Quantify the overall risk associated with each hazard.
- Establish a foundation for current/future deployment decisions and risk-reduction/hazard mitigation planning and evaluation.

A *hazard* is broadly defined as a situation or condition that can cause or contribute to harm. 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 whole community.

2.4.1 Risk Assessment Methodology

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

- Identification of geographic planning sub-zones (risk planning zones) appropriate to the community or jurisdiction.
- Identification and quantification, to the extent data is available, of the values at risk to various hazards within the community or service area.
- Identification of the fire and non-fire hazards likely to impact the community or service area relative to services provided by the fire agency.
- Determination of the probability of occurrence for each identified hazard based on prior occurrences.
- Determination of the *likely* impact severity for each hazard by planning zone.
- Determination of overall risk by hazard considering probability of occurrence and likely impact severity.

2.4.2 Values to Be Protected

Broadly defined, *values* are those tangibles of significant importance or value to the community or jurisdiction that are potentially at risk of harm or damage from a hazard occurrence. Values at risk typically include people, critical facilities/infrastructure, buildings, and key economic, cultural, historic, and/or natural resources.

People

Residents, employees, visitors, and travelers in a community or jurisdiction are vulnerable to harm from a hazard occurrence. Particularly vulnerable are specific at-risk populations, including those unable to care for themselves or self-evacuate in the event of an emergency. At-risk populations typically include children younger than 10 years, the elderly, and people housed in institutional settings. Key demographic data for the District service area includes:

- Nearly 25 percent of the population is under 10 years or over 65 years of age.
- The service area population is predominantly White (38 percent), followed by Black / African American (17 percent) and Asian (11 percent), with 33 percent of the population identifying as "other" or with two or more racial identities. 38 percent of the population identifies with a Hispanic ethnicity or background.
- Of the population over 24 years of age, more than 90 percent has completed high school or equivalency.
- Of the population over 24 years of age, 41 percent has an undergraduate, graduate, or professional degree.

- Of the population 15 years of age or older, more than 96 percent is in the workforce; 4 percent are unemployed.
- Median household income is slightly more than $91,500.
- The population below the federal poverty level is 16.4 percent.
- More than 22 percent of the population does not have health insurance coverage.

Although no projected growth data specific to the service area was available, the population for all of Harris County is projected to increase 15.5 percent over the next 25 years to 2048, an annualized growth rate of approximately 0.62 percent.[4] Population growth in the 11 zip codes all or partially within the service area was 8.13 percent[5] over the past five years, or an annualized rate of approximately 2 percent. It is reasonable to assume the district will continue to experience substantial growth in the coming years, with more than 13,000 dwelling units and 283,000 square feet of commercial development currently planned, approved, or under construction, including 16 apartment complexes with nearly 4,000 total dwelling units.[6]

Buildings

The service area has nearly 180,000 residential housing units[7] and more than 14,000 businesses[8] including manufacturing, research, technology, office, professional services, retail sales, restaurants/bars, motels, churches, schools, storage**,** government facilities, healthcare facilities, and other business and occupancy types as described in **Appendix A**.

Critical Facilities/Infrastructure

The US Department of Homeland Security defines Critical Infrastructure / Key Resources as those physical assets essential to the public health and safety, economic vitality, and resilience of a community, such as lifeline utilities infrastructure, telecommunications infrastructure, essential government services facilities, public safety facilities, schools, hospitals, airports, etc. The Department has identified 411 critical facilities within the service area. A hazard occurrence with significant impact severity affecting one or more of these facilities would likely adversely impact critical public or community services.

[4] Source: Texas Demographic Center website.
[5] Source: U.S. Census Bureau.
[6] Source: Cy-Fair Fire Department.
[7] Source: Esri Community Analyst – Community Profile (2022).
[8] Source: Esri Community Analyst – Business Summary (2022).

2.4.3 Hazard Identification

Citygate utilizes prior risk studies where available, fire and non-fire hazards as identified by the CFAI, and agency/jurisdiction-specific data and information to identify the hazards to be evaluated for this study. After review of the hazards identified in the Harris County Multi-Hazard Mitigation Action Plan, and the fire and non-fire hazards as identified by the CFAI as they relate to services provided by the Department, Citygate evaluated the following seven hazards for this assessment:

1. Building fire
2. Vegetation/wildfire
3. Medical emergency
4. Hazardous material release/spill
5. Technical rescue
6. Aviation incident
7. Marine Incident

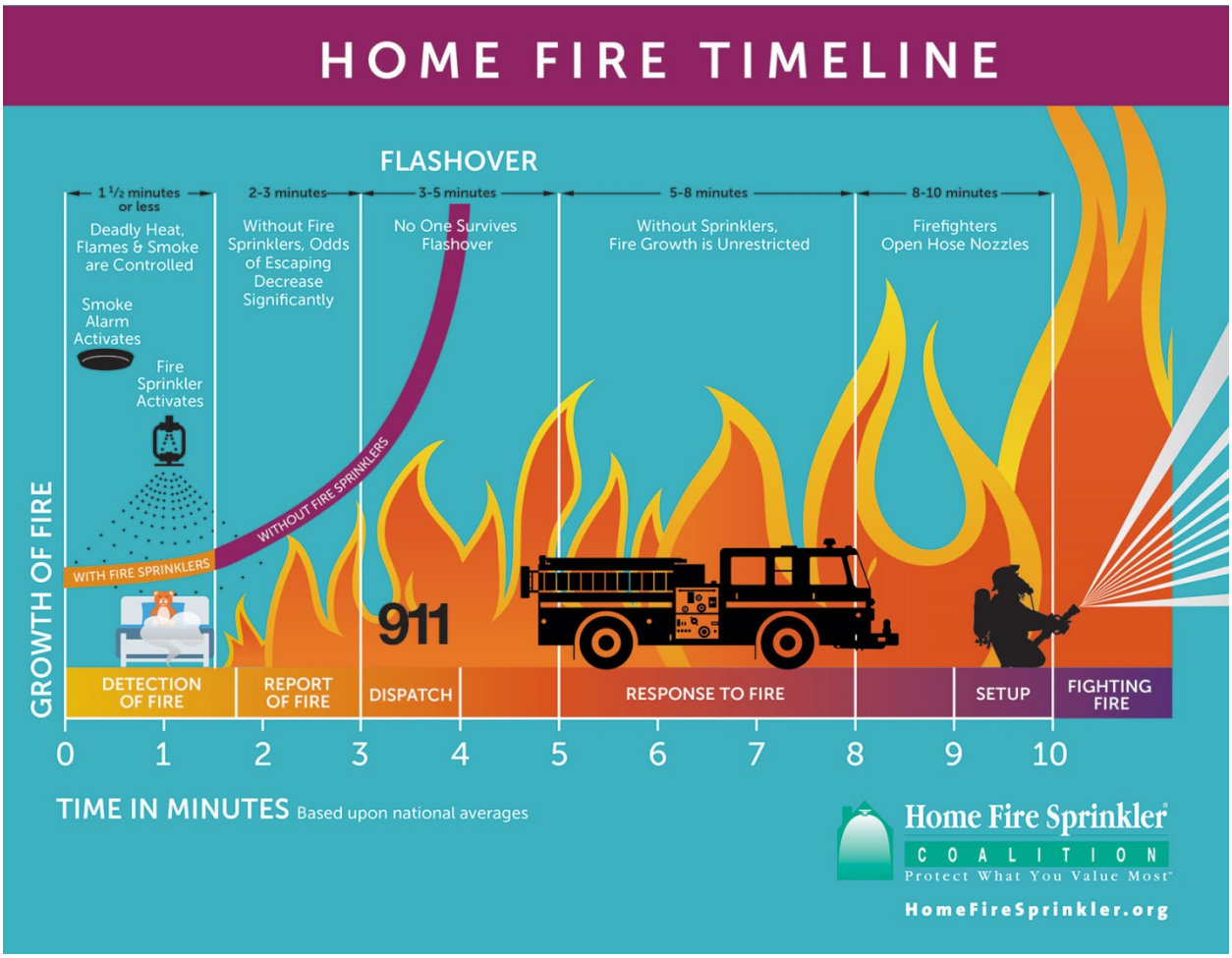
Because building fires and medical emergencies have the most severe time constraints if positive outcomes are to be achieved, the following is a brief overview of building fire and medical emergency risk. **Appendix A** contains the full risk assessment for all seven hazards.

Building Fire Risk

One of the primary hazards in any community is building fire. Building fire risk factors include building size, age, construction type, density, occupancy, number of stories above ground level, required fire flow, proximity to other buildings, built-in fire protection/alarm systems, available fire suppression water supply, building fire service capacity, fire suppression resource deployment (distribution/concentration), staffing, and response time. Citygate used available data from the Department in determining its building fire risk.

The following figure illustrates the building fire progression timeline and shows that 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, can occur as early as 3:00 to 5:00 minutes from the initial ignition. Human survival in a room after flashover is extremely improbable.

Figure 2—Building Fire Progression Timeline

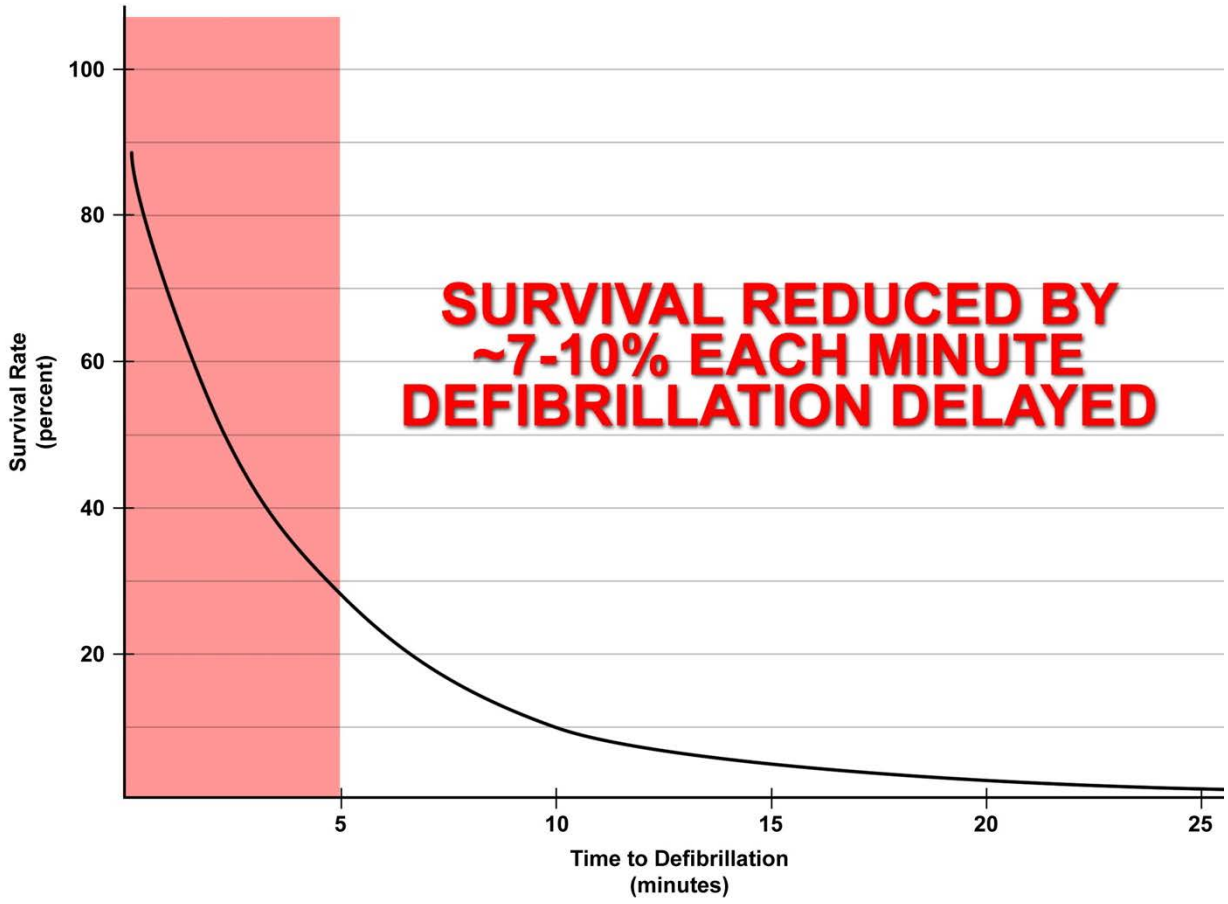


Source: http://www.firesprinklerassoc.org

Medical Emergency Risk

Fire agency service demand in most jurisdictions is predominantly for medical emergencies. The following figure illustrates the reduced survivability of a cardiac arrest victim as time to defibrillation increases.

Figure 3—Survival Rate versus Time of Defibrillation



The Department currently provides both BLS and ALS pre-hospital emergency medical services, with suppression personnel trained to the EMT Basic level and EMS personnel trained and certified at the Paramedic level.

2.4.4 Risk Assessment Summary

Citygate's assessment of the values at risk and hazards likely to impact the service area yields the following. See **Appendix A** for the full risk assessment.

- The Department serves a diverse urban/suburban population with densities ranging from less than 1,500 to more than 11,000 people per square mile over a varied land use pattern.
- The Department's service area population is projected to increase substantially over the next decade.

- The service area has a large inventory of residential and non-residential buildings to protect.
- The Department also has significant economic and other resource values to be protected, as identified in this assessment.
- The Department and Harris County have multiple mass emergency notification options available to communicate emergency information to the public.
- The service area's risk for seven hazards related to emergency services provided by the Department range from Low to High, as summarized in the following table.

Table 8—Overall Risk by Hazard and Station Area

Hazard	Station Area						
	Sta. 1	Sta. 2	Sta. 3	Sta. 4	Sta. 5	Sta. 6	Sta. 7
Building Fire	*High*	*Moderate*	*High*	*Moderate*	*Moderate*	*High*	*Moderate*
Vegetation/Wildland Fire	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*
Medical Emergency	*High*	*High*	*High*	*High*	*High*	*High*	*High*
Hazardous Materials	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*High*	*Moderate*	*Moderate*
Technical Rescue	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Aviation Incident	*Low*	*Moderate*	*Low*	*Moderate*	*Moderate*	*Low*	*Low*
Marine Incident	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*

Hazard	Station Area					
	Sta. 8	Sta. 9	Sta. 10	Sta. 11	Sta. 12	Sta. 13
Building Fire	*High*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*High*
Vegetation/Wildland Fire	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*
Medical Emergency	*High*	*High*	*High*	*High*	*High*	*High*
Hazardous Materials	*High*	*High*	*High*	*High*	*High*	*Moderate*
Technical Rescue	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Aviation Incident	*Moderate*	*Moderate*	*Moderate*	*Low*	*Low*	*Low*
Marine Incident	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*

2.5 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

SOC studies use critical task information to determine the number of firefighters needed within a time frame to achieve desired objectives on fire and emergency medical incidents. Table 9 and Table 10 illustrate critical tasks typical of building fire and medical emergency incidents, including the minimum number of personnel required to complete each task. These tables are composites from Citygate clients in urban/suburban communities with similar risks to those of Cy-Fair, with units staffed with 3–4 personnel per engine, rescue, or aerial apparatus. It is important to understand the following relative to these tables:

- It can take considerable time after a task is ordered by command to complete the task and achieve the desired outcome.
- Task completion time is usually a function of the number of personnel that are *simultaneously* available. The fewer firefighters available, the longer some tasks will take to complete. Conversely, with more firefighters available, some tasks are completed concurrently.
- Some tasks must be conducted by a minimum of two firefighters to comply with safety regulations. For example, two firefighters are required to search a smoke-filled room for a victim.

2.5.1 Critical Firefighting Tasks

The following table illustrates the critical tasks required to control a typical single-family dwelling fire with five Department response units for a total ERF of three engines, one ladder/tower, one rescue, one District Chief, and one Safety Officer. This equates with a total of 17–22 personnel depending on unit staffing. These tasks are taken from similarly staffed career fire departments' operational procedures, which are consistent with the customary findings of other agencies using the SOC process. No conditions exist to override the Occupational Safety and Health Administration (OSHA) two-in/two-out safety policy, which requires that firefighters enter atmospheres that are immediately dangerous to life and health, such as building fires, in teams of two while two more firefighters are outside and immediately ready to rescue them should trouble arise.

Scenario: *Simulated approximately 2,000-square-foot, two-story, residential fire with unknown rescue situation. Responding companies receive dispatch information typical for a witnessed fire. Upon arrival, they find approximately 50 percent of the second floor involved in fire.*

Table 9—First Alarm Residential Fire Critical Tasks – 17–22 Personnel

	Critical Task Description	Personnel Required
First-Due Engine		
1	Conditions report	1
2	Establish supply line to hydrant	2
3	Deploy initial fire attack line to point of building access	1–2
4	Operate pump and charge attack line	1
5	Or skip the above and establish incident command	1
6	Conduct primary search within OSHA regulations	2
Second-Due Engine		
1	If necessary, establish supply line to hydrant	1–2
2	Secure utilities	1–2
3	Deploy backup attack line	1–2
4	Establish Initial Rapid Intervention Crew	2
First-Due Ladder/Tower		
1	Deploy ladders to roof	2–3
2	Establish horizontal or vertical building ventilation	2–3
3	Open concealed spaces as required	2–3
4	Support suppression effort as directed	2–3
Rescue		
1	Conduct initial or secondary search and rescue, if not already completed	2–3
2	Secure utilities if not already completed	1–2
3	Establish full Rapid Intervention Crew	3
Chief Officer		
1	Transfer of incident command from first- or second-in Officer	1
2	Establish exterior command	1
Safety Officer		
1	Monitor/enforce incident safety procedures	1
Third Due Engine		
1	Support incident operations as directed	3–4

Grouped together, the duties in the previous table form an ERF, or First Alarm Assignment. These distinct tasks must be performed to effectively achieve the desired outcome; arriving on scene does

not stop the emergency from escalating. While firefighters accomplish these tasks, the incident progression clock keeps running.

Studies have shown that a small fire can spread to engulf an entire room in fewer than 3:00 to 5:00 minutes after free burning has started. Once the room is completely superheated and involved in fire (known as flashover), the fire will spread quickly both vertically and horizontally throughout the building. For this reason, it is imperative that fire suppression and search/rescue operations commence before the flashover point occurs if the outcome goal is to keep the fire damage in or near the room of origin and to rescue persons unable to self-evacuate. In addition, flashover presents a life-threatening situation to both firefighters and any occupants of the building. Fire fatalities typically include persons under 10 and over 65 years of age and those unable to self-evacuate, and nearly 25 percent of the service area population falls within those age groups.

2.5.2 Critical Medical Emergency Tasks

The Department responded to more than 27,000 EMS incidents in 2022 including vehicle accidents, strokes, heart attacks, difficulty breathing, falls, childbirths, and other medical emergencies. For comparison, the following table summarizes the critical tasks required for a cardiac arrest patient.

Table 10—Cardiac Arrest Critical Tasks – 6–7 Personnel

Critical Task		Personnel Required	Critical Task Description
1	Chest compressions	1–2	Compression of chest to circulate blood
2	Ventilate/oxygenate	1–2	Mouth-to-mouth, bag-valve-mask, apply O_2
3	Airway control	1–2	Manual techniques/intubation/cricothyroidotomy
4	Defibrillate	1–2	Electrical defibrillation of dysrhythmia
5	Establish I.V.	1–2	Peripheral or central intravenous access
6	Control hemorrhage	1–2	Direct pressure, pressure bandage, tourniquet
7	Splint fractures	2–3	Manual, board splint, HARE traction, spine
8	Interpret ECG	2	Identify type and treat dysrhythmia
9	Administer drugs	2	Administer appropriate pharmacological agents
10	Spinal immobilization	2–5	Prevent or limit paralysis to extremities
11	Extricate patient	3–4	Remove patient from vehicle, entrapment
12	Patient charting	1–2	Record vitals, treatments administered, etc.
13	Hospital communication	1–2	Receive treatment orders from physician
14	Treat en route to hospital	2–3	Continue to treat/monitor/transport patient

2.5.3 Critical Task Analysis and Effective Response Force Size

What does a deployment study derive from a critical task analysis? The time required to complete the critical tasks necessary to stop the escalation of an emergency as shown in Table 9 and Table 10 must be compared to outcomes. As stated, after approximately 3:00 to 5:00 minutes of free burning in an enclosed room, a fire will escalate to the point of flashover. At this point, the entire room is engulfed in fire, the entire building becomes threatened, and human survival near or in the room of the fire's origin becomes impossible. Additionally, brain death begins to occur within 4:00 to 6:00 minutes of the heart stopping. Thus, the ERF must arrive in time to prevent these emergency events from becoming worse.

The Department's daily on-duty response staffing is sufficient to deliver an NFPA minimum ERF of three engines, one ladder/tower, one rescue, one District Chief, and one Safety Officer totaling 17–22 personnel[9] to a low- or medium-hazard building fire, which the statistical analysis included with this report will discuss in detail. 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, the emergency will escalate instead of improving. The outcome times, of course, will be longer and yield less desirable results if the arriving force is later or smaller.

The number of personnel and the arrival timeframe can be critical in a serious fire. Fires in older or multiple-story buildings could require the initial firefighters to rescue trapped or immobile occupants. If the ERF is too small, rescue and fire suppression tasks *cannot* be conducted simultaneously. Thus, achieving good performance requires *adequate staffing* (and training).

Fires and complex medical incidents require additional units to arrive in time to complete an effective intervention. Time is one factor that comes from *proper station placement and the staffing model used*. When fire stations are spaced too far apart and one unit must cover another unit's area or multiple units are needed, the units can be too far away, and the emergency will escalate and result in a less-than-desirable outcome. Thus, some overlapping coverage between fire stations is desirable.

Previous critical task studies conducted by Citygate and NFPA Standard 1710 identify that all units need to arrive at a building fire with a minimum of 17 firefighters within 11:30 minutes (from the time of a 9-1-1 call) to *simultaneously and effectively* perform the tasks of rescue, fire suppression, and ventilation.

If fewer firefighters arrive, all tasks may 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 of the hose line above the first floor in a multiple-story building.

[9] NFPA 1710 – Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments (2020 Edition).

Because rescue is conducted with at least two two-person teams, when rescue is essential, other tasks are not completed in a simultaneous, timely manner. Therefore, effective deployment is about the **speed** *(travel time)* and the **weight** *(number of firefighters)* of the response.

2.6 Distribution and Concentration Studies—How the Location of First-Due and First Alarm Resources Affects Emergency Incident Outcomes

SOC Element 5 of 8
Distribution Study

SOC Element 6 of 8
Concentration Study

The Department's service area is currently served by 13 fire stations. When using geographic mapping tools, it is appropriate to understand what the existing station spacing does and does not cover within travel time goals; if there are any coverage gaps needing one or more additional 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 units to control routine emergencies and achieve desired outcomes before they escalate and require additional resources.
- **Concentration** – the spacing of fire stations sufficiently close to each other so that more complex emergency incidents can quickly receive sufficient resources from multiple fire stations. As indicated, this is known as the Effective Response Force (ERF) 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 and achieve desired outcomes.

To analyze first-due fire unit travel time coverage, Citygate used a geographic mapping tool that measures theoretical travel time over a road network. For this calculation, Citygate used the base map and street travel speeds calibrated to actual fire apparatus travel times from previous responses to simulate real-world travel time coverage. Using these tools, Citygate ran several deployment tests and measured their impact on various parts of the service area. A 4:00-minute first-due and 8:00-minute ERF *travel* time were used for the joint service area, consistent with best practice response performance goals for positive outcomes in urban/suburban areas.

2.6.1 Deployment Baselines

All maps referenced can be found in **Volume 3—Map Atlas**.

Map #1 – General Geography, Station Locations, and Response Resource Types

Map #1 shows the Department's service area boundary and fire station locations. The fire station symbols identify the type of primary response apparatus. This is a reference map for other maps that follow.

Map #2 – Risk Assessment Planning Zones

This map displays the fire station primary service areas which this study also uses to quantify and assess the risks to be protected by the Department.

Map #2a – Risk Assessment: Population Density

Map #2a shows the resident population density across the service area. Population drives EMS incident demand, so the areas with higher population density are typically the areas with higher EMS demand. As the map shows, the Distict's teams protect multiple areas with high population density that are not all adjecent to each other.

Map #3 – Distribution: 4:00-Minute First-Due Travel Time Coverage

Map #3 shows the 44.7 percent of the total public road miles in the District that a fire engine should be expected to reach within a 4:00-minute *travel time* assuming the respective engine is in station and encounters no traffic congestion. In Citygate's experience and opinion, this level of coverage is inadequate for urban population densities. While partially due to a mostly curvilinear street pattern, this measure is also indicative of fire stations being spaced too far apart.

The purpose of response time modeling is to determine response time coverage across a jurisdiction's geography and station locations. This geo-mapping design is then validated against dispatch time data to reflect actual response times.

Map #3a – Distribution: 4:00-Minute First-Due Travel Time Coverage (with Automatic Aid)

Map #3a shows there is very little increase in 4:00-minute travel time coverage due to the absence of close-by, adjoining partner fire stations (other than Houston) to replace the need for primary coverage delivery from inside the District.

Map #3b – Distribution: 4:00-Minute First-Due Travel Time Coverage (with Traffic Congestion)

Map #3b shows 4:00-minute travel time coverage with the impact of traffic congestion. The impact is slight overall due to there being multiple streets to carry traffic, even at peak hours. The computer model caculates the overall loss of coverage at 4.9 percent, or down to 39.8 percent from the uncongested coverage of 44.7 percent. Citygate has seen other urban clients experience traffic loss from 10–25 percent, so 4.9 percent is toward the lower end of agencies observed.

Map #3c – Distribution: 5:00-Minute First-Due Travel Time Coverage with Current Stations

Map #3c shows that if the first-unit travel time goal is increased by one additional minute to 5:00 minutes, travel time coverage from the current stations increases significantly to 70.6 percent of total road miles (as shown in Table 11), which Citygate considers good urban level coverage. No

agency can afford to cover the most distal ends of its road network at 4:00 or even 5:00 minutes, more so when the boundaries are up against hills or a body of water.

Map #3d – Distribution: 5:00-Minute First-Due Engine Travel Time Coverage with Current Stations and Traffic Congestion

This map shows the impact of traffic congestion at 5:00 minutes where there is a 9 percent loss reducing total road mile coverage to 61.6 percent. This larger percentage of congestion loss, when compared to 4:00-minute travel, is only due to the 5:00-minute coverage area being so much larger, so there is more congestion to measure.

Map #3e – Distribution: 5:00-Minute First-Due Engine Travel Time Coverage with Relocated Stations 1, 6, & 10

In this view, 5:00-minute travel coverage is measured with the three stations for which relocation is envisioned or underway. The coverage is slightly reduced from 70.6 percent to 68.6 percent, but only due to the variations of the road network as the stations are moved to better parcels of land to be more central to each service area.

Map #4 – Insurance Services Office (ISO) 1.5-Mile Coverage Areas – Existing Stations

Map #4 displays the former ISO recommendation that urban stations cover a 1.5-mile *distance* response area. Depending on a jurisdiction's road network, the 1.5-mile measure usually equates to a 3:30- to 4:00-minute travel time. A 1.5-mile measure is a reasonable indicator of station spacing and overlap. As the map shows, the coverage is smaller that the 4:00-minute map (as shown in Map #3), with a decreased coverage of only 34.3 percent, down from 44.7 percent.

Map #5 – Concentration: 8:00-Minute Urban/Suburban Effective Response Force (First Alarm) Travel Coverage

Map #5 shows the Department's current response plan should deliver an ERF of three engines, one ladder/tower truck, one rescue, one District Chief, and one Safety Officer to serious building fires within a travel time of 8:00 minutes. Given the location of the four ladder trucks, three rescues, and the chiefs from one station, the complete ERF coverage area is very limited to only 16.5 percent of the District in a core area around Station 9.

Map #6a/b – 8:00-Minute Ladder Truck Travel Time Coverage

Maps #6a/b show the aerial ladder truck coverage from either two or four stations. It is easily seen that staffing all four ladders greatly improves the coverage in the northern and central areas of the District.

Map #6c/d – 8:00-Minute Rescue Unit Travel Time Coverage

These maps show the positive impact of staffing the third rescue daily within the desired 8:00-minute goal.

Map #6e/f – 8:00-Minute Chief Officer and EMS Officer Unit Travel Time Coverage

These maps shows the 8:00-minute travel coverage of supervising officers to serious multi-apparatus incidents. The District is too large to cover within a travel time of 8:00 minutes from only one or two locations.

Map #7 – Ambulance Coverage at 8:00-Minute Travel Time

Having an ambulance in most of the stations, combined with doubling the travel time from 4:00 to 8:00 minutes, ensures that 96.2 percent of the public road network is within 8:00 minutes' travel time. Stated this way, this is considered all but "universal" ambulance coverge—assuming ambulance units are available to respond.

Map #8 – All Incident Locations

Map #8 shows the location of all incidents from January 2018 through December 2022. As can be seen, incidents occur on nearly all road segments throughout the entire service area.

Map #9 – Emergency Medical Services and Rescue Incident Locations

Map #9 shows the emergency medical and rescue incident locations over the five-year study period. With 73.07 percent of all calls for service in 2022 being EMS related, this map illustrates the need for pre-hospital emergency medical services throughout the service area.

Map #10 – All Fire Locations

Map #10 shows the location of all fires within the service area over the five-year study period. All fires include any type of fire call—from vehicle, to dumpster, to vegetation, to building. While there are obviously fewer fires than medical or rescue calls, this map illustrates that fires occur throughout the entire service area.

Map #11 – Building Fire Locations

Map #11 displays the location of all building fire incidents over the five-year study period. While the number of building fires is a smaller subset of all fires, building fires occurred in every station area over the five-year period.

Map #12 – Emergency Medical Services and Rescue Incident Location Densities

Map #12 shows, by mathematical density, where clusters of EMS and rescue incident activity occurred over the five data years. The darker density color plots the highest concentration of EMS/rescue incidents, which in most cases tracks with the greatest population densities. This type

of map makes the location of frequent workload more meaningful than simply mapping the locations of all EMS/rescue incidents, as were shown in Map #9.

Map #13 – All Fire Location Densities

Map #13 is similar to Map #12 but shows the hot spots of activity for all types of fires. The density of these incidents is greater within the older, more densely populated areas of the Cities.

Map #14 – Structure Fire Location Densities

Map #14 is similar to Map #11 but shows the hot spots of activity for building fires only. Based solely on this pattern, the ladder truck and Battalion Chief at Station 9 represent a perfect placement.

Map #15 – Future Fire Station Locations

Given the challenges to serve the District's road network efficiently, Citygate is recommending the District adopt for fire station spacing a 5:00-minute travel time goal. Citygate evaluated all underserved, infill neighborhoods as well as new growth/expansion areas with the geographic travel time and distance computer model to estimate the quantity of best-fit and cost-effective fire station additions.

For two reasons, this work is not to be considered definitive, but rather as closely approximate. First, the lack of advance zoning in Harris County does not allow for the estimation of the type of new construction and the resultant roads needed for the traffic generated. Second, Houston and the County did provide the master-planned major roads and highway connections, but there are not enough of them to completely assess how the western area of the District could fill in.

After multiple trial runs, this map shows the resultant estimate for three (3) *infill* fire stations (shown in blue) for newly covered streets and, out west and in the north, five (5) *expansion* stations for a total of *at least* eight (8) additional fire stations. This model also considers relocated and new stations #1, #6, and #10.

The orange streets next to the added blue streets are the "overlap" between a new station and existing coverage. Some overlap is desirable when multiple units or single backup coverage units are needed in any one station area. Therefore, test sites A, B, and C provide significant value in improving multiple-unit coverage in the core of the District.

The areas of expansion might eventually need two stations in addition to the five shown that are labeled "test." Some of these areas might not see full development for several years. Alternatively, final road designs may allow the five test sites to re-position enough to allow for adequate coverage.

2.6.2 Travel Timer Road Mile Coverage Measures

In addition to the visual displays of coverage that maps provide, the following table summarizes non-congested travel time coverage versus the impacts of traffic congestion.

Table 11—Service Area Travel Time Coverage Summary

Map No.	Travel Time Measure	Total Public Road Miles	Miles Covered	Percent of Total Miles Covered
3	4:00-Minute First-Due Engine	1,838	**821.9**	**44.7%**
3a	4:00-Minute First-Due Engine with Auto Aid	1,838	**868.6**	**47.3%**
3b	4:00-Minute First-Due Engine with Auto Aid (Congested)	1,838	**731.0**	**39.8%**
3c	4:00-Minute First-Due Engine with Auto Aid and New Stations	1,838		
3d	4:00-Minute First-Due Engine with Auto Aid and New Stations (Congested)	1,838		
3e	5:00-Minute First-Due Engine with Auto Aid and New Stations	1,838	**1296.7**	**70.6%**
3f	5:00-Minute First-Due Engine with Auto Aid and New Stations (Congested)	1,838	**1131.7**	**61.6%**
3g	5:00-Minute First-Due Engine with Relocated Stations 1, 6, and 10 (no auto aid)	1,838	**1261.7**	**68.6%**
4	ISO 1.5-Mile Station Spacing	1,838	**631.0**	**34.3%**
5	8:00-Minute ERF	1,838	**303.5**	**16.5%**
5a	8:00-Minute ERF (Congested)	1,838		
5b	8:00-Minute ERF with Auto Aid and New Stations	1,838		
5c	8:00-Minute ERF with Auto Aid and New Stations (Congested)	1,838		
6a	8:00-Minute Truck from Stations 2 and 13	1,838	**646.5**	**35.2%**
6b	8:00-Minute Truck from Stations 2, 7, 9, and 13	1,838	**1050.0**	**57.1%**
6c	8:00-Minute Rescue from Stations 3 and 8	1,838	**777.0**	**42.3%**
6d	8:00-Minute Rescue from Stations 3, 5, and 8	1,838	**876.2**	**47.7%**
6e	8:00-Minute District Chief from HQ	1,838	**318.6**	**17.3%**
6f	8:00-Minute EMS Supervisor from Stations 2 and 9 withg EMS Density	1,838	**551.9**	**30.0%**
7	8:00-Minute First-Due Medic Unit	1,838	**1768.3**	**96.2%**
Scenario 1	5:00-Minute First-Due Engine with Relocated Stations 1, 6, and 10 and Infill Stations A, B, and C	1,838	**1407.5**	**76.6%**

As the table shows, 47.3 percent of the public road network can be reached by a first-responding unit within a 4:00-minute best practice travel time goal. Increasing that goal to 5:00 minutes

increases coverage with existing stations to 70.6 percent *without traffic congestion impacts*, which is a modest urban/suburban-level of coverage to achieve desired outcomes. If the station spacing model is based on 5:00-minute travel time coverage, with three infill stations and planned relocated and added stations #1, #6, and #10, then coverage increases to 76.6 percent—which represents a more average level of coverage that, in Citygate's experience, still does not meet best practices.

In addition, the Department's current multiple-unit ERF deployment can only reach 16.5 percent of all public road segments within an 8:00-minute best practice goal for urban areas. This is due to the limited locations of ladder and Chief Officer units.

Finding #4: Geographic coverage models indicate the need to plan for three additional infill fire stations and at least five fire stations in the western and northern growth areas for a total of eight more stations than at present.

2.7 Statistical Analysis

SOC Element 7 of 8
Reliability & Historical Response Effectiveness Studies

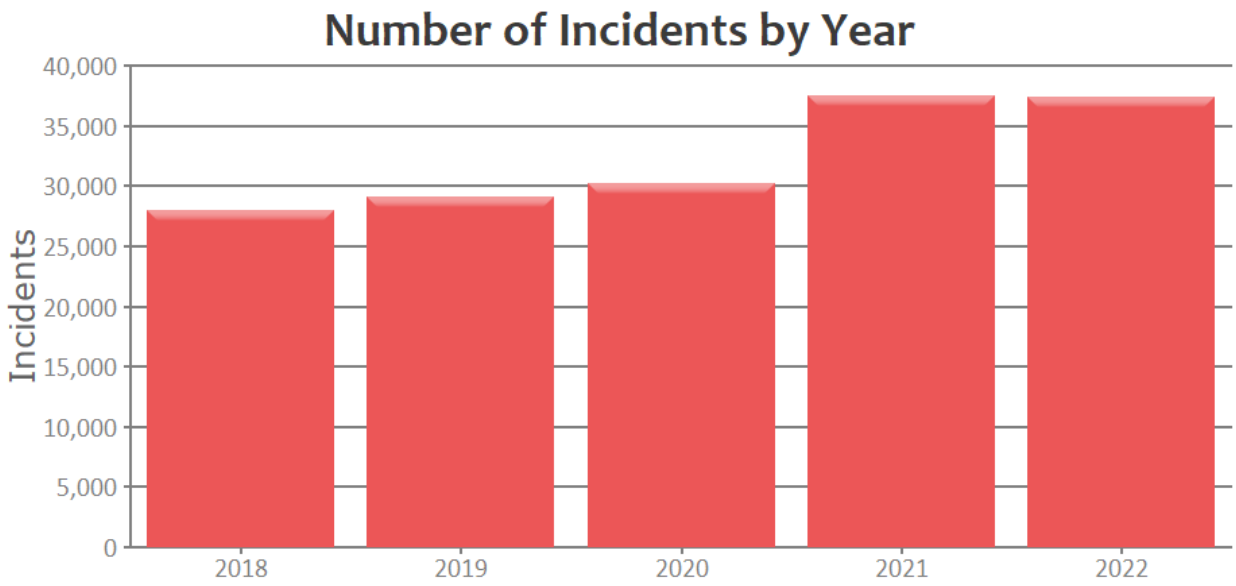
The maps described in Section 2.6 and presented in **Volume 3—Map Atlas** show the ideal situation for response times and response effectiveness given no competing calls, units out of place, or simultaneous calls for service. Examination of the response time data provides a picture of actual response performance with simultaneous calls, rush hour traffic congestion, units out of position, and delayed travel time for events such as periods of severe weather. The following subsections provide summary statistical information regarding the District's fire and EMS services.

The Department provided National Fire Information Report System (NFIRS-5) and computer-aided-dispatch (CAD) data for the period January 1, 2018, through December 31, 2022. Over the five-year period being studied, there were 162,396 incidents and 298,386 individual apparatus responses recorded in the District's record system.

In 2022, the Department responded to 37,470 incidents—a daily demand of 102.66 incidents, of which 2.28 percent were fire incidents, 73.07 percent were EMS incidents, and 24.65 percent were other incident types. During this period, there were 72,867 apparatus responses to incidents by the Department and other agencies for an average of 1.94 apparatus responses per incident.

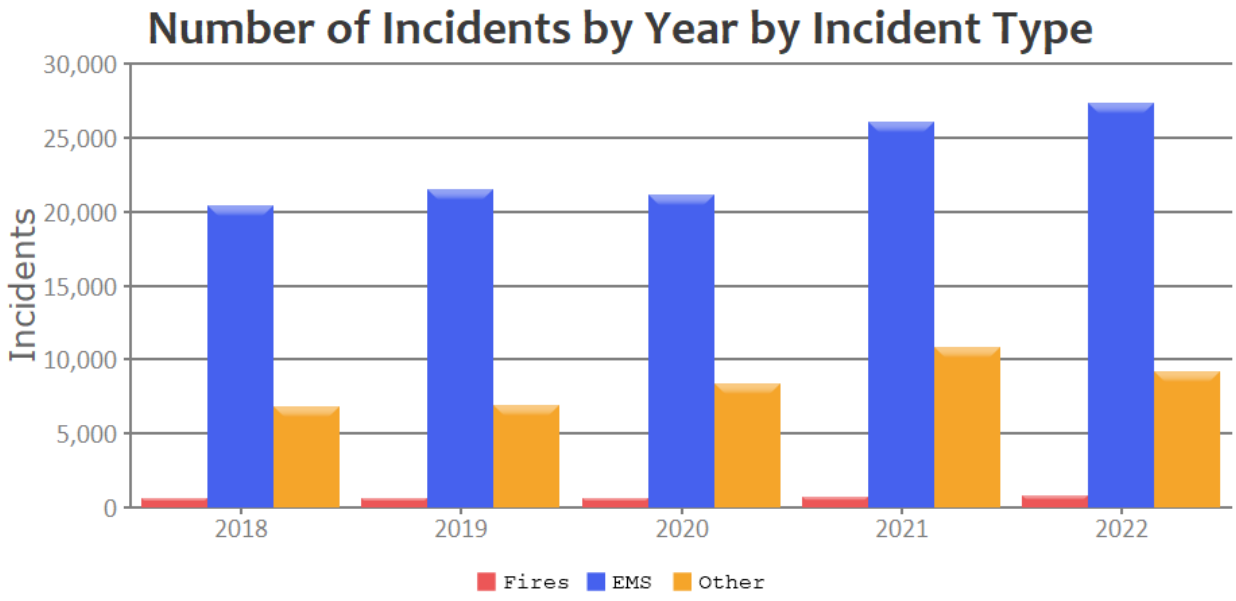
The Department experienced incident growth for four years with a leveling off in 2022, as shown in the following figure.

Figure 4—Total Service Demand by Year



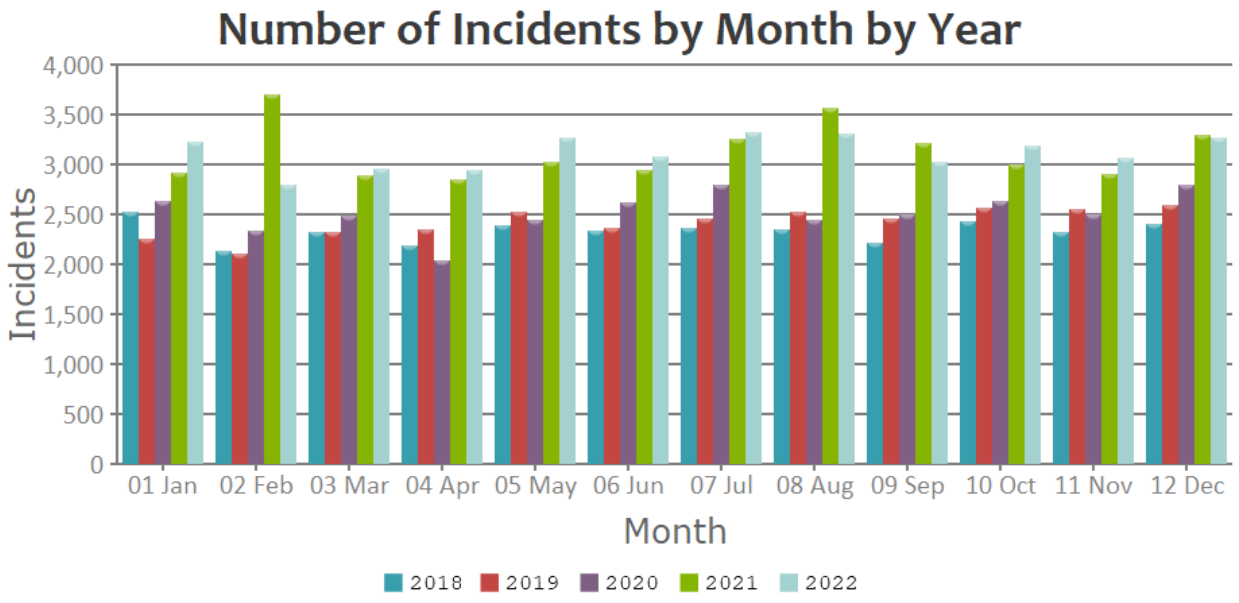
The following figure illustrates the number of incidents by incident type. In 2022, the number of fire incidents increased from 703 to 855. EMS incidents increased as well, from 26,071 to 27,378. As the figure shows, the "leveling off" of overall incident volume in 2022 can be attributed to a decline in other incident types, from 10,811 in 2021 to 9,237 in 2022.

Figure 5—Annual Service Demand by Incident Type



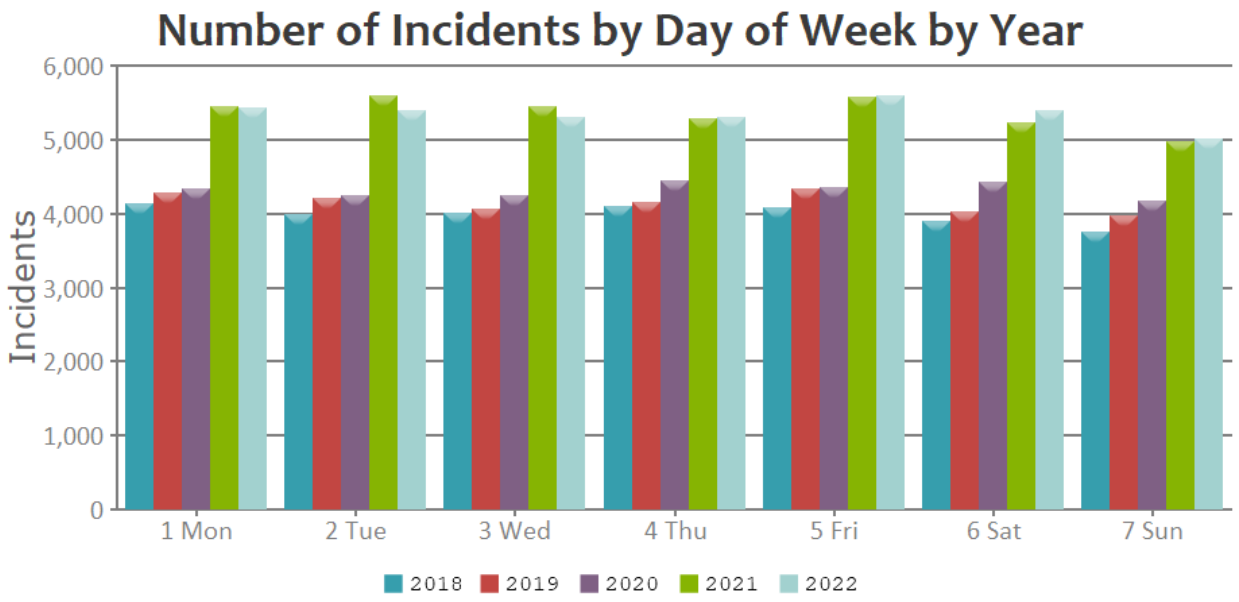
The number of incidents tends to be consistent month-to-month, with only a slight increase in activity in the summer, as shown in the following figure.

Figure 6—Number of Incidents by Month by Year



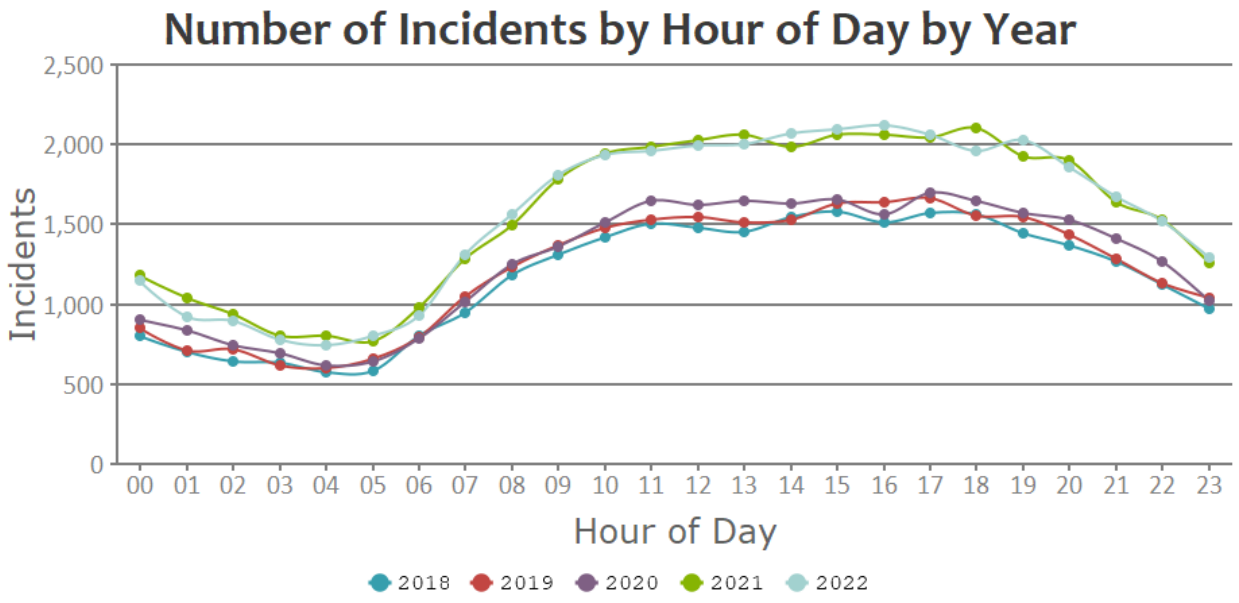
The number of incidents by day of week tends to be steady, with a slight increase on Friday and a slight decrease on Sunday, as the following figure illustrates.

Figure 7—Number of Incidents by Day of Week by Year



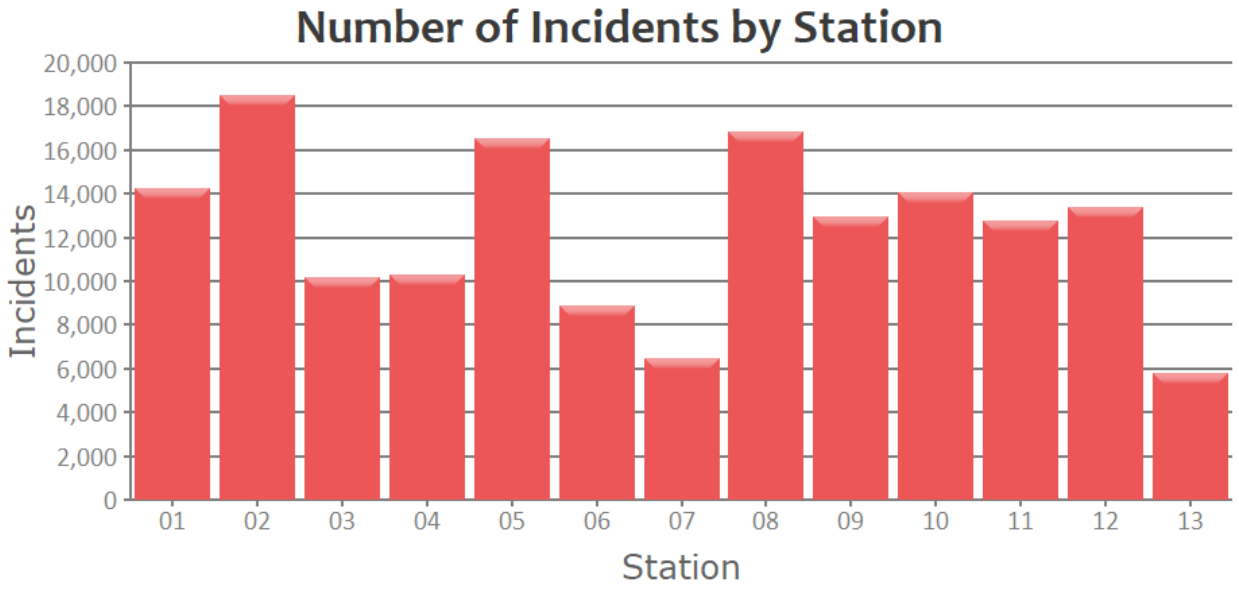
The following figure shows service demand by hour of day by year, illustrating minimal annual variance in hourly volume, with peak activity spanning mid-morning through early evening hours.

Figure 8—Service Demand by Hour of Day and Year



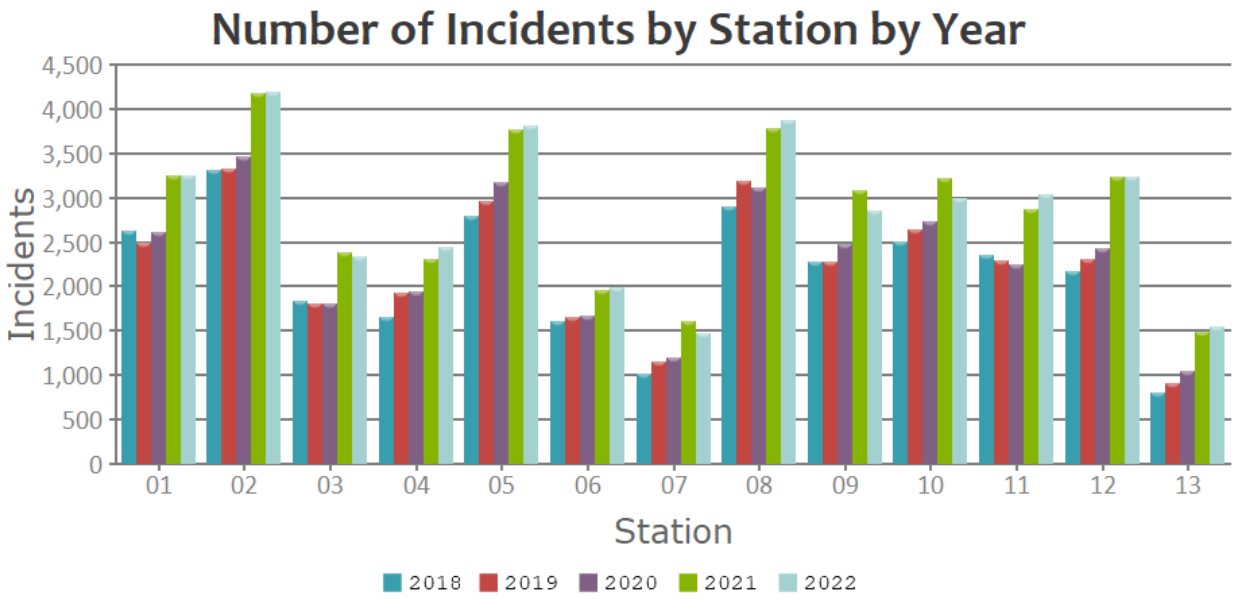
The following figure illustrates the number of incidents by station. Station 2 had the highest volume of incidents while Station 13 had the lowest.

Figure 9—Service Demand by Station Area by Year



The following figure identifies annual volume trends by station area by year, reflecting an increase in demand at all stations in 2021 and 2022.

Figure 10—Number of Incidents by Station by Year



The following table ranks activity by incident type *for those categories with more than 50 total occurrences*. There is a strong ranking for EMS incidents. Incidents that were cancelled en route also rank high. Building fires rank 18th by volume.

*[**Note**: It appears "320 Emergency Medical Service, other" may be selected by personnel to save time related to data entry. If this is accurate, training may help the first two categories to be more operationally realistic.]*

Table 12—Incidents: Quantity – Incident Type by Year (at Least 50 Total) – 2018–2022

Incident Type	2018	2019	2020	2021	2022	Total
320 Emergency Medical Service, other	99	1,327	16,784	19,907	20,774	**58,891**
321 EMS call, excluding vehicle accident with injury	15,987	15,923	1,062	1,683	2,132	**36,787**
611 Dispatched & canceled en route	2,785	3,017	4,426	5,453	**4,230**	**19,911**
311 Medical assist, assist EMS crew	2,104	2,107	2,402	3,382	2,342	**12,337**
322 Vehicle accident with injuries	1,880	1,804	294	419	626	**5,023**
412 Gas leak (natural gas or LPG)	332	273	360	493	636	**2,094**
700 False alarm or false call, other	446	352	322	447	340	**1,907**
745 Alarm system sounded, no fire - unintentional	299	285	350	457	402	**1,793**

Incident Type	2018	2019	2020	2021	2022	Total
735 Alarm system sounded due to malfunction	174	213	309	517	461	**1,674**
500 Service Call, other	331	265	217	276	267	**1,356**
554 Assist invalid	97	162	307	329	409	**1,304**
324 Motor vehicle accident no injuries	131	146	236	312	395	**1,220**
300 Rescue, emergency medical call (EMS) call, other	80	65	44	55	910	**1,154**
510 Person in distress, other	316	329	137	142	131	**1,055**
733 Smoke detector activation due to malfunction	193	165	167	198	199	**922**
743 Smoke detector activation, no fire - unintentional	134	176	137	162	175	**784**
622 No incident found on arrival of incident address	111	120	138	206	188	**763**
111 Building fire	**152**	**130**	**149**	**168**	**154**	**753**
550 Public service assistance, other	17	26	118	219	206	**586**
600 Good intent call, other	205	172	41	54	76	**548**
445 Arcing, shorted electrical equipment	92	66	106	118	124	**506**
131 Passenger vehicle fire	88	100	89	110	106	**493**
651 Smoke scare, odor of smoke	42	47	98	114	126	**427**
151 Outside rubbish, trash, or waste fire	72	63	93	96	100	**424**
730 System malfunction, other	116	90	55	79	73	**413**
381 Rescue or EMS standby	22	18	201	119	30	**390**
463 Vehicle accident, general cleanup	105	122	61	56	30	**374**
413 Oil or other combustible liquid spill	109	120	63	40	31	**363**
531 Smoke or odor removal	62	64	59	78	76	**339**
553 Public service	12	37	74	103	101	**327**
440 Electrical wiring/equipment problem, other	56	50	56	78	77	**317**
744 Detector activation, no fire - unintentional	76	56	71	55	52	**310**
740 Unintentional transmission of alarm, other	97	55	35	57	53	**297**
143 Grass fire	45	44	42	24	118	**273**
150 Outside rubbish fire, other	73	42	39	42	69	**265**
522 Water or steam leak	24	19	24	121	75	**263**
511 Lock-out	45	63	43	60	38	**249**
113 Cooking fire, confined to container	49	61	47	48	43	**248**
400 Hazardous condition, other	75	66	40	30	33	**244**
154 Dumpster or other outside trash receptacle fire	38	39	42	43	54	**216**
331 Lock-in (if lock out, use 511)	34	29	44	60	40	**207**
100 Fire, other	25	35	44	56	31	**191**
411 Gasoline or other flammable liquid spill	45	49	37	36	23	**190**
323 Motor vehicle/pedestrian accident (MV Ped)	26	23	44	48	49	**190**

Incident Type	2018	2019	2020	2021	2022	Total
736 CO detector activation due to malfunction	21	44	40	37	36	**178**
746 Carbon monoxide detector activation, no CO	14	15	28	72	48	**177**
352 Extrication of victim(s) from vehicle	39	39	34	33	31	**176**
444 Power line down	37	32	27	37	38	**171**
711 Municipal alarm system, malicious false alarm	11	7	40	70	28	**156**
142 Brush, or brush and grass mixture fire	30	29	24	20	51	**154**
424 Carbon monoxide incident	15	22	20	60	30	**147**
520 Water problem, other	15	15	8	69	33	**140**
741 Sprinkler activation, no fire - unintentional	24	17	9	37	26	**113**
353 Removal of victim(s) from stalled elevator	22	22	9	26	27	**106**
715 Local alarm system, malicious false alarm	10	8	22	41	24	**105**
441 Heat from short circuit (wiring), defective/worn	23	25	23	14	15	**100**
551 Assist police or another governmental agency	15	16	17	22	24	**94**
442 Overheated motor	13	11	22	20	27	**93**
710 Malicious, mischievous false call, other	31	15	11	23	12	**92**
671 Hazmat release investigation w/ no hazmat	5	11	31	22	20	**89**
130 Mobile property (vehicle) fire, other	15	12	21	20	14	**82**
900 Special type of incident, other	15	20	16	15	14	**80**
571 Cover assignment, standby, move up	17	11	16	18	18	**80**
631 Authorized controlled burning	14	9	23	19	10	**75**
140 Natural vegetation fire, other	25	10	14	6	20	**75**
251 Excessive heat, scorch burns with no ignition	15	18	10	16	15	**74**
731 Sprinkler activation due to malfunction	13	9	7	19	21	**69**
410 Flammable gas or liquid condition, other	25	21	6	7	10	**69**
814 Lightning strike (no fire)	16	9	12	16	11	**64**
162 Outside equipment fire	9	12	14	15	10	**60**
542 Animal rescue	9	15	7	18	8	**57**
561 Unauthorized burning	7	11	11	10	17	**56**
132 Road freight or transport vehicle fire	15	12	5	9	13	**54**
712 Direct tie to FD, malicious/false alarm	1		18	22	11	**52**
118 Trash or rubbish fire, contained	4	9	13	9	16	**51**
652 Steam, vapor, fog, or dust thought to be smoke	10	7	9	16	8	**50**

2.7.1 Service Demand by Property Use

The following table shows activity rankings by property use, with the top property use being "UUU Undetermined." This may reflect a desire to save time related to data entry at the expense of having an accurate accounting of operational data.

Table 13—Service Demand by Property Use (at Least 50 Total) – 2018–2022

Property Use	2018	2019	2020	2021	2022	Total
UUU Undetermined	**14,945**	**18,971**	**16,751**	**18,779**	**10,003**	**79,449**
419 1- or 2-family dwelling	3,754	3,873	5,334	8,597	8,264	**29,822**
429 Multi-family dwellings	2,757	897	1,112	1,880	1,670	**8,316**
400 Residential, other	674	717	492	463	4,968	**7,314**
-**BLANK**-	**345**	**498**	**2,390**	**2,118**	**1,775**	**7,126**
961 Highway or divided highway	486	548	939	1,771	1,367	**5,111**
311 24-hour care Nursing homes, 4 or more persons	472	337	463	673	1,155	**3,100**
960 Street, other	415	427	162	96	1,272	**2,372**
PROPERTY USE	35	54	244	686	1,003	**2,022**
NNN None	**194**	**50**	**9**	**10**	**1,400**	**1,663**
963 Street or road in commercial area	330	350	257	152	308	**1,397**
500 Mercantile, business, other	558	127	56	55	263	**1,059**
965 Vehicle parking area	228	235	207	144	244	**1,058**
962 Residential street, road, or residential driveway	195	174	178	155	346	**1,048**
519 Food and beverage sales, grocery store	275	126	54	69	144	**668**
340 Clinics, Doctors' offices, hemodialysis centers	66	64	93	124	320	**667**
161 Restaurant or cafeteria	90	91	74	130	217	**602**
449 Hotel/motel, commercial	91	59	54	135	226	**565**
215 High school/junior high school/middle school	93	70	100	111	149	**523**
599 Business office	73	75	91	67	167	**473**
931 Open land or field	77	82	99	84	126	**468**
213 Elementary school, including kindergarten	65	70	84	89	134	**442**
131 Church, mosque, synagogue, temple, chapel	94	62	43	81	101	**381**
571 Service station, gas station	143	25	33	29	140	**370**
254 Day care, in commercial property	81	51	48	91	91	**362**
700 Manufacturing, processing	99	90	43	66	57	**355**
900 Outside or special property, other	100	71	54	50	62	**337**
331 Hospital - medical or psychiatric	89	54	39	61	75	**318**
891 Warehouse	41	43	65	80	77	**306**

Property Use	2018	2019	2020	2021	2022	Total
888 Fire station	86	69	25	5	53	**238**
200 Educational, other	210	10	3	4	6	**233**
580 General retail, other	37	39	27	31	58	**192**
459 Residential board and care	39	34	26	22	54	**175**
342 Doctor, dentist, or oral surgeon's office	57	25	22	14	57	**175**
300 Health care, detention, & correction, other	28	28	19	37	57	**169**
341 Clinic, clinic-type infirmary	11	10	28	48	70	**167**
116 Swimming facility: indoor or outdoor	13	8	18	29	87	**155**
210 Schools, non-adult	4	18	19	21	80	**142**
581 Department or discount store	30	31	20	22	29	**132**
511 Convenience store	27	38	13	12	41	**131**
549 Specialty shop	23	24	24	26	31	**128**
211 Preschool	34	19	7	22	25	**107**
899 Residential or self-storage units	10	11	22	26	34	**103**
938 Graded and cared-for plots of land	14	18	18	29	22	**101**
557 Personal service, including barber & beauty shops	18	18	22	15	23	**96**
936 Vacant lot	25	23	19	11	17	**95**
150 Public or government, other	19	20	3	13	38	**93**
141 Athletic/health club	20	20	8	15	26	**89**
569 Professional supplies, services	19	16	18	10	20	**83**
110 Fixed use recreation places, other	33	2	7	10	31	**83**
983 Pipeline, power line or other utility right of way	16	18	17	11	20	**82**
579 Motor vehicle or boat sales, services, repair	19	12	16	9	21	**77**
592 Bank	10	19	18	17	11	**75**
559 Recreational, hobby, home repair sales, pet store	16	25	8	8	13	**70**
160 Eating, drinking places	16	12	11	6	25	**70**
539 Household goods, sales, repairs	16	10	11	18	13	**68**
162 Bar or nightclub	6	14	12	8	27	**67**
120 Variable use amusement, recreation places	44	3	5	4	6	**62**
529 Textile, wearing apparel sales	22	11	4	11	12	**60**
142 Clubhouse	5	7	12	13	22	**59**
100 Assembly, other	14	15	10	11	8	**58**
241 Adult education center, college classroom	15	12	9	6	15	**57**
124 Playground	12	11	11	11	12	**57**
981 Construction site	7	11	10	11	16	**55**

2.7.2 Simultaneous Incident Activity

Simultaneous incidents occur when other incidents are underway at the time a new incident occurs. In 2022, there was at least one incident underway about 96.5 percent of the time. The following table shows the number of simultaneous incidents by percentage.

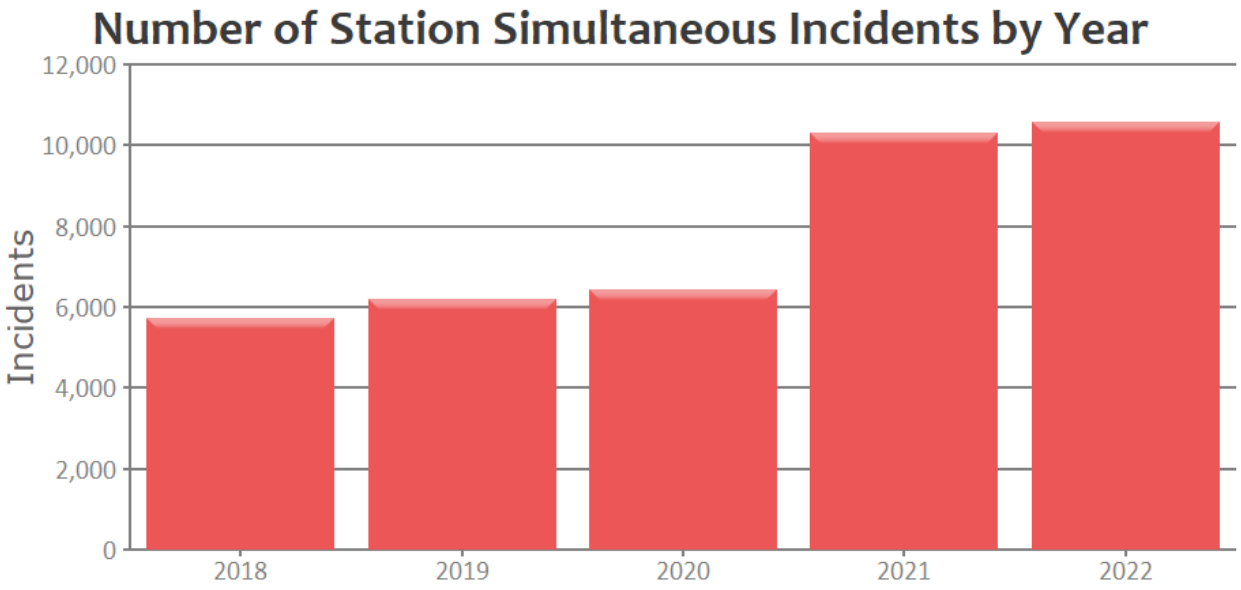
Table 14—Simultaneous Incident Activity (2022)

Number of Simultaneous Incidents	Percentage
1 or more	**96.50%**
2 or more	**87.33%**
3 or more	**73.10%**
4 or more	**56.63%**
5 or more	**40.29%**
6 or more	**26.48%**
7 or more	**15.85%**
8 or more	**8.75%**
9 or more	**4.53%**
10 or more	**2.17%**
11 or more	**1.01%**
12 or more	**0.45%**

In a metropolitan fire department, simultaneous incidents in different station areas have very little operational consequence. However, when simultaneous incidents occur within a *single* station area, there can be significant delays in response times.

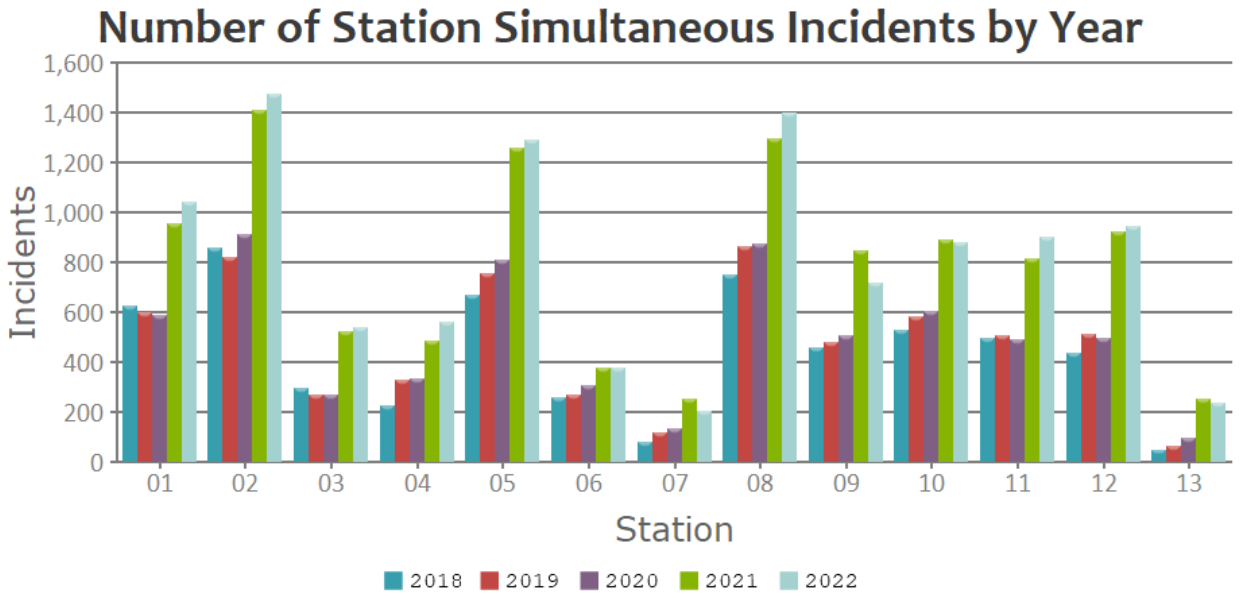
The following figure shows that the number of single-station simultaneous incidents is increasing—significantly in 2021 before increasing again slightly in 2022.

Figure 11—Number of Single-Station Simultaneous Incidents by Year



The following figure illustrates the occurrences of simultaneous incidents within single-station areas by year. Stations 2 and 8 have the highest volume of in-station simultaneous incidents:

Figure 12—Number of Single-Station Simultaneous Incidents by Station by Year



Finding #5:	With five or more simultaneous incidents occurring 40.29 percent of the time, more so in Station areas 1, 2, 5 and 8 at peak hours of the day, the District must plan to meet this surge of demand.

2.7.3 Station Area Demand by Hour

The following table summarizes overall service demand percentage by station for 2022. Only in District fire station incidents are calculated. The percentage listed is the percentage of likelihood a particular station's apparatus is involved in an incident at any given hour. This number considers not only the number of incidents, but also the duration of incidents. The busiest stations are listed first.

Table 15—Station Demand by Hour (2022)

Hour	08	02	05	01	11	12	10	09
00:00	23.57%	28.19%	31.35%	30.20%	15.54%	22.78%	22.98%	19.21%
01:00	26.26%	19.49%	21.13%	23.39%	15.28%	21.47%	20.67%	15.64%
02:00	17.41%	15.83%	24.51%	27.40%	15.74%	18.78%	17.88%	15.14%
03:00	19.14%	17.01%	19.17%	29.79%	11.56%	15.70%	14.88%	13.50%
04:00	16.42%	20.49%	17.19%	17.56%	13.71%	15.07%	16.89%	11.46%
05:00	15.28%	17.41%	19.29%	15.83%	15.55%	13.22%	16.76%	12.58%
06:00	27.97%	19.72%	21.75%	27.65%	16.97%	16.46%	19.47%	16.39%
07:00	31.52%	29.81%	24.05%	27.20%	35.69%	24.15%	34.83%	20.03%
08:00	35.46%	36.41%	35.88%	31.44%	39.23%	30.98%	34.97%	23.86%
09:00	44.87%	41.67%	41.32%	43.78%	39.82%	34.64%	39.51%	28.71%
10:00	52.19%	45.74%	41.50%	38.13%	45.35%	37.18%	36.54%	32.28%
11:00	50.13%	54.02%	50.22%	39.47%	38.36%	39.83%	39.59%	28.60%
12:00	55.01%	49.38%	50.35%	35.50%	41.23%	41.67%	41.90%	42.75%
13:00	48.15%	49.72%	54.09%	43.75%	51.25%	42.31%	36.55%	35.48%
14:00	60.42%	56.16%	50.66%	46.62%	42.68%	48.13%	35.10%	40.54%
15:00	50.61%	57.62%	49.02%	42.96%	40.06%	40.96%	44.12%	34.58%
16:00	58.39%	61.23%	44.15%	45.95%	45.71%	42.92%	35.09%	34.49%
17:00	51.35%	59.70%	50.78%	44.82%	44.12%	36.47%	32.61%	32.69%
18:00	54.47%	48.30%	42.79%	41.24%	38.88%	38.35%	34.98%	37.39%
19:00	54.47%	48.55%	49.66%	44.71%	42.24%	39.30%	34.71%	35.20%
20:00	43.98%	42.10%	44.76%	35.56%	36.83%	40.13%	37.35%	35.20%
21:00	41.85%	43.73%	37.96%	34.25%	30.19%	33.74%	38.09%	33.98%
22:00	41.07%	36.60%	46.34%	36.17%	22.62%	32.14%	21.83%	27.65%
23:00	30.11%	30.62%	28.80%	33.21%	21.72%	25.77%	26.63%	17.76%
Overall	**39.59%**	**38.73%**	**37.36%**	**34.86%**	**31.68%**	**31.34%**	**30.58%**	**26.88%**
Runs	**3,870**	**4,197**	**3,816**	**3,253**	**3,038**	**3,245**	**2,990**	**2,852**

Hour	04	03	06	013	07
00:00	12.50%	13.17%	16.46%	9.27%	7.75%
01:00	14.78%	8.69%	12.57%	5.16%	3.76%
02:00	10.60%	8.86%	15.02%	6.20%	7.32%
03:00	12.79%	5.57%	13.53%	6.47%	3.49%
04:00	10.67%	8.70%	9.42%	7.95%	6.37%
05:00	9.89%	8.63%	9.07%	6.65%	6.75%
06:00	18.15%	13.31%	12.09%	10.26%	7.65%
07:00	18.13%	17.12%	14.78%	10.21%	9.91%
08:00	27.12%	21.77%	24.07%	12.62%	12.78%
09:00	29.72%	24.67%	23.42%	16.75%	16.79%
10:00	30.49%	30.80%	28.17%	19.71%	15.62%
11:00	27.64%	31.70%	25.36%	17.96%	19.26%
12:00	33.80%	29.83%	27.68%	21.24%	12.20%
13:00	33.91%	34.84%	24.79%	24.18%	20.13%
14:00	31.74%	34.71%	24.58%	20.82%	17.65%
15:00	28.73%	30.06%	33.63%	24.60%	15.27%
16:00	32.40%	34.33%	26.11%	20.12%	19.28%
17:00	26.97%	28.90%	27.53%	20.38%	18.59%
18:00	31.98%	27.12%	21.44%	18.48%	18.36%
19:00	31.57%	28.22%	18.34%	15.16%	20.79%
20:00	25.76%	20.36%	22.83%	12.30%	14.13%
21:00	25.10%	21.29%	21.43%	17.60%	12.07%
22:00	23.18%	20.35%	17.53%	11.49%	11.77%
23:00	19.16%	12.65%	16.76%	9.41%	9.84%
Overall	**23.62%**	**21.49%**	**20.28%**	**14.37%**	**12.81%**
Runs	**2,446**	**2,344**	**1,988**	**1,554**	**1,482**

2.7.4 Unit-Hour Utilization

The unit-hour utilization (UHU) percentage is calculated using the number of responses and duration of the responses to show the percentage of time that a response resource is committed to an active incident during a given hour of the day. In Citygate's experience, a UHU of 30 percent or higher over *multiple* consecutive hours becomes the point at which other responsibilities, such as training, do not get completed.

The following table summarizes the unit-hour utilization for Department engine companies, with the busiest engine listed first. *Due to NFIRS 5 / CAD data connection issues, there may be a slight overrepresentation of utilization in the first hour.*

Table 16—Unit-Hour Utilization – Engines (2022)

Hour	CFE10	CFE12	CFE11	CFE08	CFE01	CFE06	CFE04	CFE03	CFE05	CFE02
0:00	19.16%	19.20%	16.70%	18.31%	16.77%	18.69%	15.30%	10.57%	10.27%	11.05%
1:00	6.73%	3.84%	7.09%	7.05%	6.62%	6.22%	8.41%	3.36%	3.54%	3.80%
2:00	8.49%	7.95%	7.14%	4.85%	6.86%	6.56%	4.42%	2.58%	3.36%	2.59%
3:00	6.40%	5.96%	3.33%	6.08%	4.58%	4.13%	2.36%	1.34%	2.44%	2.49%
4:00	7.45%	4.26%	4.39%	3.45%	1.82%	4.40%	2.45%	2.65%	2.86%	4.57%
5:00	5.66%	2.96%	5.54%	3.65%	3.78%	2.58%	3.42%	2.97%	2.38%	1.64%
6:00	4.55%	4.97%	4.11%	4.31%	5.79%	4.00%	2.94%	2.66%	1.32%	0.82%
7:00	7.39%	4.52%	4.94%	4.77%	6.08%	5.33%	4.90%	2.31%	3.31%	3.91%
8:00	8.90%	7.04%	7.31%	4.91%	7.91%	5.18%	5.92%	4.24%	2.67%	3.24%
9:00	9.70%	11.21%	6.06%	8.53%	7.87%	4.52%	6.35%	3.91%	4.88%	3.68%
10:00	8.57%	10.05%	6.33%	8.94%	5.23%	9.47%	6.34%	5.97%	3.91%	3.12%
11:00	10.60%	11.05%	9.22%	6.82%	6.58%	6.50%	4.82%	4.09%	4.91%	2.97%
12:00	12.93%	8.92%	8.37%	9.10%	7.61%	7.26%	9.54%	5.17%	5.57%	3.35%
13:00	12.54%	16.59%	9.91%	8.14%	7.22%	6.59%	6.11%	9.26%	6.10%	3.95%
14:00	12.98%	13.58%	7.61%	9.34%	8.17%	7.13%	6.47%	5.20%	5.64%	5.32%
15:00	17.16%	8.28%	9.89%	6.98%	9.97%	11.04%	7.21%	10.11%	6.84%	5.99%
16:00	18.66%	11.28%	10.67%	10.78%	10.96%	7.38%	9.57%	4.54%	7.35%	5.81%
17:00	11.58%	11.37%	13.52%	8.25%	9.98%	9.90%	7.87%	8.05%	9.44%	5.85%
18:00	7.52%	9.69%	13.98%	11.24%	6.93%	6.92%	6.41%	7.30%	4.26%	4.77%
19:00	14.02%	11.23%	6.69%	8.80%	9.73%	7.06%	5.49%	6.04%	7.84%	6.53%
20:00	11.51%	11.53%	7.78%	8.10%	7.29%	5.50%	5.30%	3.96%	5.24%	4.98%
21:00	12.49%	9.04%	6.59%	6.31%	5.93%	8.26%	6.73%	5.69%	3.52%	5.32%
22:00	7.92%	7.78%	8.72%	6.24%	4.69%	4.70%	7.50%	4.75%	5.20%	3.58%
23:00	14.69%	6.99%	4.45%	5.08%	8.82%	6.37%	2.18%	2.24%	2.64%	2.33%

Vehicle	CFE09	CFE13	CFE07
00:00	7.13%	6.67%	4.92%
01:00	2.95%	1.94%	0.78%
02:00	1.70%	3.05%	1.97%
03:00	2.61%	2.12%	1.30%
04:00	2.07%	1.34%	0.97%
05:00	1.14%	1.85%	1.59%
06:00	2.67%	1.73%	0.85%
07:00	1.96%	2.22%	1.50%
08:00	2.25%	1.67%	1.33%
09:00	3.79%	3.03%	1.64%
10:00	4.23%	3.90%	1.98%
11:00	4.30%	2.21%	1.73%
12:00	3.34%	3.84%	1.30%
13:00	5.23%	5.48%	2.31%
14:00	6.10%	2.87%	2.79%
15:00	4.55%	4.15%	2.74%
16:00	2.83%	3.45%	3.11%
17:00	5.82%	2.35%	2.92%
18:00	7.25%	4.52%	2.97%
19:00	3.35%	2.29%	3.54%
20:00	3.26%	3.24%	1.86%
21:00	4.36%	2.51%	1.43%
22:00	3.77%	1.96%	2.76%
23:00	3.90%	3.34%	1.15%

The following table summarizes the UHU for the Department's six primary truck companies, with the busiest trucks listed first. *Due to NFIRS 5 / CAD data connection issues, there may be a slight overrepresentation of utilization in the first hour.*

Table 17—Unit-Hour Utilization – Truck Companies (2022)

Hour	CFTW09	CFTW07	CFL02	CFL013	CFTW02
00:00	11.44%	8.50%	6.27%	5.41%	2.07%
01:00	3.78%	4.62%	1.87%	1.32%	0.98%
02:00	2.65%	2.45%	1.80%	2.83%	3.15%
03:00	2.46%	2.26%	1.82%	1.40%	1.02%
04:00	5.58%	2.70%	2.25%	1.73%	1.18%
05:00	2.32%	4.13%	2.09%	0.59%	0.69%
06:00	1.99%	1.54%	2.93%	2.10%	0.13%
07:00	4.18%	1.86%	3.03%	1.84%	0.79%
08:00	4.21%	2.22%	2.63%	2.25%	0.78%
09:00	4.16%	3.04%	2.73%	1.78%	1.14%
10:00	4.80%	2.63%	2.99%	1.84%	1.21%
11:00	3.18%	2.65%	2.86%	3.10%	2.44%
12:00	3.52%	2.77%	2.49%	1.62%	1.09%
13:00	4.23%	5.94%	4.34%	2.84%	1.26%
14:00	4.83%	3.23%	4.28%	7.97%	2.60%
15:00	4.70%	4.27%	4.08%	6.86%	1.22%
16:00	7.37%	3.31%	4.14%	4.75%	2.46%
17:00	4.72%	2.58%	6.29%	4.81%	1.77%
18:00	4.23%	3.22%	4.86%	3.19%	3.15%
19:00	6.05%	5.16%	2.98%	3.68%	1.26%
20:00	4.50%	4.92%	2.14%	1.22%	1.16%
21:00	6.94%	3.31%	7.10%	1.67%	1.67%
22:00	6.90%	3.77%	2.89%	4.02%	1.02%
23:00	1.89%	1.31%	3.17%	2.71%	3.43%

Note: In the above table CFL02 and CFTW02 are essentially the same unit. TW02 is used as a reserve unit in place L02.

The following table summarizes the UHU for the Department's Medic ambulance units with the busiest resources listed first. *Due to NFIRS 5 / CAD data connection issues, there may be a slight overrepresentation of utilization in the first hour.*

Table 18—Unit-Hour Utilization – Medic/EMS (2022)

Hour	CFM08	CFM509	CFM10	CFM02	CFM11	CFM12	CFM09	CFM05	CFM01	CFM06
00:00	33.76%	37.15%	31.47%	32.81%	22.98%	28.50%	27.83%	27.90%	28.23%	26.35%
01:00	28.81%	15.44%	21.12%	17.22%	9.75%	19.30%	14.43%	14.01%	17.12%	14.38%
02:00	20.35%	12.12%	17.14%	15.25%	13.82%	15.52%	17.48%	16.39%	20.51%	15.35%
03:00	18.68%	14.92%	18.74%	15.07%	10.79%	14.11%	10.30%	14.09%	16.98%	10.25%
04:00	14.35%	14.88%	17.90%	19.10%	10.71%	13.98%	9.10%	13.06%	13.97%	9.27%
05:00	16.52%	11.07%	17.65%	13.82%	14.54%	11.77%	10.62%	13.23%	14.93%	10.59%
06:00	25.33%	15.35%	21.88%	16.06%	17.30%	15.63%	16.82%	15.84%	24.48%	12.54%
07:00	31.15%	22.81%	33.32%	30.71%	26.01%	22.25%	17.89%	20.98%	21.37%	17.69%
08:00	29.33%	32.06%	33.61%	30.26%	30.67%	31.24%	23.81%	25.50%	21.35%	29.31%
09:00	41.71%	38.17%	40.20%	37.14%	32.05%	28.02%	26.37%	27.48%	31.44%	28.63%
10:00	42.62%	41.84%	31.53%	35.59%	35.70%	31.37%	36.65%	29.01%	32.55%	27.81%
11:00	45.75%	47.04%	39.82%	38.85%	35.19%	32.70%	32.77%	32.94%	31.90%	34.40%
12:00	44.17%	49.21%	39.15%	38.38%	37.19%	38.85%	41.17%	34.84%	28.66%	34.90%
13:00	39.74%	42.83%	38.51%	38.39%	42.41%	37.26%	41.01%	32.64%	34.76%	30.72%
14:00	53.53%	55.00%	41.17%	42.94%	42.86%	35.83%	36.28%	33.70%	35.18%	31.66%
15:00	39.38%	36.98%	49.73%	40.12%	41.31%	37.89%	38.36%	39.74%	30.38%	36.59%
16:00	47.29%	54.85%	35.20%	46.69%	43.32%	32.60%	41.91%	35.69%	29.41%	35.03%
17:00	42.99%	52.65%	37.79%	42.23%	33.20%	35.88%	40.06%	32.33%	28.41%	31.85%
18:00	43.33%	40.50%	40.13%	40.06%	37.00%	30.86%	34.10%	36.83%	28.94%	26.41%
19:00	46.74%	46.31%	38.75%	33.53%	38.53%	36.64%	32.32%	30.48%	32.31%	30.90%
20:00	39.24%	42.94%	36.03%	39.59%	36.11%	32.20%	34.03%	32.03%	24.19%	29.28%
21:00	32.71%	36.68%	34.18%	37.04%	27.37%	29.66%	35.74%	33.40%	26.58%	23.08%
22:00	36.99%	35.82%	27.63%	28.95%	24.75%	29.32%	25.28%	30.63%	27.80%	23.96%
23:00	28.39%	24.96%	32.11%	25.77%	20.18%	21.45%	15.83%	23.61%	21.33%	20.18%

Hour	CFM03	CFM04	CFM13	CFM07	CFM505	CFM502
00:00	20.71%	17.41%	13.34%	12.29%	5.59%	1.65%
01:00	9.11%	14.34%	6.11%	4.13%	1.45%	1.30%
02:00	6.56%	10.38%	6.76%	5.76%	2.70%	0.90%
03:00	6.49%	9.88%	7.17%	4.12%	0.59%	2.49%
04:00	8.66%	10.10%	6.73%	5.70%	3.82%	1.26%
05:00	8.52%	7.17%	5.92%	6.57%	2.44%	0.81%
06:00	13.32%	15.64%	8.53%	9.18%	4.74%	0.79%
07:00	17.45%	17.58%	10.75%	10.66%	3.47%	1.23%
08:00	22.94%	26.93%	14.31%	12.16%	2.47%	2.90%
09:00	26.73%	26.03%	20.71%	19.18%	4.87%	2.54%
10:00	31.61%	29.59%	22.75%	18.90%	4.37%	1.50%
11:00	25.83%	28.43%	24.92%	18.68%	5.20%	5.67%
12:00	32.90%	29.56%	23.85%	17.24%	10.14%	3.92%
13:00	34.14%	34.19%	25.48%	19.99%	5.26%	4.74%
14:00	32.73%	32.10%	25.82%	21.20%	9.16%	1.48%
15:00	33.00%	27.24%	25.94%	19.74%	4.84%	4.04%
16:00	35.06%	30.45%	23.00%	20.56%	6.51%	5.22%
17:00	28.84%	24.17%	25.24%	19.13%	4.62%	4.31%
18:00	31.14%	31.66%	21.53%	19.15%	4.14%	2.28%
19:00	31.72%	28.60%	24.95%	18.71%	10.07%	4.11%
20:00	24.03%	24.71%	14.29%	14.95%	7.29%	2.04%
21:00	21.08%	22.13%	20.20%	13.51%	6.16%	1.11%
22:00	22.93%	18.87%	10.00%	11.66%	2.94%	1.81%
23:00	12.99%	18.03%	8.41%	10.44%	2.99%	1.28%

2.7.5 Hospital Offload Time

When a medic ambulance transports, the care of the patient must be formally transferred to the Emergency Room staff. If, upon arrival of the ambulance, the staff do not have an open bed or nursing staff available, the patient must wait on the ambulance gurney with the District's paramedic, typically in a hallway until care is transferred. Formally named Average Patient Offload Time, or APOT, these delays are also casually called "wall time" and can significantly impact an ambulance deployment plan's capacity to keep units in service.

District ambulances can transport to any one of 106 facilities in the region. Of these facilities, ten hospitals receive most of the patients. In 2022, the 90th percentile APOT for these ten hospitals was **55:03** minutes/seconds. If a hospital delay time of 55:00 minutes is added to just an

8:00-minute total response time and a typical 25:00 minutes on scene with the patient, then a typical out-of-service time per transport is 88:00 minutes. 90:00 minutes or longer is not unusual.

Thus, at peak hours of the day—with at least four ambulances typically committed at once, 56.6 percent of the time—the District's medic ambulance plan is short almost a constant six hours of unit productivity. This measure places the UHUs above and the response times to follow in perspective: when units are committed, and other units that are farther away must cover incidents in their home area, response times lengthen.

Finding #6:	None of the primary firefighting units have hourly workload utilization that is high enough to be of concern in the next few years.
Finding #7:	Medic ambulances are very busy—10 of the 14 medic units on a 24-hour-per-day schedule are overloaded at present according to a unit-hour utilization (UHU) measure over many consecutive hours, and 90th percentile hospital offload delays are 90 minutes. The Department should seek immediate relief via the use of peak-hour-of-the-day medic ambulances during peak hours of the day and a second 24-hour medic ambulance in the busiest demand area.

2.7.6 Response Time Performance

Measurements for the performance of the first response apparatus to arrive at emergency incidents are the number of minutes and seconds necessary for 90 percent completion of the following response components:

- Call processing / dispatch
- Crew turnout
- First-Unit travel
- Call to arrival

*[**Note**: All measures to follow are for 2022 and only use complete records with incident codes for NFIRS Incident Records for Fire and EMS events. "Other" types are <u>not</u> included in the data.]*

Call Processing / Dispatch

Call processing measures the time from the first incident timestamp until apparatus are notified of the request for assistance.

Call processing performance depends on what is being measured. If the first incident timestamp takes place at the time the public safety answering point (PSAP) physically answers a 9-1-1 call

(at times, calls can be briefly held in queue), then call processing begins at *PSAP Time*. If a later time stamp is used well into the dispatcher listening to the caller, such as *Alarm Time* (typically when information has been entered into the computer and the *Enter* key is pressed), the processing time segment only represents a portion of the entire processing operation.

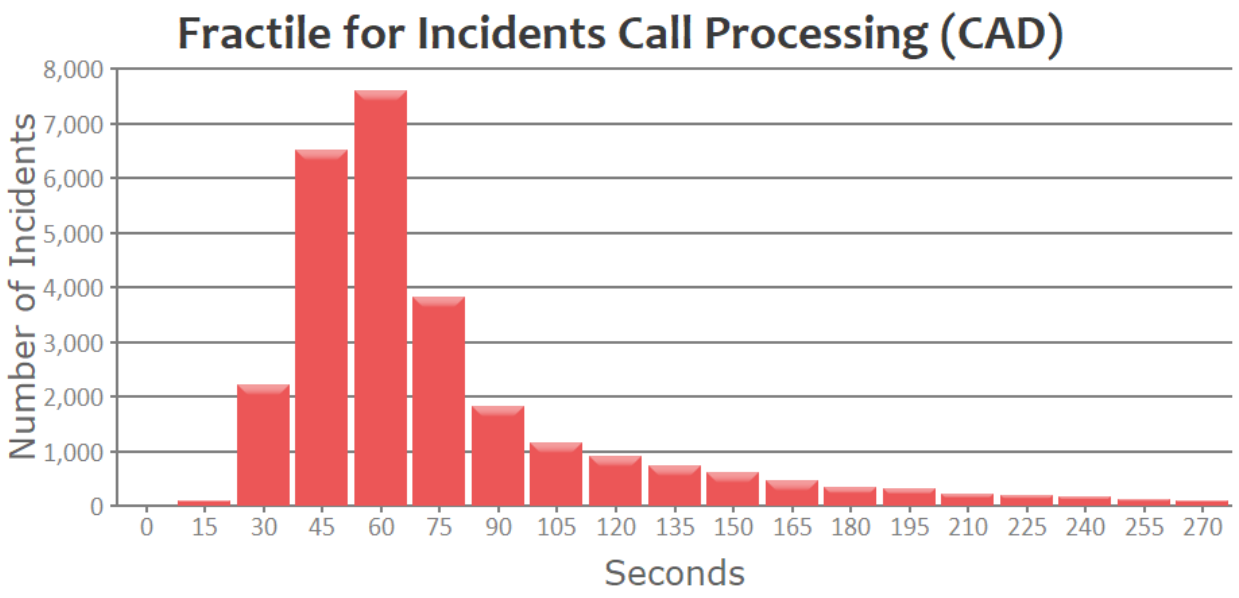
In addition, not all requests for assistance are received via landline 9-1-1. Generally, there will be a mix of channels for receiving requests for assistance. Each channel will have a timestamp at a different point in the processing operation. This is not as much of a factor if most requests are received via 9-1-1 PSAP.

The call-processing information in the following table and figure reports dispatch time from the District's Dispatch Center *Alarm Time.* Times are shown in minutes/seconds to 90 percent of all incidents and do not reflect 9-1-1 line transfers from law enforcement centers.

Table 19—90th Percentile Dispatch Performance from Call Receipt (2018–2022)

Station	Overall	2018	2019	2020	2021	2022
District-Wide	2:11	2:12	1:54	2:40	1:54	2:13

Figure 13—Fractile for Incidents Call Processing (CAD) – 2022



Finding #8:	Dispatch processing times to all serious requests are 30 seconds longer than a best practice time of 1:30 minutes. However, the District does not track call-processing time related to life-threatening EMS and fire events. These are processed much faster and can be separately reported.

Crew Turnout

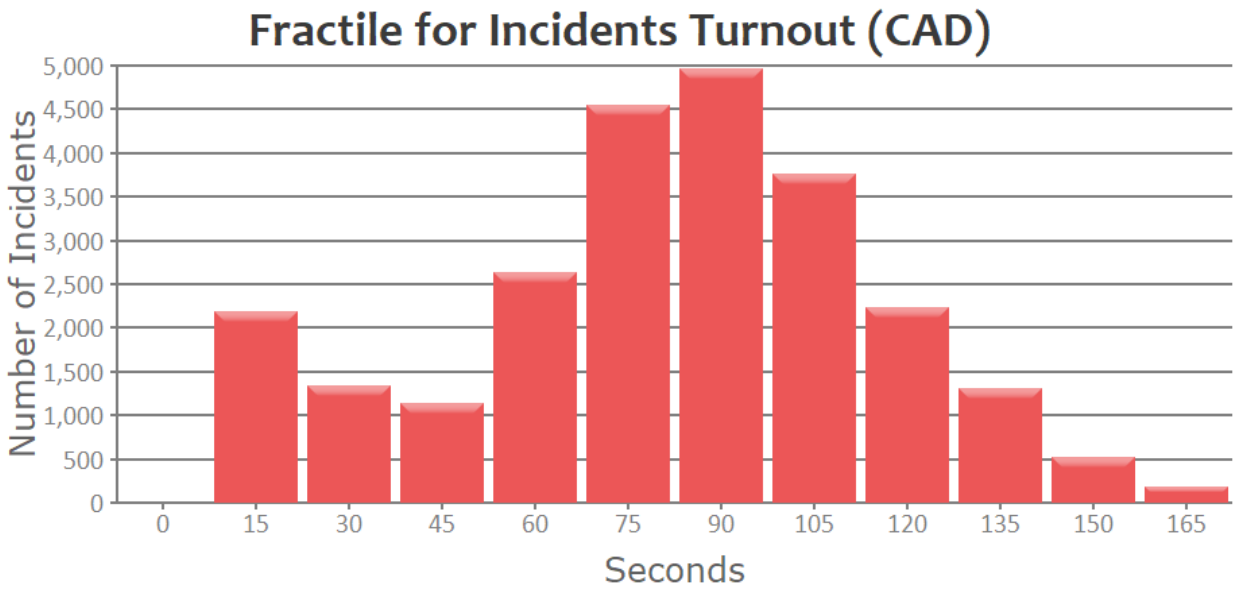
Crew turnout performance measures the time from completion of the dispatch notification until the start of response apparatus travel. Due to station design and the donning of mandatory protective clothing before responding, Citygate recommends a 2:00-minute goal across 24 hours at 90 percent compliance.

Table 20—90th Percentile Turnout Performance (2018–2022)

Station	Overall	2018	2019	2020	2021	2022
District-Wide	3:26	2:04	3:15	3:50	3:38	3:19

The following figure illustrates fractile turnout time performance. There are some incidents with the time from dispatch to a unit responding recorded as being between 15 and 30 seconds. This may indicate dispatches which have occurred while the apparatus is already on the road. Compliance peaks at 90 seconds. There remain a significant number of emergency incidents that take longer than 2:00 minutes for turnout.

Figure 14—Fractile for Incidents Turnout (CAD) – 2022



Finding #9:	Historic turnout times are sluggish and require education, training, and time reporting back to the crews to bring this measure down. Reducing this measure by 60 seconds is not impossible.

First-Unit Travel

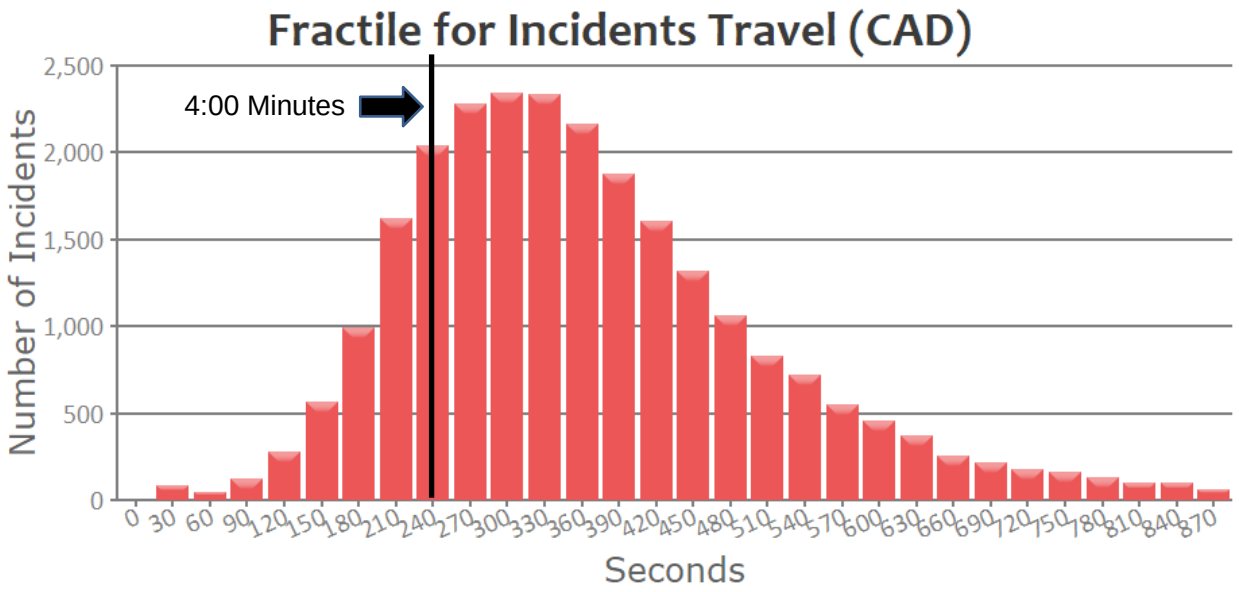
Travel performance measures the interval from start of first-due apparatus movement to arrival at the emergency incident. For most areas with urban/suburban population density, a 4:00-minute first-due unit travel time 90 percent of the time would be considered highly desirable. As the following table illustrates, the District's 90th percentile first-due unit travel time performance for 2022 was *slower* than the best practice and Citygate-recommended 4:00-minute goal for urban areas.

Table 21—90th Percentile First-Unit Travel Time Performance (2018–2022)

Station	Overall	2018	2019	2020	2021	2022
District-Wide	8:37	8:52	8:23	8:59	8:41	8:07

The following figure illustrates fractile travel time performance, with 300 seconds (5:00 minutes) representing the peak segment. There is, however, a very slow decrease in volume after this time stamp—which indicates that, while many incidents can be reached at or under 5:00 minutes, there are still a significant number of incidents that require much longer travel times.

Figure 15—Fractile for Incidents Travel (CAD) – 2022



The following table measures 90 percent travel time performance to **in-station area** fire and EMS incidents. Using the GPS Automatic Vehicle Location (AVL) "movement time," travel time decreases from 8:07 minutes to 6:27 minutes, or a reduction of 1:40 minutes. This indicates that when a home apparatus is not available to respond, there is a 1:40-minute performance penalty to be paid in relation to travel time.

Table 22—90th Percentile First-Unit Travel Time Performance – In-Station Area (2018–2022)

Station	Overall	2018	2019	2020	2021	2022
District-Wide	6:57	7:19	6:50	7:21	6:55	6:27

Finding #10: First-unit travel time performance for Fire and EMS incidents District-wide in 2022 ranges from 6:27 to 8:07 minutes at the 90th percentile. This is significantly *slower* than the 4:00 to 5:00-minute best practice goal for urban areas. None of the station areas come close to a 4:00-minute travel time.

Citygate also reviewed the number of incidents by hour of the day, which show the inverse relationship between performance and incident volume. The higher the volume of incidents, the

lower the performance. Stated this way, at peak hours, many responses are made by units outside of the station area.

In 2022, 65.23 percent of fire and EMS responses had local apparatus arriving first within their district. This means that for the District as a whole, just over one third of incidents are answered by apparatus from outside the station area arriving first.

Lastly, Citygate reviewed travel time by both station area or type of unit, by six-hour time block per a 24-hour day, and there is only minor variation.

While, for the sake brevity, these deeper review tables are not included here, the root causes of sluggish travels times across all measures are multifaceted and intractable without the availability of more responding units and the building of more grid (versus curvilinear) street network layouts.

Call to Arrival

Call to arrival measures time from receipt of the 9-1-1 call until the first apparatus arrives at the incident. Best practice goals for urban communities are 1:30 minutes for call processing, 2:00 minutes for turnout, and 4:00 minutes for travel, for a total response time of 7:30 minutes.

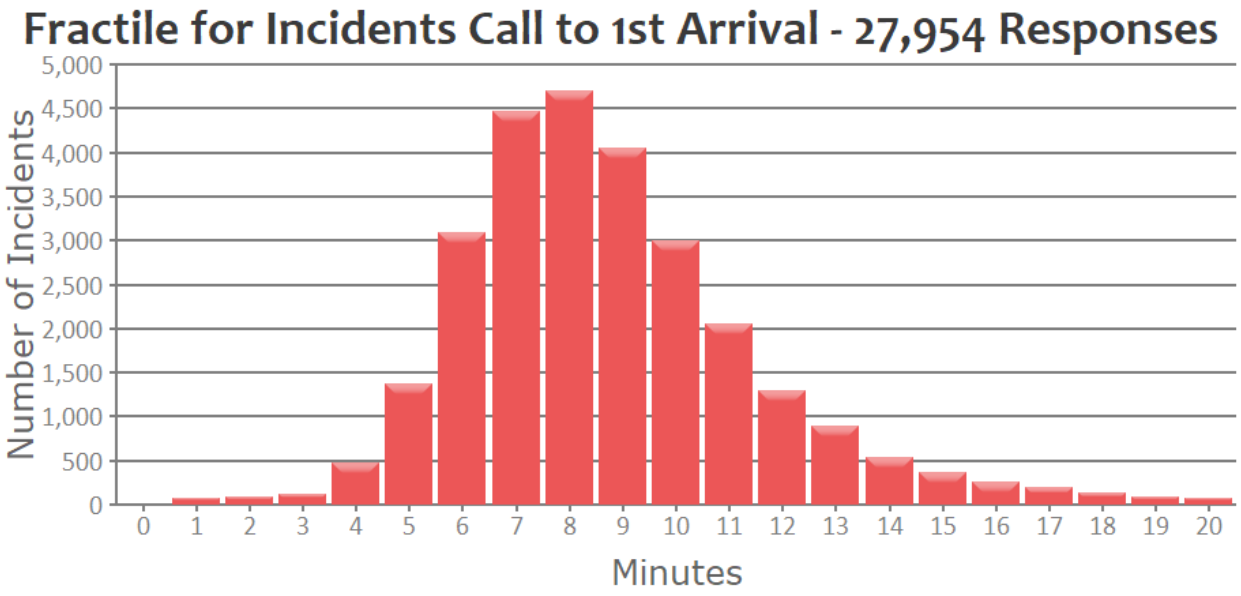
The following table shows that, Department-wide, 90th percentile call-to-first-unit-arrival performance is nearly 5:00 minutes *slower* than a typical 7:30-minute goal.

Table 23—90th Percentile First-Unit Call-to-Arrival Performance (2018–2022)

Station	Overall	2018	2019	2020	2021	2022
District-Wide	12:26	11:58	11:55	13:37	12:35	11:52

The following figure illustrates fractile call-to-arrival performance, with 8:00 minutes representing the peak segment. Again, the right-shifted graph indicates a slow drop-off in the number of arrivals requiring longer time increments.

Figure 16—Fractile for Incidents Call to First Arrival – 2022



Finding #11: At 11:52 minutes in 2022, the 90th percentile call-to-arrival time District-wide is significantly *slower* than a 7:30- to 8:30-minute best practice goal for urban areas. None of the station areas come close to a 7:30-minute call-to-arrival time.

Effective Response Force Travel Time

The tables in this section illustrate travel time performance for the District's six categories of building fire ERF / First Alarm response.

For urban building fire risks, NFPA 1710 and Citygate recommend that, to ensure good outcomes, the ERF should arrive in 8:00-minutes *travel* time—measured when the last needed unit arrives on-scene.

Over the five years of data analyzed, there were 802 building fires. If "Aid Given" mutual aid fires are eliminated, the number of fires decreases to 730. If building fires outside of each local station area are eliminated, the number further decreases to 695.

Based on the risks to be protected in a service area, departments pre-configure sets of multiple-unit response teams. In Cy-Fair, these are called "boxes" after the old street corner fire alarm boxes. To measure multi-unit response time, the following analysis uses the Box Alarm units for a single-family home fire. The "Full Box" alarm assignment of units was evaluated:

- 3 engines
- 1 ladder
- 1 EMS
- 1 other

This sorting resulted in 248 building fire ERF incidents. Once the outlier limits were also applied, there were 227 ERF incidents by response group. The following analysis is based on incidents from January 7, 2018, to November 22, 2022. The following table shows all station areas as well as the incident counts as there are so few building fires, the actual counts are small and vary across the District.

Table 24—Full Box – 90th Percentile ERF Response Group Travel Performance (2018–2022)

Station	Overall	2018	2019	2020	2021	2022
Department-Wide	**19:19 (227)**	**22:12 (24)**	**20:10 (28)**	**19:17 (45)**	**15:59 (58)**	**18:23 (72)**
Station 1	**21:33 (14)**	22:12 (2)		19:17 (6)	15:07 (3)	21:33 (3)
Station 2	**17:24 (30)**	14:55 (3)	17:24 (3)	17:38 (7)	15:22 (9)	12:20 (8)
Station 3	**19:08 (15)**	14:28 (1)	14:57 (1)	19:23 (2)	15:59 (7)	19:08 (4)
Station 4	**18:22 (11)**	19:29 (2)		17:24 (2)	14:44 (3)	18:22 (4)
Station 5	**17:48 (26)**	20:20 (2)	15:36 (2)	16:32 (9)	15:50 (3)	19:19 (10)
Station 6	**20:53 (25)**	23:01 (4)	20:55 (5)	11:55 (2)	16:39 (5)	13:22 (9)
Station 7	**21:21 (3)**			11:54 (1)		21:21 (2)
Station 8	**18:43 (21)**	19:46 (4)	15:21 (1)	16:18 (4)	11:53 (6)	14:58 (6)
Station 9	**16:02 (28)**	12:33 (1)	16:02 (4)	17:13 (5)	13:07 (9)	16:38 (9)
Station 10	**15:51 (28)**	22:43 (3)	19:30 (6)	13:49 (4)	15:44 (6)	13:39 (9)
Station 11	**16:32 (10)**	16:42 (1)	16:32 (4)		13:01 (1)	12:37 (4)
Station 12	**20:56 (12)**	20:56 (1)	18:47 (2)	19:27 (2)	22:33 (4)	17:20 (3)
Station 13	**21:17 (4)**			21:17 (1)	13:56 (2)	15:11 (1)

As the table shows, none of the station areas came close to 8:00-minute travel at 90 percent. This is due to multiple factors: not enough staffed ladders, engine areas that are too large, high-volume EMS incidents also using engines for total staffing needs, and the curvilinear street design across the District's road network topography.

Finding #12: At 18:23 minutes in 2022, the 90th percentile Effective Response Force (ERF or First Alarm) *travel* time for the last unit to arrive District-wide is significantly *slower* than an 8:00-minute best practice goal in urban areas. None of the station areas come close to an 8:00-minute ERF travel time measure. There are too few units spread across too large a road network to quickly deliver six units to an incident.

2.8 Overall Evaluation

SOC Element 8 of 8
Overall Evaluation

The Department serves a diverse urban population with a mixed residential and non-residential land-use pattern typical of Harris County.

If the District Commissioners' desired emergency outcomes in urban population areas include limiting building fire damage to only part of the inside of an affected building or minimizing permanent impairment resulting from a medical emergency, or both, then the District will need to provide both first-due unit and multiple-unit ERF coverage in similar-risk neighborhoods consistent with Citygate's best practices-based response performance recommendations.

Citygate finds the Department's response apparatus to be appropriate to protect against the hazards likely to impact the District's fire service areas. Daily staffing per unit provides for at least two ERFs sufficient for one to two emerging or serious fires while maintaining engine and ambulance emergency responses.

The resultant total response time of 11:52 minutes for significant fire and EMS emergencies from Fire Dispatch Center answer to first-unit arrival to significant fire and EMS emergencies is significantly longer than a typical, best practice-based, and Citygate-recommended goal of 7:30 minutes in urban areas. Given the road network design and growth areas around still-undeveloped open spaces, as in other urban areas with similar challenges, Citygate is recommending the District use a 5:00-minute travel time measure for future fire station spacing. Thus, a total response time goal would be first-unit arrival within 8:30 minutes and ERF arrival within 11:30 minutes of call receipt at Fire Dispatch, all at 90 percent or better reliability.

In terms of emergency incident workload per unit, no single firefighting unit or station area is approaching workload saturation. However, during long hours of the day, the ambulance system is at saturation due to total and simultaneous incident demand, which is further compounded and worsened further by long patient transfer times at hospitals. This means units are crossing sections of the District to cover other units' incident requests, which creates a cascade of longer response times.

Improving response times will not be easy or quick given the circumstances in the District's service area. There will need to be a multiple-issue, multiple-year effort to improve. Current staff and technology resources can be applied to improving turnout times. Over time, adding three stations will assist underserved infill areas. The growth areas—principally on the western and northern edges of the District—will need at least five additional stations. In addition to at least one fire engine per station, additional ambulances and ladder trucks will also be necessary.

The ambulance system is at capacity for personnel assigned on 24-hour shifts. At some point, after too many incidents over the course of a long shift, patient care could degrade. As soon as possible, multiple peak-hour ambulances are needed seven days a week.

Given the diversity of needs within its service area, the District should adopt multiple response time goals to drive planning for and the monitoring of fire and EMS service performance. The District should also focus on *equity of access* to a first responder. Stated this way, for areas with similar risk, one neighborhood should receive help in about the same time (and with the same outcome goal) as another across the District. In summary, the District's response times cannot materially improve closer to best practices for positive outcomes without adding a significant number of resources.

2.8.1 Overall Deployment Recommendations

Based on the technical analysis and findings contained in this SOC, Citygate offers the following overall deployment recommendations:

Recommendation #1: Ensure that Dispatch is staffed and has the procedures in place to rapidly dispatch life-threatening emergencies and keep urgent incident processing to 90 seconds where language or location barriers do not exist.

Recommendation #2: Through feedback and training, decrease crew turnout times to 2:00 minutes over a 24-hour day.

Recommendation #3: Adopt Updated Deployment Policies: The District's Commissioners should adopt complete performance measures to aid deployment expansion and to monitor equity of performance across the diverse District. Measures should be for both urban areas and areas of emerging growth. The measures of time should be designed to deliver outcomes that will save patients upon arrival when possible and keep small and expanding fires from becoming more serious. With this is mind, Citygate recommends the following measures.

3.1 Urban Areas – Distribution of Fire Stations: To treat pre-hospital medical emergencies and control small fires, the first-due unit should

arrive within 8:30 minutes, 90 percent of the time, from receipt of the 9-1-1 call at Fire Dispatch. This equates to a 90-second dispatch time, a 2:00-minute company turnout time, and a 5:00-minute travel time.

3.2 **Urban Areas – Multiple-Unit Effective Response Force (ERF) for Serious Emergencies:** To confine building fires near the room of origin, keep vegetation fires under one acre in size, and treat multiple medical patients at a single incident, a multiple-unit ERF of at least 17 personnel, including at least one Chief Officer, should arrive within 11:30 minutes from the time of 9-1-1 call receipt at the Fire Dispatch Center, 90 percent of the time. This equates to a 90-second dispatch time, a 2:00-minute company turnout time, and an 8:00-minute travel time.

3.3 **Medic Ambulances** – To provide paramedic-level patient care along with first responder engines or ladders, deploy ambulances based on an 8:00- to 10:00-minute travel time for a total response time of no more than 13:30 minutes.

3.4 Adopt a medic ambulance workload measure of a Unit-Hour Utilization (UHU) rate saturation point of no more than 35 percent over eight consecutive hours.

3.5 **Urban Areas – Hazardous Materials Response:** To protect the District's service area from the hazards associated with uncontrolled release of hazardous and toxic materials, send the nearest first-response fire unit to assess the situation, isolate and deny entry, and determine the need for the Hazardous Materials Response Team from Cy-Fair, the County Fire Marshal, and/or Houston.

3.6 **Urban Areas – Technical Rescue:** To provide technical rescue services as needed with enough trained personnel to facilitate a successful rescue, a multiple-unit ERF of at least 17 personnel, including on-duty technical rescue specialists and at least one Chief Officer, should be capable of responding throughout the District's service area to facilitate safe rescue/extrication and delivery of the victim to the appropriate emergency medical care facility.

3.7 **New Growth Areas** – Adopt tiered deployment measures based on population density and community risks to control building fires from spreading to other buildings or to the wildland, controlling wildland fires from spreading to inhabited buildings, and minimizing permanent

impairment from a medical emergency. The response time goals could be as follows:

3.7a When there are more than 10,000 residents in a contiguous area beyond a 5:00-minute travel time from a station, at that point have a fire station and crew operational.

3.7b In commercial-only areas, if there are more than 5,000 employees (or others) in a contiguous area beyond an 8:00-minute travel time from a station, at that point have a fire station and crew operational.

SECTION 3A—HEADQUARTERS SERVICES REVIEW: INTRODUCTION

3A.1 HEADQUARTERS SERVICES OVERVIEW

An integral component of this Fire Services Master Plan is an in-depth review and evaluation of the Department's management organization and headquarters support functions including:

- **Administration Division**
  - Dispatch Services
  - Human Resources
  - Information Technology (including Radio)
  - Public Information
  - Finance
- **Operations Division**
  - EMS Operations and Clinical Oversight (including EMS Training
  - Suppression (including Health and Safety, Special Operations, and Suppression Training)
  - Community Risk Reduction
- **Resources and Logistics Division**
  - Facilities
  - Fleet Services
  - Quartermaster

For fire department administration, the NFPA recommends, 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]."[10] Best practices recommend a management organization and headquarters programs with adequate staffing capacity to provide a properly trained, equipped, and supported response force to ensure prompt response and safe, competent service delivery. Compliance regulations for fire services operation

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

are increasing, so the proper hiring, training, and supervision of operational personnel requires a significant commitment to leadership and general management.

In addition, the provision of public agency fire services is highly regulated by state law through the Texas Commission on Fire Protection (TCFP).[11] In Texas, the Department of State Health Services (DSHS) regulates emergency medical services. Through these Texas agencies, fire and EMS organizational standards and recommendations have the force of administrative law. Therefore, all government agencies meeting specified conditions that utilize their employees to provide firefighting services must comply with TCFP and DSHS requirements.

The NFPA publishes more than 300 recommended standards on fire protection, from construction codes to fire department operations, management, and equipment. The TCFP checklist for fire department compliance has 335 individual items across 47 themes for mandatory compliance to state statute and specific NFPA-referenced citations. Citygate's review of the following headquarters sections included awareness of these published best practices and requirements. TCFP inspects regulated fire agencies biennially, and after its first and only review in February 2022, the District was given only one recommendation—to maintain all standard operating procedures to the latest applicable NFPA and Texas requirements. Citygate agrees with this recommendation.

Lastly, where federal and state law or other organizations have best practices and requirements, we also compare the District to those, such as in finance and human resources. We also use Citygate's active fire department management experience and our consulting experience across hundreds of fire departments. Taken together, we know "what right looks like."

3A.2 METHODOLOGY

Citygate reviewed the current District's administrative support organization and evaluated its lines of authority, span of control, and workload capacity gaps, if any. Citygate then made findings relative to that evaluation and provided recommendations for consideration by the Department and Commission leadership to improve the overall efficacy of the District's administrative organization.

Citygate's methodology in conducting this review included:

- Requesting and reviewing extensive data and documentation relative to the various administrative functions
- Review of all headquarters job descriptions

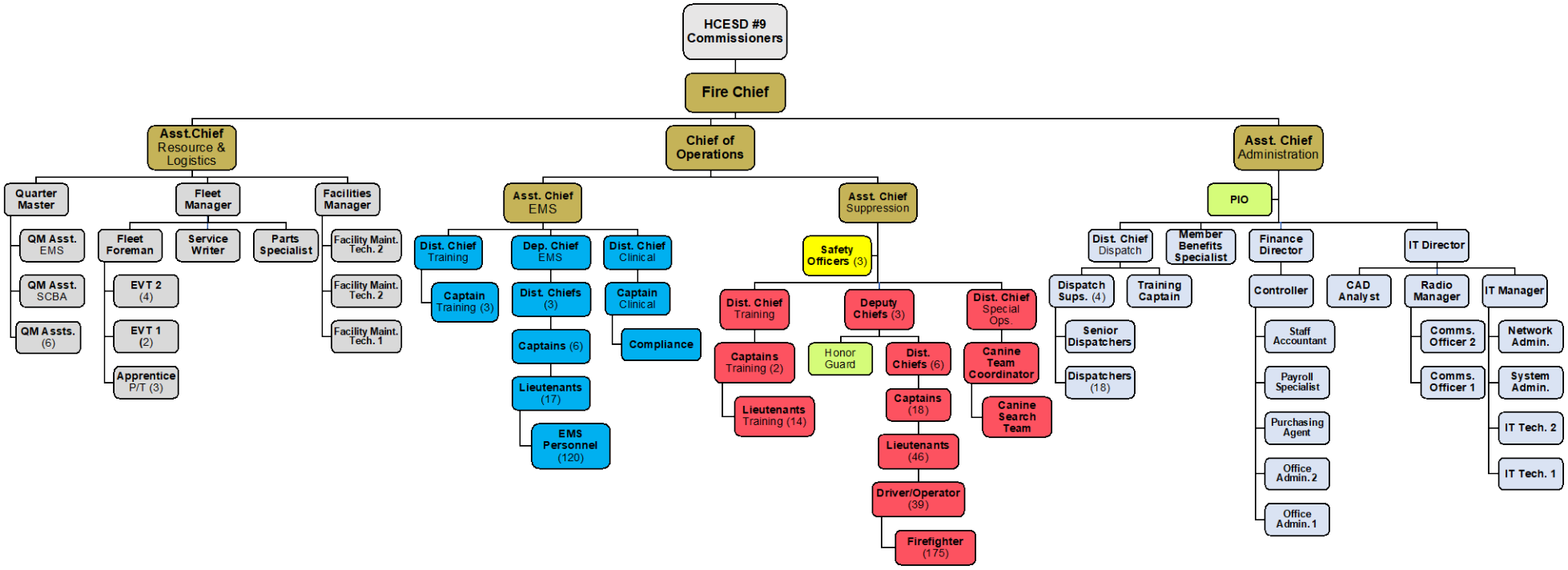
[11] https://www.tcfp.texas.gov/about/our-mission

- Review of all operating procedures and policies
- Conducting a high-level workload by hours and tasks analysis of key responsibilities for each administrative and headquarters support position
- One-on-one interviews with administrative and headquarters support staff
- Review of any relevant regulatory requirements and recognized best practices
- Review of any formal or informal performance metrics
- Evaluation of each administrative support function to include as appropriate the organizational structure, key responsibilities, staffing level, regulatory compliance, practices and procedures, performance, and actual or potential single points of failure, if any.

3A.3 District Management Organization

The following figure shows the District's organizational structure.

Figure 17—District Organizational Chart



As the figure shows, the District's headquarters functions are appropriately grouped into three Divisions under the Fire Chief—Field Operations, Resources and Logistics, and General Administration. The Operations Division is led by a Chief of Operations and two Assistant Chiefs lead Resources and Logistics and Administration. Under each of the three divisions are technical sections led by both chief officers and non-sworn managers.

Finding #13: The District's overall headquarters organization design is appropriate under best practices for a District of Cy-Fair's size. The functional layout of the organization can scale up as the District's services expand along with new development.

The following table summarizes District staffing by Division and Section.

Table 25—Staffing Summary by Division

Division / Section	Personnel			Total
	Full-time	Part-Time	Volunteer	
Administration	**45**	**7**	**0**	**52**
Executive Team	6	0	0	**6**
Dispatch	20	4	0	**24**
Finance	6	0	0	**6**
Human Resources	1	0	0	**1**
Information Technology	10	2	0	**12**
PIO	2	1	0	**3**
Operations	**280**	**74**	**128**	**482**
EMS				
Training	4	0	0	**4**
Response	133	7	0	**140**
QA/QI	3	0	0	**3**
Suppression				
Training	3	12	0	**15**
Response	136	55	125	**316**
Safety	0	0	3	**3**
Special Operations	1	0	0	**1**
Resource and Logistics	**22**	**4**	**0**	**26**
Facilities	4	0	0	**4**
Fleet	10	3	0	**13**
Quartermaster	8	1	0	**9**
Total	**347**	**85**	**128**	**560**

3A.4 Office of the Fire Chief

As the full Organizational Chart shows, the District has no office support (clerical) capacity other than in the Finance Section, nor any technical management analyst capacity for data analysis. Every professional and technical position is effectively working "out of class" providing their own support. This leads to ineffective use of available work time for managers, chief officers, and technical specialists, and it is a recurring theme across all headquarters functions.

While the District has been growing significantly since 2019, the executive management functions reflected at the top of the Organizational Chart (Figure 17) are surprisingly few given over 500 full-time and part-time employees and a 2022 operating budget of nearly $70 million. Citygate makes this observation not merely based on the absence of office support positions, but also based on the factors outlined in the following bulleted list combined with Citygate's experience with what other organizations of a similar size have in place. Complex public safety agencies need a more robust executive team for *a rapidly growing* organization that must be effective, compliant with regulations and standards, and able to properly manage the workforce for success. Citygate's team has the following overall concerns with the District's current organizational structure and authorized headquarters personnel:

- There is no Executive Assistant or Senior Office Support position to the Fire Chief.
- There is no future planning, Quality Assurance / Data Analyst position given current and anticipated future District growth.
- There is no Professional Standards review accountability function.
- There is no Clerk of the Board or public records position (City Clerk).
- There was no Fiscal Director until within the last six months.
- There is no Human Resources Director, and the section is not built out. (Director recruitment was underway as of the second quarter of 2023.)
- The Marketing Director position was filled in late Spring of 2023.
- While the District is a "right to work" entity, the Fire Chief and all senior managers should have employment contracts to provide stability from political whims for making tough professional decisions; high-cost executives should have some commonsense protections for their livelihood and families.
- Several of the mid- and executive-level chief officers work an additional full-time position elsewhere as 24-hour shift-based officers and for Cy-Fair as 40-hours per week managers; however, they are not always in Cy-Fair for the entire week,

Monday through Friday. This practice has continued from the volunteer era and is allowed in Texas.

For the District to thrive and grow to be one of the largest fire departments in Texas (outside of the three or four largest city departments) serving over 600,000 to 700,000 residents, it must expand management and Board governance beyond the era of a smaller, volunteer-based organization with part-time leadership.

Second, the existing managers (even if all are full-time) cannot be expected to do technical work below their job descriptions and still fully engage in high-level planning, direction, coaching, problem solving, strategic decision-making, and community engagement. Technical work should be accomplished by mid-managers and technical staff—not by the top six executives.

Some of the work can be outsourced, as the District's legal counsel is providing Board agenda and records services. But other duties such as public record requests, filing, and records act retention still must be completed by staff. At present, this work is performed by the top six executive chief officers.

The District's Board and the command staff recognize some of this and have taken proactive steps related to the Finance, Human Resources Director, and PIO functions. They can take further steps in this Master Plan to provide office support professionals (clerical) and quality/data-driven analysis oversight positions. Several more critical functions that are understaffed will be described further in the following sections.

This leaves a remaining serious issue to be rectified—employment contracts for senior managers and chief officers. Employment contracts are common in Texas public agencies (and other states) to separate the political from the professional, more so where there is not a civil service system. Contracts do not allow malfeasance, and executives can be dismissed for cause or bought out early. However, if they perform to contract requirements, based on structured goals and annual reviews, they and their families have some semblance of stability. A recent snapshot of 13 other Fire ESDs found that 40 percent utilize employment contracts. Part of implementing contracts with executive personnel needs to entail determining a phased transition for the individuals with prior long-term employment (with retirement elsewhere) becoming solely full-time District employees. This can and must be done as soon as possible. In the future, all newly hired or promoted mid-to-executive managers should be solely District employees.

3A.4.1 Office of the Fire Chief Findings and Recommendations

Based on this review, Citygate makes the following findings and recommendations for the Office of the Fire Chief:

Finding #14: The Department lacks any level of clerical support for the Fire Chief.

Finding #15: The Fire Chief and Chief of Operations have been responsible for developing and updating all Department Standard Operating Guidelines (SOGs), a function better suited to a lower-level position.

Finding #16: The Department must commit at least one FTE position overall to the updating and follow-up for 100 percent of all 87 operating policies/orders and 75 job descriptions.

Finding #17: The District has historically contracted with its legal counsel for Clerk of the Board duties and responsibilities.

Finding #18: No District personnel, particularly the executive-level chief officers, have employment contracts as is typical for large public safety agencies.

Recommendation #4: Add one senior-level office technical support position to support the Fire Chief and the PIO.

Recommendation #5: Add one District Chief reporting to the Fire Chief for Professional Accountability; coordinate and conduct serious personnel case resolution with the chain of command and supervise a Fire Captain updating all District SOGs and administrative policies.

Recommendation #6: Design and implement employment agreements for the executive managers and other highly sensitive, critical section managers. Include phased agreements to close out dual-employer managers.

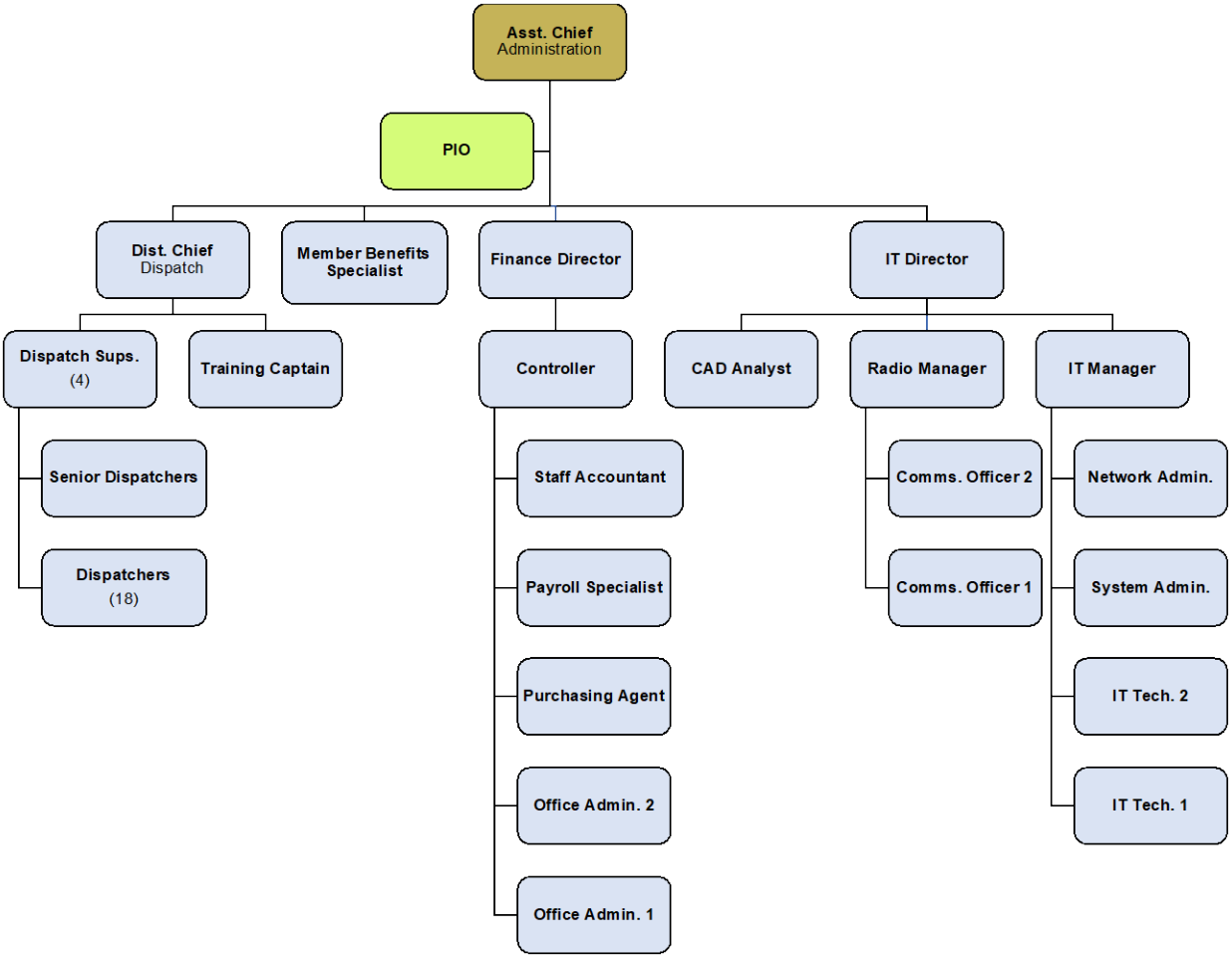
Recommendation #7: Consider adding one Clerk of the District to manage documents, records, record retention, and if desired Commission minutes and Commissioner scheduling assistance.

SECTION 3B—HEADQUARTERS SERVICES: ADMINISTRATION DIVISION

3B.1 ADMINISTRATION DIVISION OVERVIEW

The Administration Division includes 52 personnel providing dispatch, finance, human resources, information technology, and public information services as shown in the following figure.

Figure 18—Administration Division Organization



The Assistant Chief of Administration has five direct subordinates, which is manageable in theory; however, two of the five functions are large, very technical, and are essential to the District's healthy operation. Although currently under recruitment, the Department has not had a dedicated Human Resources Director to this point in its evolution—a position Citygate considers an essential administrative function in a large public sector organization like Cy-Fair.

More importantly, the organization does not have any office support capacity (other than in the Finance Section), analyst capacity, or a fully built out Human Resources Section. This means the Administrative Assistant Chief is performing all typical Human Resource Director functions and most specialist functions. The Department also did not have a dedicated Finance Director until late 2022.

The four Administration Division sections are all appropriate as "general District services." This includes dispatch, as it requires close coordination with Information Technology, radios, geographic mapping, and advance planning for new growth. All of these sections are best located and managed under a single executive manager.

At the top of this Division, it is very apparent that the technical/professional mid-managers have no office support or analyst capacity. This needs to be addressed to support the overall capacity of the Assistant Chief to plan, manage, and provide appropriate quality control and coaching. Each individual section's support needs will be addressed in the sections to follow.

To its credit, the Department has published **87** SOGs—covering at least 98 percent of the topics Citygate hoped to see in general administration, and ranging from personnel practices, to finance rules, reporting losses, privacy disclosure, and security to name just a few themes.

On the downside, most of these SOGs were published in 2019 when the Department merged with the District. Some are up to date as of a few months ago; however, a significant challenge is the lack of sufficient staff capacity to research regulatory changes, update drafts, route for fact-checking approvals, and then actually publish updates, both from a technical and wording/layout skill set. Thus, the Department is falling steadily behind on updates other than those legally mandated or posing the highest risk.

3B.1.1 Administration Division General Findings and Recommendations

Finding #19: The Administration Division at the topmost level is understaffed by a minimum of one mid-level Office Support position, one Senior Management Analyst, and one Administrative Captain.

Recommendation #8: Add one FTE mid-level technical support position to provide critical clerical support capacity for the Administration Division office.

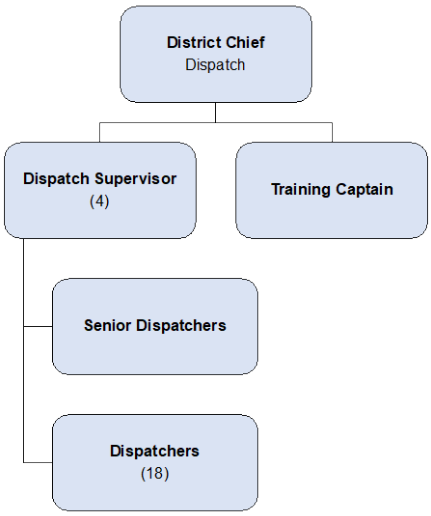
Recommendation #9:	To provide District-wide, integrated analysis of services, quality control measures, and planning for change due to growth, add a senior-level Management Analyst reporting to the Assistant Chief of Administration.
Recommendation #10:	Consider adding one Administrative Captain to review and update all SOGs and job descriptions.

3B.2 DISPATCH SERVICES

Given that the District has always provided fire and ambulance services to such a large area of Harris County, it has always operated its own 9-1-1 Dispatch Center. A dispatch/communications center is the critical "hub of the wheel" for listening to the 9-1-1 caller in need, sending the resources which best fit the need(s) of the caller, and then supporting the on-scene resources. The center also provides coordination as needed with neighboring centers for mutual aid and area-wide disaster coordination. Any 9-1-1 center is a mission critical component of the emergency response and depends on advanced technology—from incoming 9-1-1 circuits to computer-aided-dispatching tools, radio links, and highly trained professional dispatchers. Such centers are expensive, must have redundant technology, must be secure, and must provide quality training and dispatcher quality improvement oversight. By contract, the District's Dispatch Center also dispatches for Rosehill Fire Department at $20 per incident.

With a 2022 operating budget of $2.7 million (exclusive of capital expense), Dispatch services are provided 24/7/365 by a staff of 20 full-time and 4 part-time employees, organized as shown in the following figure.

Figure 19—Dispatch Center Organization



In 2022, there was no turnover related to the 20 full-time positions. In the late Spring of 2023, the Dispatch District Chief left the Department to accept a position in the private sector.

The Center Manager (District Chief) works a 40-hour schedule. The four Dispatch Supervisors work a rotating schedule to provide dispatcher break relief and incident support around the clock. The Training Captain works a 40-hour schedule and provides support for the on-boarding of new dispatchers and quality assurance oversight and continuing education for the supervisors and dispatchers.

The Dispatch Center is housed in a separate 6,986-square-foot facility on Wheat Cross Drive, which was built in 2002 and later given an interior renovation in 2013. It is a one-story brick building with a metal roof on a large, secure parcel and hosts the main radio transmission tower. The parcel is large enough for the expansion of the building to the rear; however, the brick building was not constructed for this possibility. There is limited interior growth potential, and it is likely that, in future decades, more space will be needed. As of the 2013 update, the building appears to follow Americans with Disabilities Act (ADA) requirements.

In addition to the large room housing the dispatch consoles, the building's layout provides for separate technology spaces with appropriate automatic fire detection/suppression systems and two backup emergency power sources. The building also includes offices, a conference/training room, a kitchen, restrooms, and the Department's backup Department Operations Center (DOC).

The Department's backup dispatch site is a smaller, five-dispatch console room in the Fire Administration building. The Department does not own a mobile communications van for sustained on-scene operations at very large emergencies and, as such, does not have a mobile backup operation.

The Center is dual accredited with the Center of Excellence from the International Academies of Emergency Dispatch (IAED) for fire and medical response dispatching (EFD and EMD).

3B.2.1 Personnel

The minimum staffing level per 12-hour shift is 4 personnel including a Dispatch Supervisor (Lieutenant) and 3 Dispatchers (mix of full-time and part-time personnel). All Dispatch employees complete a Field Training and Evaluation Program (FTEP) which includes all internal and external certification courses required by the Department and IAED:

- Emergency Medical Dispatcher (EMD)
- Emergency Fire Dispatcher (EFD)
- Emergency Telecommunicator (ETC)

Dispatch Services utilizes the following job descriptions and qualifications for personnel.

- **Emergency Telecommunicator Trainee** – Dispatch personnel who are not fully released from the entry training program.
- **Dispatcher** – Minimum Certification Level and successful completion of the entry training.
- **Dispatch Communications Training Officer** – Minimum Dispatcher Certifications and a minimum of two (2) years as fully released dispatcher; obtain and maintain approved Communications Training Officer Certification.
- **Senior Dispatcher** – Minimum Dispatcher Certification; minimum of two (2) years as a fully released dispatcher; obtain and maintain Communications Training Officer Certification; obtain and maintain Communications Center Supervisor Certification.
- **Dispatch Supervisor (Lieutenant)** – Minimum Senior Dispatcher Certification; minimum of two (2) years as a Senior Dispatcher; obtain and maintain Emergency Dispatch Quality Certification (ED-Q).
- **Communications Captain** – Minimum of Dispatch Supervisor Certifications. Minimum of (2) years as Supervisor or (4) as Senior Dispatcher and ED-Q certification.
- **Emergency Telecommunications Instructor (ETC-I)** – Tactical/Field Operations experience.
- **District Chief** – Minimum of Dispatch Supervisor/Captain certifications; not less than five years full time with the District; bachelor's degree in related field.

The Communications Captain is responsible for all dispatch training and internal/external continuing education. The position oversees the FTEP for new employees, the hiring process and testing for all new dispatcher applicants, and the Center's Quality Assurance program.

To maintain accreditation and operational excellence, the Center's program includes all four shift supervisors, the Communications Captain, and the District Chief. Together they provide weekly/monthly routine oversight using case review standards from the Accreditation Commission. This work is tracked in the AQUA Ascent Software to ensure the confidentiality of records, reporting forms, and employee evaluations. A Dispatch Review Committee (DRC) discusses and reviews general compliance, develops continuing dispatch education, and provides policy recommendations. A Dispatch Steering Committee (DSC) reviews general compliance and approves policy recommendations.

Dispatcher recruitment and retention is the most significant issue in almost all dispatch centers. It is a unique, stressful occupation that requires deep technical training before even being allowed to be a designated trainee side-by-side with a dispatcher. Thus, the bottleneck is the Center's ability to train, and the limit is two, possibly three trainees at a time. Unexpected retirements, resignations, or long-term injury leaves can significantly impact a dispatch center. As such, the Department recruits frequently and at the time of this review was at 20 full-time and four part-time personnel. The management team is working hard to get back to 24 personnel, and at current pace, it will likely be at least the second quarter of 2024 before the Center is back to full staffing.

In reviewing the duties and workload by position, Citygate notes the Center's District Chief, Communications Captain, and Dispatch Supervisors appear to be working *more than full-time—without factoring in their earned leave time off.* Thus, at times, some lower-level priorities are likely not completed in a timely manner.

The Center has written SOGs for Dispatch Quality Assurance, training, personnel operating and behavior expectations, and job descriptions, as well as ongoing process improvement reviews.

3B.2.2 Operations

The Center strives for compliance with best practice[12] incident event processing to dispatch the highest-priority incidents—where there is an imminent threat to life—within 60 seconds, 90 percent of the time:

- Trauma (e.g., penetrating chest injury)
- Neurologic emergencies (e.g., stroke, seizure)
- Cardiac-related events
- Unconscious/unresponsive patients
- Allergic reactions
- Patient not breathing
- Choking
- Other calls as determined by the Department
- Fire involving or potentially extending to a structure(s)

[12] NFPA 1225 – Standard for Emergency Services Communications (2022 Edition).

- Explosion.

For 2022, the most recent data available for this study, 15-second answering compliance was 98.5 percent, and 20-second answering compliance was 99.7 percent. Other dispatch processing times are included in the deployment statistics section of this study.

3B.2.3 Dispatch Services Findings and Recommendations

Finding #20: The Department's Dispatch Center is designed, equipped, and staffed in conformance with recognized industry best practices and is compliant with the appropriate national certifications; Department leadership and the community should be very proud of its dispatch program.

Finding #21: The Dispatch Center lacks formal segregated funding in the budget to accrue for future technology and building replacement needs in conformance with recommended fiscal best practices.

Finding #22: The Department has to maintain a full roster of dispatchers and has the difficult task of maintaining an appropriate authorized staffing level of dispatchers per shift.

Recommendation #11: Consider adding four dispatchers, one per shift, to provide the additional capacity needed to ensure minimum staffing is always available without excessive overtime.

3B.3 HUMAN RESOURCES

As of the time of this review, the District does not have a dedicated Human Resources section, including a dedicated, highly credentialed Human Resources Director, which is very atypical for an organization of the Department's size. Traditional human resource duties are mostly shared by the Administration Assistant Chief, a Member Benefits Specialist, and a Payroll Technician in the Finance Section as shown in Figure 18. New employee recruitment and promotional processes are currently handled by the Member Benefits Specialist and the Administrative Assistant Chief with testing support from the EMS and Suppression operations and training groups.

While the District's 2022 budget included approximately $14.8 million for direct Human Resources costs, most of that funding is for employee benefits and outside contracts such as insurance.

3B.3.1 Typical Fire/EMS Human Resource Functions

The success of any public agency in providing quality services depends on the support and effectiveness of its human resources (HR) function. Often an HR department is referred to as the "conscience" of an organization, responsible for oversight of the most valuable resource of any organization, its employees. HR departments follow and support employees from the time they are initial applicants through separation or retirement. Typical HR services include:

- Recruitment and selection services, promotional exams.
- Employee benefits – vendor management and employee changes.
- Employee relations services – job descriptions, evaluations, changes in payroll status, issue resolution, labor relations.
- Professional standards – accountability, policies, procedures.
- Risk management – workers' compensation program, quality liability and insurance services, employee wellness programs such as fitness, cancer prevention awareness, and behavioral health.
- Organizational development – beyond just training.

HR departments are a valuable resource in guiding supervisors and managers through the multiple and complex rules, regulations, and laws that govern personnel actions. They play a critical role in making an agency an employer of choice by effectively recruiting and retaining quality employees, and they are responsible for developing skilled employees who can perform at a high level. To be effective, the HR department must be a strategic partner with the agency's leadership.

The Department desires to become the best employer possible. Reaching that goal begins with becoming an employer of choice through the recruitment and hiring of the best available job candidates. This involves the Department marketing itself as an employer of choice through an aggressive outreach recruitment plan. The plan should stress the goal to recruit a highly qualified and diverse applicant pool. Recruitment activities should expand to non-traditional venues and events. A more diverse applicant pool will improve the quality of job applicants.

To ensure that the District is offering competitive wages and benefits, it needs to develop a strategy for the periodic study of classification specifications and for conducting salary surveys. Further, it must establish policy concerning where it wishes to rank its employee classifications in the labor market regarding salary and benefits.

To retain quality employees, the District should develop an Organization Development Division to support employees with their professional growth. Efforts should include succession planning to identify and develop future leaders. In the current competitive job market, quality employees will not hesitate to leave an employer that does not make a commitment in their long-term professional development.

3B.3.2 Resources

To its credit, the Department has a 57-page Personnel Handbook last updated in April 2022. In reviewing current workload by position, Citygate found that the Member Benefits Specialist is working at approximately 140 percent of full-time workload capacity (excluding earned leave use) just to ensure the most critical job functions including personnel and payroll changes are completed in a timely manner, with the other mid-management functions deferred to the Assistant Chief. Member Benefits Specialist responsibilities include:

- Employee benefits coordination
  - Open enrollment
  - Renewal
  - Changes
  - Billing
  - Etc.
- Process claims (unemployment, Family Medical Leave Act (FMLA), disability cases, workers' compensation, OSHA regulations, vehicle and other accidents documentation)
- Insurance company employee communications and problem solving
- New hire onboarding and terminations
- Employee status change communications to payroll and the chain of command
- General HR support
- Payroll specialist backup
- HR records maintenance
- Annual driver's license status report reviews

Over the last year, this position has averaged +/- 10 hours overtime per pay period for an effective workweek of 45+ hours. All other supervisor or executive management decisions go to the Assistant Chief. One such example is coordinating the federal Fair Labor Standards Act (FLSA) rules for when an employee changes ranks or duty schedule, which must be smoothed out to avoid unneeded overtime. To its credit, this small team does touch on or complete the following critical functions:

- Tracking of new hire and promotional washout rates for causation.
- Record keeping (paper and electronic records).
- Certifications and qualifications – training division tracks with multiple notices and checks that must be coordinated and filed with HR.
- Annual driver's license status checks.
- Backup for Payroll Specialist. The District uses electronic timecards with verifications.

Given this level of staffing for HR functions, Citygate is very concerned that the District is at risk for multiple "single points of failure" if either the Member Benefits Specialist or the Assistant Chief are absent for periods longer than a typical vacation or if the Payroll Specialist position experiences a longer-term absence. While the two specialists are cross-trained for each other's responsibilities and tasks, one position cannot effectively do both jobs if the other is absent long term.

Given the current staffing level, many if not most other strategic HR best practices to ensure appropriate personnel development and oversight are not getting completed in a timely manner or at all, including:

- No annual employee evaluations. A previous system was deemed inadequate and terminated with a replacement process sidelined due to insufficient capacity.
- Some policies and procedures need development or updating, such as the employee handbook, nepotism policy, District vehicle personal use, purchase cards, and the apparatus refueling account card.
- Expanded community outreach for entry-level hiring and the physical abilities testing.
- Work on a regional fire academy partnership to increase throughput and economies of scale given the anticipated need for additional response staffing.

3B.3.3 Human Resources Findings and Recommendations

Finding #23: The District's Human Resources functions are inadequately staffed for an agency the size of Cy-Fair and must quickly scale up to meet the upcoming growth in field personnel.

Recommendation #12: The District must hire an experienced public sector Human Resources Director as soon as possible and allow that person to build out the needed Human Resources organization.

Recommendation #13: The District should expect that even an emergent Human Resources Section will need three more specialists and an Office Support position. Including an added Director, this amounts to five new full-time personnel as quickly as they can be recruited.

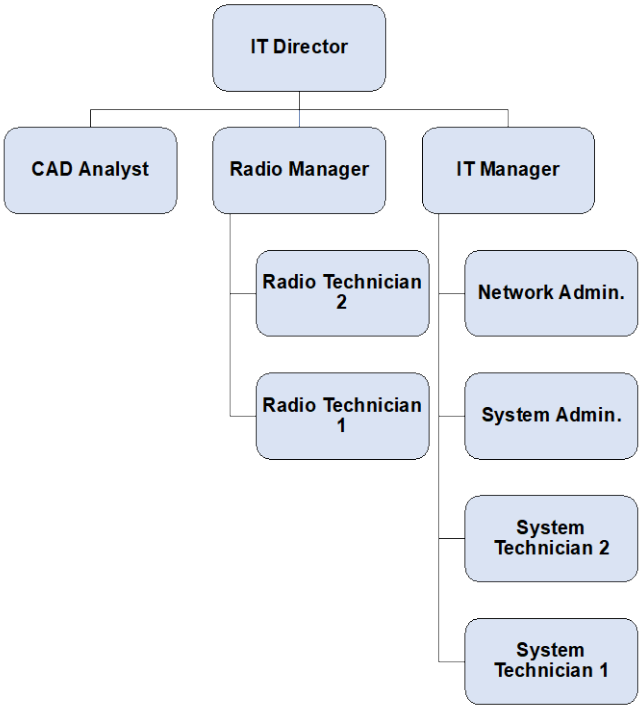
Recommendation #14: The District should consider adding up to three FTE technical Human Resources Specialists to provide the full range of HR capacity and support as typically needed for an organization the size of the District.

Recommendation #15: The District should consider adding one FTE entry-level technical Office Support position to provide clerical support for the fully built-out Human Resources section.

3B.4 Information Technology

The Information Technology (IT) Section provides all District IT needs and support with a staff of 10 full-time and two part-time personnel organized as shown in the following figure. The IT Section had a 2022 operating budget of $6.3 million. Services provided by the IT Section touch all aspects of a modern fire/EMS agency and it is the "central nervous system" for the District's operations and personnel.

Figure 20—Information Technology Section Organization



The IT Director was hired in 2022 with fire service IT experience. The Section and District have several IT use and security policies, all of which conform with recognized IT best practice.

Citygate's review of IT Section workload shows that all six technical support positions are at or over capacity. These positions provide installation, maintenance, help desk and support, and repairs, including fire stations and other buildings. The four radio technicians are also at capacity and much of their time goes to repair of existing devices, new vehicle installations, and programming of radios. Every radio in the District (including the Dispatch Center and transmission tower locations) requires programming when replaced or when upgrades are released. Understanding that every vehicle has one or more portable radios, there are hundreds of units to be kept operational.

The Director and staff are all performing their functions with no analyst or clerical support.

The CAD Analyst position is also operating at maximum capacity. This position is handling all dispatch system technology, some quality assurance monitoring, and software and Geographic Information System (GIS) updates. This position requires in-depth technical knowledge of the CAD vendor's systems and geographic mapping skills to update new streets and address ranges into the dispatch system. At present, this position also does additional mapping work for the District, time permitting, with no meaningful backup for absences. Finally, this position also must

manage the District's security cameras and building access electronic controls. The security system has grown in recent years and is requiring more time than the CAD position can provide.

The IT Section's six positions are appropriately divided into a Technology Systems Analyst, a Network Administrator, and four Help Desk support positions. At the time of this study, one Help Desk position was vacant. Overall IT support is provided after hours via an on-call rotation as the District's systems must be maintained and fully operational 24/7/365.

The District's IT infrastructure is in good shape. While no formal replacement savings plan for future capital expenditures exists, the funds have been available annually to replace mission critical components and desktop computers on a five-year or seven-year replacement cycle. The Director believes the Section's maintenance plan and workload rotation meet the District's uptime reliability needs.

Regarding IT security, the District has very strong hardware, software, and policies in place. In Citygate's opinion, these are not only best practice but, in some cases, leading edge. The Section has deployed cutting edge security monitoring software with a managed response plan as/if needed. All dispatch and critical headquarters systems are based inside the District's firewalls and are not cloud based. When software system vendors must access systems for repairs, such as the dispatch system, they schedule permission in advance, are given temporary firewall passage, and a District IT professional monitors the data stream and what the support technician is doing.

As for single point failure risks, the Section's Director informed Citygate that they are getting better at cross-training and documentation. However, more cross-training among the radio technicians is needed. Given a 164-square-mile service area, the District operates its own radio system, and contracts with Motorola for 24-hour radio system, Mach Alert, FSA, NICE dispatcher recorder, and Nokia Microwave system troubleshooting and repair services. The radio specialists also maintain the fire station electronic crew alerting systems.

At present, the largest single point of failure risk is the sole CAD Analyst position with no internal backup. In the future, potential failure points will be the District's inability to grow and maintain radio, CAD, and station alerting technicians with enough depth to handle long-term unplanned absences or vacancies. Other IT positions for the network and servers, for example, are moderately more generic. However, as an employer, the District should compensate and manage these positions as an employer of choice in a very difficult market for quality IT professionals.

3B.4.1 Information Technology Findings and Recommendations

Finding #24: The District's Information Technology Section is appropriately designed, managed, and staffed to meet <u>current</u> District needs.

Recommendation #16:	To meet the challenge of single point of failure positions and upcoming fire station crew growth, the District should add IT technicians in the most overworked and limited backup staff positions.
Recommendation #17:	To understand and highlight the costs of IT replacement, it would be a best practice to have a replacement plan savings item to save ahead for replacements according to planned schedules.
Recommendation #18:	In the Information Technology Section, add a second CAD Analyst, one Radio Technician, and one Help Desk support position to limit single points of failure and provide for District growth in field operations.

3B.5 PUBLIC INFORMATION

Public information services are provided by one full-time and two part-time personnel. At present, the Public Information Officer (PIO) reports to the Administration Assistant Chief. The PIO does not have any direct office support; however, four other Department personnel have access to the social media accounts. The entire program is an emerging one that is needed for an operation of the District's size and anticipated growth.

Common and necessary PIO duties for a fire/EMS agency typically include:

- All real-time alerts and messages
- All daily social media posts
- Media advisories and press releases
- Creation of all graphics and messaging
- Monthly / quarterly newsletters
- Department Operation Center PIO for major disasters
- Annual report
- National recognition weeks
- Memorials, ceremonies, and funerals

- Website updates and maintenance
- Social media streaming events
- Policies, trainings, and documents.

3B.5.1 Public Information Recommendation

Recommendation #19:	The District will need to develop an internal Public Information Officer (PIO) master plan identifying priorities and service deliverables.

3B.6 FINANCE OPERATIONS

Following is a review of the Finance Section's administrative support functions. A comprehensive analysis of the District's fiscal position is included in Section 4.

3B.6.1 Fiscal Policies and Procedures

Recommended best practices from the Government Finance Officers Association (GFOA) include formal written financial policies and procedures to provide a strategic, long-term approach to financial management. Some examples of the benefits of formal financial policies include:

- Clarification of strategic intent for financial management
- Definition of financial boundaries
- Management of risks to financial condition
- Compliance with established public management best practices.

A key component of effective financial policies is systematic monitoring, reviewing, and updating. Financial policies and procedures should be monitored to ensure compliance; reviewed to ensure the policies are still relevant and meet the goals, objectives, and legal requirements of the agency; and updated at least every three years pursuant to an established review schedule.

While the Department has written policies for purchases, sales, reimbursements, capital asset definitions, responsibilities, and guidelines, it lacks a more comprehensive set of fiscal policies meeting recognized best practice recommendations for public agencies. A critical factor in achieving budget stabilization is the establishment of and compliance with comprehensive formal written financial policies and procedures. These policies should drive the fiscal activities of the Department to maintain fiscal stability and health. Creation of these policies should be completed referencing recognized industry best practices. Citygate recommends using the best practice

recommendations established by the GFOA, a nationally recognized authority on municipal government financial operations. Financial policies should be formally adopted by the Board of Commissioners and maintained in a policy manual that guides the fiscal operations of the department.

Following are some best practice financial policy examples recommended by the GFOA:

- Budget/Forecasting
- Debt management
- Capital planning
- Grants
- Investment
- Revenue control
- Fund balance
- Internal control

In conjunction with fiscal policies, the Department should create a comprehensive accounting procedures manual that outlines financial operational procedures. The basis of financial procedures is established in the District's by-laws; however, the accounting procedures manual should provide additional specificity as to authorized procedures including:

- Purchasing
- Accounts payable (including credit cards)
- Cash receipt and handling
- Accounting
- Accounts receivable
- Utility billing
- Personnel
- Payroll.

GFOA Best Practices

Following are excerpts from the GFOA website:

Every government should document its accounting policies and procedures. Traditionally, such documentation has taken the form of an accounting policies and procedures manual. Thanks to advances in technology, even more effective methods are now also available for this purpose.

An appropriate level of management to emphasize their importance and authority should promulgate accounting policies and procedures. The documentation of accounting policies and procedures should be evaluated annually and updated periodically, no less than once every three years, according to a predetermined schedule. Changes in policies and procedures that occur between these periodic reviews should be updated in the documentation promptly as they occur. A specific employee should be assigned the duty of overseeing this process. Management is responsible for ensuring that this duty is performed consistently.

The documentation of accounting policies and procedures should be readily available to all employees who need it. It should delineate the authority and responsibility of all employees, especially the authority to authorize transactions and the responsibility for the safekeeping of assets and records. Likewise, the documentation of accounting policies and procedures should indicate which employees are to perform which procedures. Procedures should be described as they are intended to be performed rather than in some idealized form. Also, the documentation of accounting policies and procedures should explain the design and purpose of control related procedures to increase employee understanding of and support for controls.

The GFOA website provides further details regarding best practice recommendations and rationale.[13]

Fiscal Policies and Procedures Finding and Recommendation

Finding #25: While the District has some financial policies, it lacks a more comprehensive set of fiscal policies meeting recognized best practice recommendations for public agencies.

Recommendation #20: The District should establish a comprehensive set of fiscal policies and accounting procedures in conformance with recommended best practices of the Government Finance Officers Association.

[13] http://www.gfoa.org/best-practices

3B.6.2 Systems Technology

The primary financial system used by the District is Microsoft Dynamics GP. This system consolidates the District's fiscal activity; however, the District also utilizes other standalone financial systems including:

- PowerDMS (accounting and record-keeping) – used to upload financial information into the cloud to provide accessibility to the external auditors.
- Paylocity (payroll) – a third-party system used by CFFD for payroll processing. This system is not integrated with the CFFD's Microsoft Dynamics GP system and information must be manually uploaded.
- Operative IQ (Quartermaster inventory) – used for administration of the CFFD central stores inventory.
- Collective Data (fleet and facilities monitoring system) – monitors equipment and facilities activity including fiscal activity.

This process of using multiple non-integrated fiscal systems can lead to input errors that can impact the accuracy of the information being presented. Per District staff, the selection of various standalone financial systems was made as the best solution(s) for the division(s)/section(s) they support rather than for overall integration capability. Citygate acknowledges that implementation of a comprehensive, fully integrated financial system can be both expensive and time consuming and that the District may not be able to begin this process right away; however, the benefits of increased efficiency, improved internal control (which can minimize fraud risk), improved transparency, and decreased human error due to manual information integration makes the effort worthwhile. Citygate recommends that over the next two years, the District review the financial systems to assess their effectiveness and complete a cost versus benefit analysis of the implementation of a fully integrated Enterprise Resource Planning (ERP) system.

Systems Technology Finding and Recommendation

Finding #26: The District utilizes multiple non-integrated fiscal systems that can lead to input errors that impact accurate record-keeping.

Recommendation #21: The District should explore options to implement a fully integrated Enterprise Resource Planning (ERP) system to improve overall fiscal efficacy and controls.

3B.6.3 Performance Measures

The GFOA has developed approximately 200 best practice recommendations related to municipal financial operations. The Finance Section staff should review this list and use it as a guide when developing written fiscal policies.

One specific area identified by Citygate during its review is the lack of overall District goals and performance measures to reflect how the divisions and sections are meeting District objectives. One recommendation of this review is the enhancement of the development and usage of performance measures as a tool to gauge operational effectiveness.

GFOA Best Practices

The following selection is from the GFOA's best practice recommendation for performance measures:

> *Performance measures are used by governments to collect information about operational activities, achievement of goals, community conditions, or other environmental factors to better understand a situation and make informed decisions. Regardless of if an organization has a centralized collection system for performance measures, the use of performance data should be integral to an organization's decision-making processes and leaders within an organization should set expectations that key decisions are supported by evidence. For optimal use, performance measures need to be developed considering the potential audience for the information. As a result, organizations need to identify and track measures at an operational, managerial, policy making, and community level.*
>
> *GFOA recommends all organizations identify, track, and communicate performance measures to monitor financial and budgetary status, service delivery, program outcomes, and community conditions. When identifying performance measurements, governments should focus on making sure that measures meet the following conditions:*
>
> - ***Useful** – measures should provide information that is helpful to decision making, understanding, or accountability efforts.*
> - ***Relevant** – measures can be clearly linked to the service delivery/program outcomes that they are intended to measure, appropriate for the outcome being measured, and are readily understandable.*
> - ***Reliable** – collection methods and measure definitions need to be understood so stakeholders can rely on the information.*
> - ***Adequate** – ensure enough and an appropriate variety of measures are used to measure performance and that measures do not incentivize behavior that adversely*

impacts the measures – such as a quantity versus quality scenario. There is often not a single measure that can provide sufficient context and understanding.

- ***Collectible*** *– measures are readily available and do not involve excessive time/effort to collect.*
- ***Consistent*** *– measures can be regularly collected to track outcomes over time and avoid the need to continuously identify new measures.*
- ***Environment*** *– measures include variables related to externalities that impact service delivery and program performance.*
- ***Responsibility*** *– clearly identify responsibilities for collection, storage, and dissemination of the data.*
- ***Systems*** *– existing data collection capacities are leveraged appropriately, or new systems are identified to ease the burden of data collection.*

Further, when identifying and using performance measures, organizations may find it helpful for comparison purposes or a recognized standard to assess current outcomes, facilitate discussion or share ideas that lead to improvement efforts. However, governments must recognize the challenges and potential misrepresentations that can occur without careful consideration. For example, most governments exist in a unique environment and performance data is subject to a variety of contributing factors that may or may not be present in comparison data. In addition, many measures may seem similar, but have a different definition of how the measure is calculated making a true comparison impossible. Once collected, governments should ensure that measures are communicated and well understood. This includes communication both internally and externally.

When communicating performance measures internally ensure the following:

- ***Expectations*** *– clearly communicate how performance measures will be utilized in decision-making and across all levels of the organization.*
- ***Purpose*** *– emphasize that performance measures are used to inform decisions and facilitate improvement and understanding. Governments should be careful to avoid performance measures that are collected to simply show achievement for the purpose of soliciting recognition or rewards. Similarly, less than favorable outcomes should be evaluated to understand the root cause of the issue and avoid quick punitive actions as this will make accurate data collection efforts more difficult in the future.*

- ***Clarity*** *– clearly articulate the performance measures, including both expected results/targets and actual results.*
- ***Data Integrity*** *– the source of the data and how the data is interpreted or used to draw conclusions should be clearly articulated.*
- ***Context*** *– provide background on why these performance measures were chosen, such as cost, timeliness, availability, etc.*
- ***Production*** *– reference sources of performance measures and how the measures were collected.*
- ***Dissemination*** *– ensure performance measures are distributed throughout all levels of the organization and are made readily available.*

When communicating performance measures externally the following items should be addressed to ensure measures are readily available and accessible:

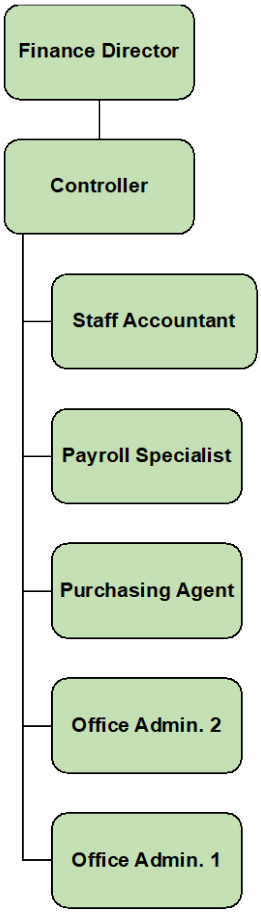
- ***Delivery*** *– how and where will the performance measures be communicated.*
- ***Audience*** *– identify who the primary audience of the information will be.*
- ***Format*** *– what is the best way to present the information.*
- ***Frequency*** *– how often will the performance measures be communicated/updated.*
- ***Clarity*** *– explain the exact source of the data, how the calculations were conducted and why, what the performance measures show, both expected results/targets and actual results.*
- ***Context*** *– provide background on why these performance measures were chosen, why, if any target measures were set and why, and what the results mean to operations, service levels, or community outcomes.*

Performance measures provide insight into how the departments are achieving their goals, which should be developed based on District goals established by the Board of Commissioners.

3B.6.4 Finance Staffing and Workload Capacity

As shown in the following figure, the Finance Section of the Administration Division includes seven full-time personnel under the supervision of the Finance Director and manages the typical functions of a municipal finance department, including budget development and management, general accounting, accounts receivable/auditing, accounts payable, purchasing, and payroll.

Figure 21—Finance Section Organization



Citygate's review of workload by position found all Finance Section staff working at or slightly more than full-time capacity—although some of this workload is not directly finance related according to the Finance Director, including front-desk receptionist responsibilities, community events, etc. According to the Finance Director, the Section is adequately staffed for its current responsibilities with minimal extra workload capacity.

The Finance Section has intentionally focused on developing redundant capacity of all key functions to ensure no single points of failure from any single absence. Future anticipated staffing capacity needs include one additional Admin. 2 for accounts payable and potentially another generalist position to assist with budget management.

Finance Section Staffing and Workload Capacity Findings

Finding #27: The Finance Section has adequate staffing capacity to meet current responsibilities and workload.

Finding #28:	The Finance Section has intentionally developed redundant capacity of all key functions to ensure no single points of failure from any single absence.

3B.6.5 Fiscal Services Evaluation

Overall, Citygate's fiscal review finds that the District is currently fiscally sound. However, additional facilities and staffing that will impact fiscal reserves will be needed to serve current and future growth and to provide services meeting community needs and expectations. While management is committed to bringing the District into better conformance with recognized public agency best practices and operational standards, it currently lacks a comprehensive set of fiscal policies and accounting procedures, a process for the public to report suspected fiscal fraud, designated fiscal reserve funds and related policies, a comprehensive long-range Capital Improvement Plan, and long-range fiscal planning. Citygate further suggests that the District consider establishing a fraud prevention hotline to identify and address potential fiscal fraud.

Fiscal Services Finding and Recommendation

Finding #29:	The District lacks a process for the public to report suspected fiscal fraud.

Recommendation #22:	The District should establish a toll-free fraud prevention hotline to report suspected fiscal fraud.

SECTION 3C—HEADQUARTERS SERVICES: OPERATIONS DIVISION

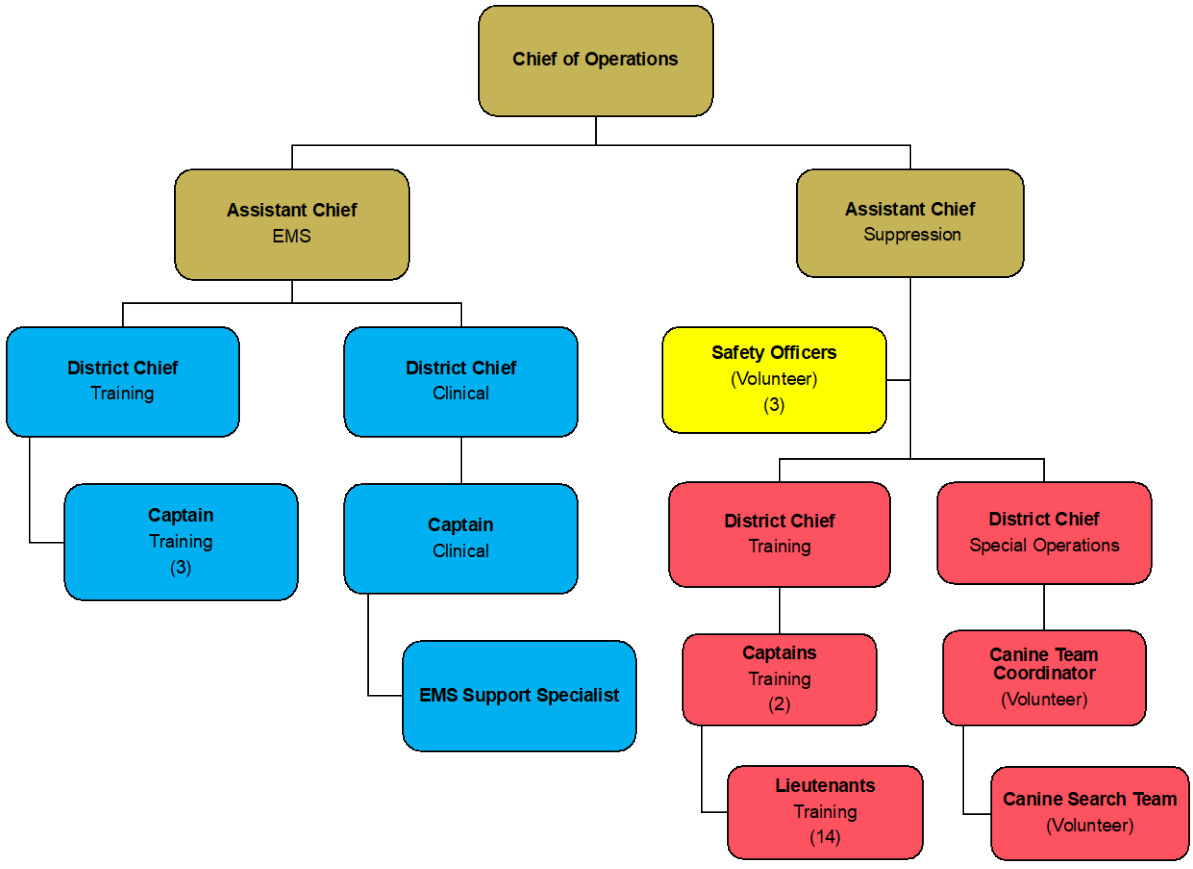
3C.1 OPERATIONS DIVISION OVERVIEW

The Operations Division administrative support staff consists of 11 full-time, 12 part-time, and 3 volunteer personnel under the Chief of Operations as summarized in the following table and figure.

Table 26—Operations Division Administrative Support Staffing Summary

Section	Full-Time	Part-Time	Volunteer	Total Personnel
EMS Training / Clinical Oversight	7	0	0	**7**
Suppression Safety / Special Operations / Training	4	12	3	**19**
Total	**11**	**12**	**3**	**26**

Figure 22—Operations Division Administrative Support Organization



3C.2 Chief of Operations Office

The Chief of Operations oversees all direct customer-facing programs and services including the EMS and suppression sections with no support staff, particularly a mid-level Technical Office Support position to provide needed clerical support for the Chief of Operations.

3C.2.1 Chief of Operations Office Finding and Recommendation

Finding #30: The Chief of Operations oversees all direct customer-facing programs and services including the EMS and suppression sections with no support staff.

Recommendation #23: Consider adding one FTE mid-level Technical Office Support position to provide needed clerical support for the Chief of Operations.

3C.3 EMS Section Operations and Clinical Oversight

The EMS Section is one of the major field operational branches providing direct emergency customer service. The Cy-Fair Volunteer Fire Department became involved in the ambulance business in roughly 1980. The first unit was donated to the Department. The Department went on to purchase another used unit—a 1979 Ford module unit. Later, the Department purchased two new 1981 Ford van-type units for stations 5 and 10. In 1983, the Department purchased the first Wheel Coach module. Additional units of this type were purchased and have replaced some of the early units. With this fleet of ambulances, the EMS program grew stronger each year. Initially, ambulances were staffed with all-volunteer crews. Later, two primary ambulances were staffed with paid crews at night.[14]

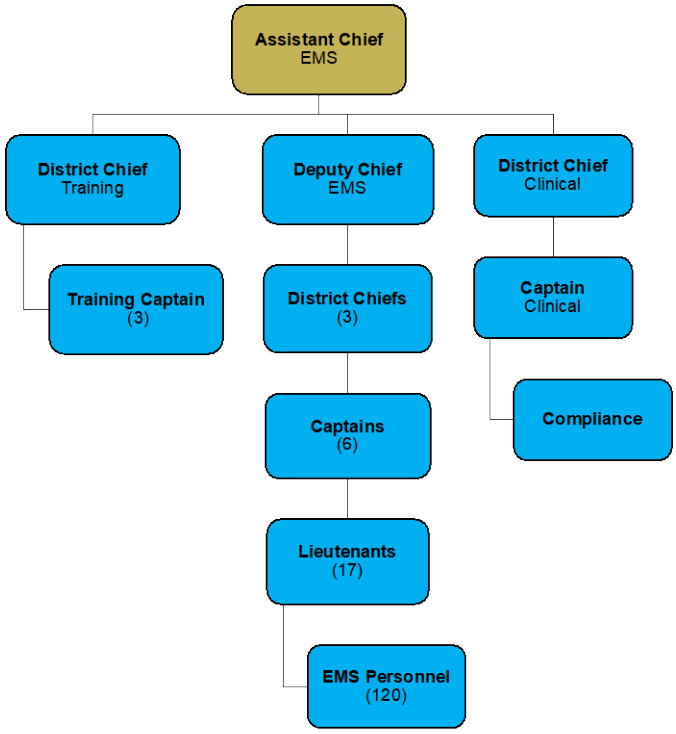
As of 2022, the EMS Section includes 155 full-time and part-time career personnel staffing 14 medic units (ambulances) and providing daily paramedic-level care. Each ambulance is staffed with a minimum of one BLS Emergency Medical Technician (EMT) and one ALS Paramedic.

For supervision, the Section fields three District Chiefs as EMS Supervisors, one per shift. For specialty services, there are two Advanced Paramedic Provider (APP) units on each of the three shifts.

[14] Cy-Fair Web site History

The EMS Section is organized as shown in the following figure.

Figure 23—Operations Division – EMS Section Organization



In 2022, the Section's operating budget was $13,394,619, with no capital expense that year.

Currently, each of the 13 fire stations has a medic unit staffed 24/7/365. Three additional added capacity and/or part-time units are Medic 509 at Station 9 and Medic 502/505 (stations 2 and 5). The plan is for these units to operate during peak hours, but they are currently running the regular 12-hour or 24-hour schedule when they are staffed. The Section also has ten fully licensed and equipped reserve medic apparatus and other (older, unlicensed) units. The ten licensed reserve units also provide one to three peak-hour units.

The medic units are certified at the BLS level with the capacity for paramedic ALS-level care. At the time of this study, the Section had enough paramedics to operate 90 percent of the medic units at the ALS level. Only about eight percent of the long-standing field staff is at the BLS/EMT level. Since 2016, the Department has only hired paramedics to staff its medic units.

The Section is managed by an Assistant Chief of EMS who is credentialed in the level of care certifications. Medical direction is provided by a contract Medical Director who has been with the Department for 15 years. The Director is appropriately Board Certified in Emergency Medicine, is in active practice at Houston Methodist Sugar Land Hospital, and is also Chief of Staff Associate

Medical Director at the University of Texas Physician Group. There is also an Assistant Medical Director who is in active practice at Hermann Texas Medical Center, a Medical Director for Life Flight, and a Major in a USAF Pararescue unit. The medical directors are available 24/7 for phone consultation and are on-site weekly. They assist with education, protocol updating, quality assurance, quality improvement (QA/QI), and evaluation of all personnel certifying to Paramedic Level 1.

EMS field operations are managed by a Deputy Chief with each of the three shifts overseen by a District Chief at Station 13. In addition, for supervision and on-scene quality oversight or complicated patient issues, there are two EMS Supervisor Captain positions at stations 2 and 9. Medic units are staffed by lieutenants, paramedics, and EMTs.

3C.3.1 EMS Training

For clinical training, a District Chief manages the planning and provision for all Section personnel. Continuing education is done mostly in-house or on overtime at regional specialty classes. Three captains assist with the provision of the training. All other instructors are in-house. When new hire paramedics are approved for field training, they are assigned to one of 18 lieutenants (six per shift) that serve as Field Training Officers (FTOs). These positions, along with quality-of-care data analysis, allows the EMS Section to utilize robust change-management processes to function as an organization that is actively learning and adapting.

The Department is the first fire-based EMS department in the state to receive the designation of Comprehensive Clinical Management Program (CCMP) site. The program assures that EMS personnel receive continuing EMS education, quality improvement, intensified individual monitoring, mentoring, assessment, and ongoing professional development as required by Section 157.39 under Department of Star Health Services law. This qualifies the EMS personnel to recertify under the CCMP designation with the state.

For clinical oversight, a District Chief manages all EMS quality assurance and improvement programs. Assistance is provided by one Captain for QA/QI and another for compliance and billing oversight and records requests / subpoenas.

3C.3.2 Personnel Credentialing

In EMS, there are different levels of care skills, from entry level to advanced. Furthermore, increasing skills not only improves patient care, but allows a career ladder in EMS for employee retention. The EMS Section is appropriately using these skill levels with requisite training, certification, and mandatory continuing education to maintain certifications.

All EMS care providers must complete the Field Training and Evaluation Program, which currently includes all credential levels to Paramedic 3 as follows.

- **First Responder** – Fire Operations personnel who are not certified at the EMT level or above

- **Attendant 1** – Minimum EMT Certification
  - Suppression personnel are only certified to the A1 level regardless of licensure

- **Attendant 2** – Minimum AEMT Certification

- **Attendant 3** – Minimum Paramedic Certification
  - Attendant Paramedic EMS Division must obtain Paramedic 1 within two years of hire

- **Paramedic** 1 – Minimum Paramedic Certification
  - Traditional "in-charge" Paramedic in other departments

- **Paramedic 2** – "Autonomous Provider"
  - Final step before entering Officer Selection

- **Paramedic 3** – Medical Control Provider
  - Required for all Captains and above

EMS lieutenants, who serve as field training officers and ride-up captains, must maintain Paramedic 2 certification, and EMS captains, who serve as operations supervisors, must maintain Paramedic 3 certification. In addition, EMS district chiefs serve as a shift or section manager; the EMS Deputy Chief oversees multiple shifts or sections; and the EMS Assistant Chief manages the entire EMS section.

3C.3.3 Quality Oversight Programs

EMS quality team members utilize FirstPass solutions to perform a first pass analysis of the Section's patient care bundles (similar skills used by chief complaint and/or injury type/severity). Shift captains then perform an examination of identified outliers to care or patient norms, and then manage daily corrective discussions needs and correct false positive occurrences. The Clinical Action / Preventative Action (CAPA) process is used to identify system and individual clinical issues to mitigate and minimize clinical errors. The process includes operational/clinical investigation and training/clinical improvement. These processes are intended to serve as a learning environment and platform to improve the EMS Section's system of care.

All QA/QI programs require excellent data tracking starting with patient care electronic records. The EMS Section oversight and quality of care programs are very data driven, using a minimum of 21 different types of pre-designed statistical reports to track operations, skills, patient care, and staff turnover. These measures use multiple Medical Director-designed Key Performance

Indicators (KPI's) to allow consistency of review across all types of care needed and all of the Section's care givers. The EMS Section also embraces the Just Culture approach to build trust in education and quality improvement being everyone's responsibility—not just a punitive, "top down" process that is solely the domain of supervisors. This is embraced and used as part of the Department's quality-of-care metrics.

3C.3.4 Overall EMS Section Observations

Due to the national shortage of paramedics that was exacerbated by the COVID-19 pandemic, the EMS Section has been hiring paramedics as they become available. Currently, the Section is slightly overstaffed with paramedics and is using them to decrease overtime use and to backfill earned leave absences as soon as possible, as well as to operate one to three peak-demand-hour medic units to lower workload on crews and improve response times. EMS Section turnover in 2020 was down to 12.6 percent, and most of the current workforce has been with the Department 3–15 years.

The Section is pilot testing leading-edge field care programs in telemedicine via remote physicians and alternative destination transports. Early results are discouraging as not that many calls per day meet the criteria and there are not enough contracted-for alternative destinations yet. The Section also is piloting the use of whole blood in the field to improve care in massive blood loss cases. However, this is an expensive program and perhaps only needed three times per month. These drawbacks are common in other, similar pilot programs and, as such, indicate the issues to be overcome by field care and traditional medical providers. The Section is to be commended for attempting innovations and learning from them.

In reviewing the Section's workload analysis, the quality-of-care oversight positions are at or past capacity due to increasing call volumes and other program work direction pulling the staff onto short-term specialty needs. The billing and oversight staff are also overburdened by increasing service demand. The staff maintain tight controls on controlled drugs as mandated under federal laws and their Medical Directors' licenses. They also have adequate inventory control and supplies, yet most of these (along with the other sections) are not yet fully automated. At times, there are breakdowns in communications between the Quartermaster and EMS leadership regarding what is being ordered and product specifications.

As with the rest of the agency, there are no formal employee evaluations related to job description expectations. Problems must be dealt with on a case-by-case basis, and the employee improvement plans needed when coaching is not adequate are not always started early enough.

EMS training is separated from fire suppression training, which can cause calendar coordination issues and facility scheduling problems. There is also the need for not just firefighter EMS skill training but to develop a united procedure set on incidents where all the skill sets are needed and may overlap.

EMS personnel supervision is separated from fire suppression. There are essentially two chains of command with no District-wide HR functions, training, quality-of-care uniformity, or focus on reducing overlap. Personnel policies such a calling in absent, or out-of-service time, or other issues should have a common framework and lens by which all personnel are managed for success.

The EMS and Suppression sections do not have robust, written plans with outside law enforcement and schools for mass casualty events, including chain of command, use of the National Incident Command System, and protection of field personnel in highly dangerous situations. There are six regional police agencies of three types to be coordinated with—Sheriff, Constable, and School District. Improving planning in this arena is not the sole province of Cy-Fair Fire/EMS, but it needs to be a strong voice for improved coordination.

3C.3.5 EMS Section Findings and Recommendations

Finding #31: The EMS Section is well organized within national and state regulations and best practices for basic and paramedic-level ambulance care.

Finding #32: The EMS section lacks any technical office support capacity.

Finding #33: The EMS Section goes to great lengths to be data driven and focused on quality improvement and clinical oversight. It is innovating as necessary.

Finding #34: Ever-increasing incident demands (as described in this study's deployment section) are straining the EMS Section's ambulance and headquarters team's capacity.

Finding #35: Because of its existence prior to the addition of many career firefighters, the EMS Section is operating more as an independent, non-integrated entity, which—while largely working to date—is not sustainable as District services continue to expand.

Recommendation #24: The EMS Section must review its workload assignments to overhead staff in depth and determine trigger points where added training and clinical oversight staff are critical, and not just more convenient, due to the pull of meetings and special projects.

Recommendation #25:	The EMS Training Unit must be merged into one Departmental Training Unit for continuity of culture, leadership, and resource allocation.
Recommendation #26:	The EMS Section can embrace dual-role, cross-trained paramedic/firefighters where employees desire to and can excel over time in being assigned to work medic units or fire apparatus. Doing so will help merge the two cultures together over time.
Recommendation #27:	The Section's leadership can also embrace individuals who would want dual EMS/Fire certifications allowing future leaders one or both certifications. This does not mean that current or future EMS leaders must acquire State Firefighter certifications, nor does it imply (in the other direction) that firefighters must obtain advanced ALS certifications.
Recommendation #28:	Supervisors in both EMS and firefighting must redesign the integration of operations and culture under one leadership and supervision dynamic from the station house to the Fire Chief. A house divided is never as successful. Specialties are fine, but they do not define the entire leadership and HR culture.
Recommendation #29:	Consider adding one FTE entry/mid-level Technical Office Support position to provide needed technical clerical support for EMS Section administrative staff.

3C.4 SUPPRESSION SECTION

3C.4.1 Suppression Assistant Chief Office

The Suppression Assistant Chief manages all suppression functions including safety, training, special operations, and the three suppression deputy chiefs with no support staff, particularly an entry/mid-level Technical Office Support position to provide needed clerical support for the Suppression administrative support staff.

Suppression Assistant Chief Office Finding and Recommendation

Finding #36: The Suppression Assistant Chief manages all suppression functions, including safety, training, special operations, and the three suppression deputy chiefs with no support staff, particularly an entry/mid-level Technical Office Support position to provide needed clerical support for the Suppression administrative support staff.

Recommendation #30: Consider adding one FTE entry/mid-level Technical Office Support position to provide needed clerical support for the Suppression Assistant Chief's office.

3C.4.2 Health and Safety

In support of the personnel fulfilling the fire and EMS mission, the Department's health and safety program responsibilities are distributed among the headquarters executive team.

Prior Studies

In 2014, the previous Cy-Fair Volunteer Fire Department retained McGrath Consulting Group, Inc. to conduct a Fire/EMS Department Review and Assessment. In the health and safety realm, this study recommended that the Department add a risk management position to address workers' compensation, insurance, and safety policy. The study also recommended dedicated Incident Safety Officer (ISO) positions be implemented within the Operations Division. Additionally, traffic signal preemption at street intersections was recommended along with the development of a facility familiarization and pre-incident planning process to support fireground effectiveness and safety at incidents.

Best Practice References

Citygate utilized the following industry-recognized best practice guidelines and recommendations from the NFPA for this review:

- NFPA 1500 Standard on Fire Department Occupational Safety and Health Programs (2021 Edition)
- NFPA 1501 Standard on Fire Department Safety Officer (2020 Edition)

- NFPA 1521 Standard for Fire Department Safety Officer Professional Qualifications (2020 Edition)
- NFPA 1582 Standard on Comprehensive Occupational Medical Program for Fire Departments (2022 Edition)
- NFPA 1583 Standard on Health-Related Fitness Programs for Fire Department Members (2022 Edition)
- NFPA 1584 Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises (2022 Edition)
- NFPA 1403 Standard for Live Fire Training Evolutions (2018 Edition)
- NFPA 1404 Standard for Fire Service Respiratory Protection Training (2018 Edition)
- NFPA 1451 Standard for Providing Emergency Service Vehicle Operations Training (2018 Edition)
- NFPA 1201 Standard for Providing Emergency Services to the Public (2020 Edition)
- NFPA 1250 Recommended Practice in Emergency Service Organization Risk Management (2020 Edition)
- NFPA 1561 Standard on Emergency Services Incident Management System and Command Safety (2020 Edition)
- Texas Administrative Code Section 435.21

Health and Safety Overview

The health and safety duties of a fire department are necessary to ensure employee wellness and operational safety. Responsibilities for the following health and safety functions are shared among the Department's executive team:

- Risk management planning
- Code compliance
- Accident prevention and investigation
- Data and trend analysis

- Facility safety inspection program
- Health and wellness
- Liaison for injured worker treatment
- Incident Safety Officer (ISO) program management.

Most of the Department's management duties related to health and safety are managed by the EMS Assistant Chief and the Suppression Assistant Chief who co-chair the Department's Accident Review Board. The Department has Standard Operating Guidelines (SOGs) for driving and accident procedures (SOG ADM.01.05) that detail safe driving and accident reporting protocols through the investigation and review process, which results in a preventable or non-preventable finding that may be considered for disciplinary action pursuant to the Department disciplinary policy. The Department also utilizes vehicle safety cameras (procedures detailed in SOG ADM.02.05) and a policy for response to roadway incidents (SOG OPS.06.03). Model programs utilized in the Department include Emergency Vehicle Operator Course (EVOC), National Traffic Incident Management Responder Training (TIM), and Courage to be Safe.[15] The Department also includes annual cancer awareness training within its continuing education deliveries.

The Department has had volunteer Incident Safety Officers (ISOs) for more than 20 years, and in addition to the three current volunteer ISOs—who respond to incidents after normal weekday work hours and on weekends—the Department's full-time chief officers assume ISO duties during weekdays, pursuant to Department SOG JD.03.05. However, none of the Department's officers serving as an ISO, whether volunteer or full-time, are certified for that function. In addition to responding to incidents, ISOs serve as the field investigator for accident reporting and evidence collection utilized in the review process. They are also responsible for drafting post-incident analysis reports from the safety perspective.

Emergency medical infection control procedures are carried out by EMS supervisors, who serve as designated infection control officers (SOG OPS.03.03) and are responsible for establishing the medical rehabilitation section at incidents and sequestering suppression personnel when their vital signs remain in "Red flag" limits (SOG OPS.06.02).

In 2020, the Department adopted the International Association of Fire Fighters and International Association of Fire Chiefs (IAFF/IAFC) Fire Service Joint Labor-Management Wellness-Fitness Initiative (Second Edition), with reference to both NFPA 1582 – Standard on Comprehensive Occupational Medical Program for Fire Departments (2007 Edition) and NFPA 1583 – Standard on Health and Related Fitness Programs for Firefighters (2008 Edition). This initiative is

[15] Course produced by the National Fallen Firefighters Foundation: www.everyonegoeshome.com

confidential and non-punitive. It is formalized in policy SOG ADM.02.015 with elements including body scan, medical/health screening, physical conditioning, fitness assessment, and long-term record keeping in an employee health database.

The Department utilizes policies for incident management (SOG OPS.02.02), fireground accountability (SOG OPS.06.01), and credentials (trains) officers for incident command duties within the Blue Card[16] system. Live fire training also utilizes established procedures detailed in SOG OPS.07.01.

Health and Safety Review

Citygate's review of the health and safety responsibilities shared by executive team officers find it to be compliant with current TCFP requirements for safety-related policies and procedures as well as most NFPA-recommended standards. While Citygate finds the Department's comprehensive effort sufficient, it is recommended that the Department create a dedicated Health and Safety Officer position to consolidate responsibilities and drive a comprehensive risk management planning process.

Citygate further finds the Department's accident review process is compliant with recommended standards but could be more effective by expanding the Accident Review Board (ARB) to include line personnel for their professional development and to increase relevance of a safety culture at the station level. Line personnel involvement in the review board process would also yield increased feedback needed to keep safety policies relevant and compliant.

Collectively, many members of the Department's headquarters team noted the need for a building familiarization program and efforts have begun to establish a process. Citygate finds that the lack of a building familiarization and pre-incident planning program for multi-family and commercial occupancies is a critical gap in facilitating safe, effective incident operations. Pre-incident planning is included in NFPA 1500 – Standard on Fire Department Occupational Safety and Health Programs (2021 Edition) as a specific element of a comprehensive risk management plan and approach.

Health and Safety Findings and Recommendations

Finding #37: The Department has a non-centralized approach to health and safety program management.

[16] Nationally recognized incident command certification program: www.bshifter.com.

Finding #38:	The Department's Accident Review Board does not include operational line personnel representation.
Finding #39:	Department personnel serving as Incident Safety Officers (ISOs) lack TCFP certification for that role.
Finding #40:	The Department does not have an active building familiarization and pre-incident plan program.

Recommendation #31:	The Department should establish a dedicated Health and Safety Officer to consolidate responsibilities and develop a comprehensive risk management plan.
Recommendation #32:	The Department's Accident Review Board should be expanded to include line personnel.
Recommendation #33:	The Department should expand the job description of the Incident Safety Officer (ISO) position to include Texas Commission on Fire Protection certification and require certification of all personnel assuming those duties at incidents.
Recommendation #34:	The Department should establish a building familiarization and pre-incident plan program for all multi-family and commercial occupancies.

3C.4.3 Special Operations

In addition to fire and emergency medical hazards, the Department has established a Special Operations Section in the Suppression Division to mitigate hazards relative to technical rescue and hazardous material occurrences.

The Special Operations Section is responsible for ensuring operational response capacity and competency relative to the following hazards:

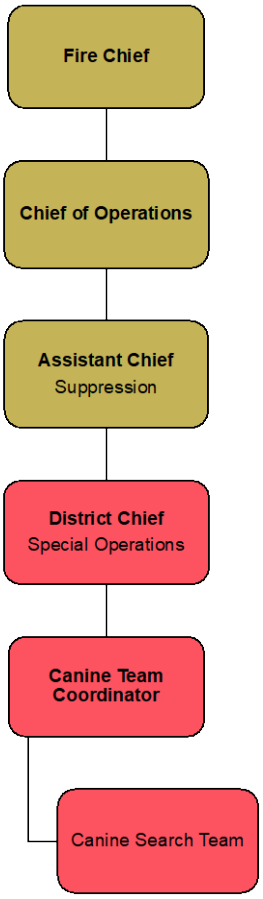
- Confined space rescue
- Rope rescue (high/low angle)
- Structural collapse

- Surface water rescue
- Swift water rescue
- Trench rescue
- Vehicle extrication
- Wide area search
- Hazardous material incident support (decontamination)

The Department deploys three heavy rescue units at stations 3, 5, and 8. Two of the three rescues are staffed daily with a minimum of three personnel—including full-time, part-time, and volunteer personnel—on a rotational shift schedule. When staffed, each rescue unit has a minimum staffing of three personnel. In addition to the equipment carried on the heavy rescue apparatus, the Department deploys eight trailered evacuation/rescue boats from stations 3, 6, 7, 8, and 12; one fireboat from Station 11; and three high-profile evacuation vehicles (transporters) from stations 5, 10, and 13.

The Special Operations Section is overseen by a full-time Special Operations Coordinator (District Chief) who is responsible for ensuring training and certification currency, maintaining training and certification records, and maintaining equipment and supply inventories. The Coordinator reports to the Suppression Division Assistant Chief and supervises the volunteer Canine Team Coordinator and, indirectly, the single volunteer Canine Search Team member as shown in the following figure.

Figure 24—Special Operations Organization



Hands-on training is conducted at a training facility shared with Lone Star College located adjacent to Station 11 at 18132 West Road. There are no training props specific to Special Operations. While the TCFP is expanding technical rescue certification requirements, it only specifies high/low angle rope rescue curriculum currently. The Department is compliant with NFPA certification standards and is keeping pace with emerging TCFP requirements.

The Harris County Fire Marshal's Office (HCFMO) provides technical hazardous material spill/release response within the Department's service area and has a response apparatus located at the Department's previous Fire Station 2 located at 11210 Tower Oaks Blvd. This HCFMO HazMat Team also provides support for confined space rescue incidents within the Department's service area. All Department response personnel are trained to the Hazardous Material First Responder Operations (FRO) level as required by TCFP regulations. The Department provides incident command and decontamination support for the HCFMO Hazardous Materials Response Team as needed within the service area.

While the HCFMO is responsible for issuing confined space permits, there is an informal process between the Department and the HCFMO that allows for some notification of these permits and the Department has initiated shadowing HCFMO inspectors during Tier II[17] occupancy inspections. Other than the Tier II facilities identified in the Department's CAD system, there are no other pre-incident plans for high-hazard occupancies. The rescue apparatus carries no radiation detection equipment but does carry four gas monitoring meters.

The Department has SOGs for incident management (SOG OPS.02.02), confined space operations (SOG OPS.05.04), hazardous material procedures (SOG OPS.04.01), use of absorbent (SOG OPS.04.02), and search team deployment (SOG OPS.05.02).

Best Practice References

Citygate utilized the following industry-recognized best practice guidelines and recommendations from the NFPA for this review:

- NFPA 1006 Standard for Technical Rescue Personnel Professional Qualifications (2021 Edition)
- NFPA 1500 Standard on Fire Department Occupational Safety, Health, and Wellness Program (2021 Edition)
- NFPA 1670 Standard on Operations and Training for Technical Search and Rescue Incidents (2017 Edition)
- NFPA 2500 Standard for Operations and Training for Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services (2022 Edition)
- Texas Administrative Code Title 37

Special Operations Review

Citygate's review of the Special Operations Section finds it to be compliant with current TCFP requirements and most applicable NFPA standards. Citygate finds the Department's minimum daily staffing of two rescue units to be minimally sufficient for most technical rescue hazards likely to occur within the service area, with additional capacity from the staffed engine and ladder crews with their assigned extrication tools and equipment. However, we encourage daily staffing of all three rescues as soon as is fiscally and operationally possible to ensure adequate technical response

[17] Tier II chemical reporting as defined and regulated by the Texas Commission on Environmental Quality.

capacity for more serious or concurrent incidents across the entire service area within a response time to facilitate desired outcomes.

Citygate's review finds the Department's Special Operations training program meets best practice recommendations and standards with credentialed certifications and task books. The Department also has an effective multi-year Capital Expenditure Plan in place to replace Special Operations apparatus and equipment at the end of expected useful service life.

Training is an important component of skills maintenance that impacts operational readiness and efficacy of a technical rescue effort. Access to Special Operations training props is essential to conduct high-quality initial and recurrent training within the team. Citygate finds that the current training site located within the jurisdiction has no props dedicated to the technical rescue disciplines that the Department is providing to the community.

Citygate's review finds that there is a low level of familiarization with the contents or operations occurring in high-hazard occupancies within the jurisdiction. While shadowing of inspection personnel has begun, knowledge of hazardous materials and coordination with partner agencies prior to incidents is an informal arrangement. Citygate finds that this lack of facility knowledge coupled with the lack of training props is a serious detriment to the level of competency that can be maintained by the Department.

Special Operations Findings and Recommendations

Finding #41: The Department's daily staffing of two rescue units is minimally sufficient to mitigate most technical rescue hazards likely to occur, with additional capacity from the staffed engine and ladder crews with their assigned extrication tools and equipment.

Finding #42: The Special Operations Section does not have access to dedicated technical rescue training props within the jurisdiction.

Finding #43: The Special Operations Section has no formal facility familiarization program for high-hazard occupancies.

Finding #44: Incident commanders must manage an interagency effort at technical hazardous materials responses.

Recommendation #35:	The Department should consider staffing all three rescue units exclusively with trained personnel daily as soon as fiscally and operationally feasible to ensure adequate technical response capacity for more serious or concurrent incidents across the entire service area within a response time to facilitate desired outcomes.
Recommendation #36:	The Department should consider establishing its own or providing access to training props for Special Operations disciplines.
Recommendation #37:	The Department should consider establishing a formal familiarization program for target occupancies and develop plans that can be readily accessed by incident responders.
Recommendation #38:	The Department should consider providing Hazardous Materials Incident Commander (HMIC) training and certification to District Chiefs to ensure recognition and coordination of interagency responses.

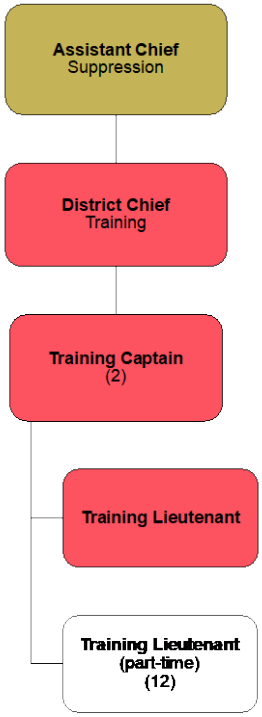
3C.4.4 Suppression Training

The EMS and Suppression Sections each have separate, non-integrated training staff and programs. *EMS Section training is discussed in detail in Section 3.5.2.*

Overview

The Suppression Division Training Section is responsible for ensuring all suppression personnel meet TCFP certification and continuing education requirements for their respective positions and assignments. The Training Section operates with a staff of four full-time and 12 part-time personnel under the direction of the Training District Chief as shown in the following figure.

Figure 25—Suppression Training Section Organization



It is important to note that at the time of this review, EMS and Suppression training are managed independently by each respective operations section with little or no coordination.

Best Practice References

Citygate utilized the following industry best practice guidelines and recommendations for this review:

- NFPA 1401 Recommended Practice for Fire Service Training Reports and Records (2017 Edition)
- NFPA 1402 Standard on Facilities for Fire Training and Associated Props (2019 Edition)
- NFPA 1403 Standard on Live Fire Training Evolutions (2018 Edition)
- NFPA 1404 Standard for Fire Service Respiratory Protection Training (2018 Edition)
- NFPA 1407 Standard for Training Fire Service Rapid Intervention Crews (2020 Edition)

- NFPA 1408 Standard for Training Fire Service Personnel in the Operation, Care, Use, and Maintenance of Thermal Imagers (2020 Edition)
- NFPA 1410 Standard on Training for Emergency Scene Operations (2020 Edition)
- NFPA 1451 Standard for a Fire and Emergency Service Vehicle Operations Training Program (2018 Edition)
- NFPA 1561 Standard on Emergency Services Incident Management System and Command Safety (2020 Edition)
- NFPA 1670 Standard on Operations and Training for Technical Search and Rescue Incidents (2017 Edition)
- NFPA 2500 Standard for Operations and Training for Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services (2022 Edition)
- Texas Administrative Code Title 37

At the time of this review, the Department lacked formal training policies or SOGs with the exception of those related to live-fire training. The Department also lacks a formalized process to identify annual training needs to acquire and maintain the knowledge, skills, and abilities needed to deliver services consistent with the Department's mission in conformance with recognized best practices.[18]

New Hire Training

All new full-time or part-time District firefighters are required to hold a current TCFP basic firefighter certification, requiring 468 hours of training as well as current EMT-Basic or higher certification prior to employment. Newly hired firefighters must successfully complete a two-week District academy to evaluate fire and EMS knowledge and skills, and to orient new hires to Department policies and procedures prior to their initial station assignment. New-hire training is managed and conducted by station-level officers and District Chiefs independent of the Suppression Training Section.

The following tables summarize recent full-time and volunteer firefighter academy training.

[18] Reference: Center for Public Safety Excellence *Fire and Emergency Services Self-Assessment Manual* (9th Edition).

Table 27—Full-Time Firefighter Training Academy Summary

Academy Date		Number of Cadets	Number Still Employed with District	Percent Still Employed
Year	**Month**			
2019	November	24	23	95.83%
2020	March	33	29	87.88%
2021	April	26	23	88.46%
	October	17	15	88.24%
2022	April	13	10	76.92%
	July	18	15	83.33%
2023	February	15	15	100%

Source: Cy-Fair Fire Department

Table 28—Volunteer Firefighter Training Academy Summary

Academy Date		Number of Cadets	Number Still Employed with District	Percent Still Employed
Year	**Month**			
2020	February	14	1	7.1%
2021	February	6	1	16.7%
	September	16	5	31.3%
2022	September	15	7	46.7%
2023	April	18	11	61.1%

Source: Cy-Fair Fire Department

Continuing Education

The Department requires full-time and part-time Suppression personnel to complete a minimum of 20 hours of continuing education / training annually in conformance with TCFP requirements in addition to any specific TCFP position certification requirements. Volunteer personnel with less than 20 years of service are required to complete a minimum of 12 hours of training per quarter. In addition to manipulative training, the Department utilizes Target Solutions and Moodle to deliver on-line continuing education training meeting NFPA and TCFP requirements. While the Department only requires 20 hours of annual training in conformance with TCFP requirements, most other Citygate client fire agencies of comparable size strive to require 10–20 hours *per month* (240 annually), or to acquire and maintain the knowledge and skills to safely perform the tasks required for their assignment/position.

Certification Training

The TCFP has established certification requirements for the following specific fire agency positions/functions:

- Structural fire suppression
- Aircraft rescue firefighting
- Marine firefighting
- Head of Department
- Fire Service Instructor
- Wildland Firefighter

The Section has also developed Boat Operator and Advanced Law Enforcement Rapid Response Training (ALERRT) curriculum and is currently working to obtain credentialing of Section staff to deliver the training in-house rather than through an external source at a higher cost.

The Department utilizes Moodle, an open-source online learning platform, to deliver technical certification training in-house.

Training Facility

The Department utilizes the Board Meeting Room at its administrative facility for classroom training as well as the former Fire Station 9 for its two-week new hire training academy. The Department also and has an agreement to utilize the classroom and outdoor training props at the Lone Star College Cy-Fair campus on Barker-Cypress Road adjacent to Fire Station 11 as available and coordinated through the Suppression Training Section. According to Suppression Section staff, this LSC Cy-Fair facility is rarely utilized due to scheduling conflicts and limited availability. In Citygate's experience, an agency the size the Department should have sufficient facilities and space available within the jurisdiction to conduct classroom, live-fire, ventilation, driver/operator, technical rescue, and multi-company manipulative training during normal workday hours.

Record Keeping

The Department maintains its suppression training records in Target Solutions. Citygate's review of the Department's suppression training records found total training hours for the most recent two-year period (June 1, 2021 – May 31, 2023) ranged from a low of 23 hours to a high of 788 hours as summarized in the following table.

Table 29—Suppression Training Summary

Employment Status	Number of Employees[2]	Total Training Hours[1]			
		Low	High	Average	90th Percentile
Full-Time	119	77	788	**335**	**137**
Part-Time	63	32	78	**130**	**80**
Volunteer	105	23	676	**175**	**77**
Total	**287**	**66,497**		**232**	**83**

Source: Cy-Fair Fire Department
[1] For the two-year period from June 1, 2021 – May 31, 2023
[2] Includes only suppression personnel employed for the full two-year period

As the table shows, 90 percent of all suppression personnel employed for the full two-year period documented at least 83 hours of training for the same period, or slightly more than double the 20 hours annually as required by TCFP exclusive of any certification requirement(s).

Suppression Training Findings

Finding #45: District Suppression personnel averaged 116 hours of training annually over the most recent 24 months; 90 percent documented 83 or more hours over the same period.

Finding #46: District suppression training is meeting TCFP requirements, with 90 percent of suppression personnel documenting more than twice the required 20 hours per year exclusive of any certification requirement(s).

Suppression Training Review

Citygate's review of the Suppression Training Section found it to be appropriately organized, although completely independent of the EMS Training Section. There is little interaction between the two, with the exception of EMS Training assigning EMS training classes in Target Solutions and monitoring firefighter EMS certification status and notifying the employee and his/her supervisor if their certification is nearing expiration without having met continuing education requirements.

Suppression training is predominantly delivered online via District-hosted learning platforms, with technical certification curriculum including Fire Instructor and Officer classes delivered in-person by Training Section staff. All suppression personnel—whether full-time, part-time, or volunteer—are required to meet 20 hours of continuing education annually, plus any certification requirements

specific to their position, in conformance with TCFP regulations. Each volunteer station and shift has a designated Lieutenant responsible for coordinating and documenting training. The shift Truck Officer is responsible for coordinating and documenting all full-time and part-time shift training.

In addition to the division of suppression and EMS training functions, challenges facing the Suppression Training Section include:

- Lack of a dedicated training center with adequate classroom, outdoor drill space, and training props to support the current and anticipated future needs of the Department.
- Insufficient staffing capacity to meet all expectations and maintain continuity of training across the Department, including specialty functions and programs.

Suppression Training Findings and Recommendations

Finding #47: EMS and suppression training are managed independently by each respective operations section with little or no coordination.

Finding #48: The Department lacks a complete set of formal written policies and procedures for suppression training.

Finding #49: The Department lacks a formalized process to identify annual training needs to acquire and maintain the knowledge, skills, and abilities needed to deliver services consistent with the Department's mission in conformance with recognized best practice.

Finding #50: New-hire firefighter training is managed and conducted independently of the Suppression Training Section.

Finding #51: The Department lacks access to a single facility with sufficient classroom and outdoor space available within the District to conduct classroom, live-fire, ventilation, driver/operator, technical rescue, and multi-company manipulative training during normal workday hours.

Finding #52: The Suppression Training Section is understaffed to meet its current and anticipated future growth responsibilities and maintain continuity of training across the Department including specialty functions and programs.

Recommendation #39:	The Department should merge EMS and Suppression training into a single, integrated Training Section as soon as possible to ensure training continuity, accountability, and effective utilization of training resources.
Recommendation #40:	The Department should develop and implement Standard Operating Guidelines establishing minimum initial and recurrent annual training/certification requirements consistent with the Department's job descriptions for all incident-based positions and functions.
Recommendation #41:	The Department should develop a process to evaluate and identify the annual training needed to acquire and maintain the knowledge, skills, and abilities necessary to deliver services consistent with the Department's mission in conformance with recognized best practice.
Recommendation #42:	Acquire access to an existing facility during and outside normal workday hours, or plan to provide a dedicated training facility within the District to conduct classroom, live-fire, ventilation, driver/operator, technical rescue, and multi-company manipulative training during normal workday hours.
Recommendation #43:	Consider adding two FTE positions to the Suppression Training function to include one Captain and one Lieutenant to provide the additional staffing capacity needed to meet section responsibilities and workload.

3C.5 COMMUNITY RISK REDUCTION

3C.5.1 Overview

Unlike most jurisdictions where the agency providing fire protection services also administers and enforces the local adopted fire code, the Harris County, Texas Fire Code designates the County Engineer and County Fire Marshal as the only officials authorized to administer and enforce the County Fire Code. As such, the Office of the County Engineer receives applications, reviews construction documents, and issues permits for construction regulated by the Code. The Fire Marshal's Office then inspects the premises for which such permits have been issued, enforces compliance with the provisions of the Code, and issues permits for operations regulated by the

Code. This precludes the District from having any voice or authority in determining what development takes place within it, what fire and/or life safety protection measures are required, and inspection of those fire and life safety protection systems.

As such, the District has no Fire Prevention function, or (as it is increasingly referred to) no Community Risk Reduction function. Despite this, industry best practices recommend that communities conduct a risk assessment and develop a Community Risk Reduction Plan to reduce or eliminate the frequency and impacts of hazard occurrences including fires, medical emergencies, etc.[19]

While this Fire Services Master Plan includes a comprehensive Community Risk Assessment of the District's service area (**Appendix A**), the District has not yet developed a comprehensive Risk Reduction Plan. However, the District does provide the following risk reduction-related programs and services:

- Citizen CPR/AED training
- Smoke alarm installation / battery changes
- Participation in health fairs, job fairs, National Night Out, and Fire Fest
- School visits by request
- Infant car seat installation checks
- Drug disposal.

Another typical byproduct of a fire agency having its own prevention / community risk reduction program is that risk, fire, and life safety protection systems information gets shared with response personnel as the building or facility is constructed, often with a "walkthrough" of higher-hazard facilities just prior to occupancy—providing response personnel not only with building/facility familiarization, but also with critical information should a serious incident occur at that location. Given the high building fire and hazardous material risk within specific sections of the District's service area,[20] the lack of building/hazard familiarization and pre-incident planning as cited in the Health and Safety Program review in Section 3.5.3 is a critical operational safety gap that should receive prioritized attention. This could be mitigated with a focused effort to obtain timely building permit information from the Office of the County Engineer, and a dedicated Risk Reduction Specialist shadowing Fire Marshal's Office inspectors on new construction fire and life safety systems inspections and facilities generating, using, or storing Tier II-threshold quantities of

[19] NFPA 1300 – Standard on Community Risk Assessment and Community Risk Reduction Plan Development (2020 Edition).

[20] Reference: Appendix A—Community Risk Assessment, Table 2.

hazardous materials. This Risk Reduction Specialist could also be tasked with generating pre-incident plans for designated higher-risk facilities and occupancies that could be made available electronically in real time to response personnel at emergency incidents. This function could also be tasked to develop a District-wide Risk Reduction Plan to provide strategies and tactics to reduce the incidence and impacts of high-frequency and high-impact hazard occurrences.

In addition, fire hydrants within the District service area are either privately owned or provided by one of more than 110 separate Municipal Utility Districts (MUD). Recognized industry best practice recommends standardized color coding of hydrants to identify available fire flow as well as annual inspection and maintenance. Citygate's review of the District's service area found no standardized hydrant color coding and Department staff advised that hydrant inspection and maintenance is the responsibility of the individual MUDs. In addition, Department SOGs preclude the use of private hydrants due to liability exposure if the private water system is damaged from Department use.

3C.5.2 Community Risk Reduction Findings and Recommendations

Finding #53: The Department lacks a Community Risk Reduction Plan that provides strategies to reduce or eliminate the incidence and impacts of high-frequency and high-impact hazard occurrences in conformance with industry-recognized best practice.

Finding #54: The Department lacks a program to develop pre-incident plans for higher-risk facilities and occupancies that could be made available electronically in real time to response personnel at emergency incidents.

Finding #55: Fire hydrant testing and maintenance is inconsistent within the District's service area.

Recommendation #44: The District should develop a Community Risk Reduction Plan to reduce or eliminate the incidence and impacts of high-frequency and high-impact hazard occurrences in conformance with industry-recognized best practice.

Recommendation #45:	The Department should develop pre-incident plans for higher-risk facilities and occupancies that could be made available electronically in real time to response personnel at emergency incidents.
Recommendation #46:	The Department should coordinate with the numerous Municipal Utility Districts within the service area to request standardization of fire hydrant color coding and regular inspection and testing in conformance with recognized best practices.

SECTION 3D—HEADQUARTERS SERVICES: RESOURCE AND LOGISTICS DIVISION

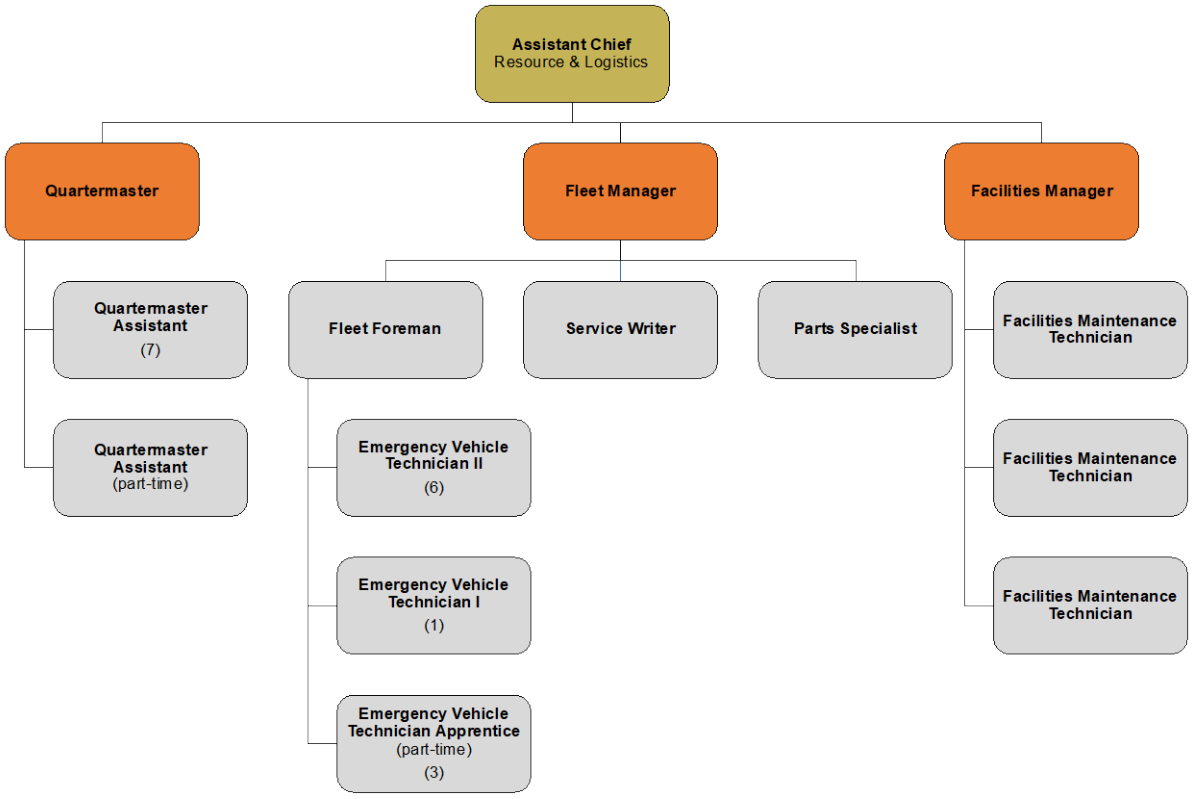
3D.1 RESOURCE AND LOGISTICS DIVISION OVERVIEW

The Resource and Logistics Division consists of 22 full-time and 4 part-time personnel under an Assistant Chief as summarized in the following table and figure.

Table 30—Resource and Logistics Division Staffing Summary

Section	Personnel		Total
	Full-Time	Part-Time	
Facilities	4	0	**4**
Fleet Services	10	3	**13**
Quartermaster	8	1	**9**
Total	**22**	**4**	**26**

Figure 26—Resource and Logistics Division Organization



3D.2 Resource and Logistics Assistant Chief's Office

The Resource and Logistics Assistant Chief administers all District resource and logistics programs including facilities, fleet, and quartermaster sections with no technical office support.

3D.2.1 Resource and Logistics Assistant Chief's Office Finding and Recommendation

Finding #56: The Resource and Logistics Assistant Chief oversees the District's facilities, fleet, and logistics functions with no technical office support capacity.

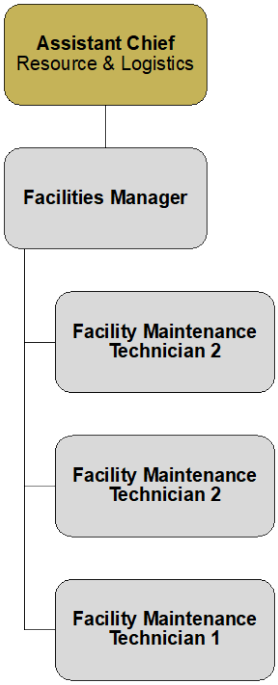
Recommendation #47: The District should consider adding one FTE mid-level Technical Office Support position to provide needed clerical support for the Resource and Logistics Division.

3D.3 Facilities Section

3D.3.1 Overview

The Facilities Section is responsible for maintaining all District sites and building facilities with a staff of four full-time personnel under the direction of the Facilities Manager as shown in the following figure.

Figure 27—Facilities Section Organization



Most facility maintenance services are provided from the District's administration facility by the three Facility Maintenance Technicians; however, more complex, technical repairs and landscaping maintenance are contracted out to local, private-sector vendors. Work order requests are submitted through the District's website, acknowledged and prioritized by the Facilities Manager, and assigned to one or more of the technicians or a contract vendor. All work orders are tracked in the District's asset management software suite.

The Facilities Section receives an average of approximately 150 work orders monthly and takes great pride in timely response and resolution of those requests. Vendors contracted for maintenance of critical facility systems including HVAC, ice machines, overhead doors, elevators, and alarm systems are required to provide 24-hour availability and response to work order requests.

3D.3.2 Review

Citygate's review of the Facilities Section finds it to be appropriately organized and adequately staffed and equipped to provide timely and effective maintenance and repair of current District facilities. The section also utilizes contract vendors effectively for critical systems requiring 24-hour service capability. Citygate's review of section staff workload found no excess capacity and staff capacity being fully utilized. The District will need to consider adding additional technician capacity as it continues to grow and add facilities. Current challenges for the Facilities Section include:

- Contract vendor availability due to hiring challenges.
- Condition of older stations.
- Training on newer technical building components and systems.
- Compensation in alignment with local market to ensure ability to recruit and retain highly qualified technical staff.

3D.3.3 Facilities Section Findings and Recommendations

Finding #57: The Facilities Section of the Resource and Logistics Division is appropriately organized and adequately staffed and equipped to provide timely and effective maintenance and repair of District facilities.

Finding #58: The Facilities Section utilizes private vendor contracts effectively to provide 24-hour repair capability for critical facility systems such as HVAC, ice machines, overhead doors, elevators, and alarm systems.

Finding #59: The Facilities Section workload capacity is being fully utilized with no excess capacity available.

Finding #60: Newer District facilities have more technical components and systems resulting in additional training needs for Facilities Section staff.

Recommendation #48: The District will need to plan for additional facility maintenance technician capacity as it continues to grow and add facilities.

Recommendation #49: The District should continue conducting regular periodic compensation surveys to ensure compensation of technical specialists is in alignment with the local/regional job market to ensure the ability to recruit and retain highly qualified personnel.

3D.4 FLEET SERVICES

3D.4.1 Introduction and Background

As an element of this Fire Services Master Plan, Citygate reviewed the Fleet Services Section of the Resource and Logistics Division.

To accomplish its mission to "Make a positive impact through professionalism and dedication in order to deliver a service that is second to none to the Cy-Fair Fire Department Community we serve," the Department must have a vehicle fleet that is optimally reliable and safe to operate. Citygate's review of the Fleet Services Section found it to be a full-service fleet support operation with what Citygate observed to be a very competent staff comprised of professional technicians and dedicated supervisory and management staff.

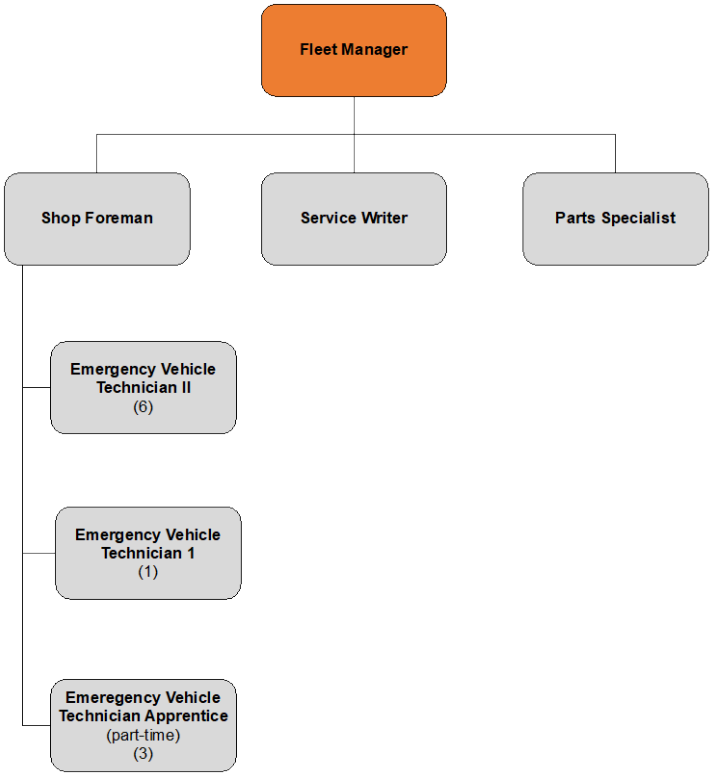
Prior Studies

In 2014, the then Cy-Fair Volunteer Fire Department retained McGrath Consulting Group, Inc. to conduct a Fire/EMS Department Review and Assessment. This study found that the Department had a very progressive apparatus maintenance program and facilities were appropriate for the tasks associated with this division. The study also found the fleet consisted of an appropriate number of engines, trucks, rescue, ambulance, and tender apparatus; however, the study expressed concern over the large number of staff and specialty vehicles. The study recommended a less aggressive apparatus replacement program with a total of 16 reserve apparatus and an ambulance re-chassis program after eight years of front-line service.

3D.4.2 Overview

The Fleet Services Section is responsible for the procurement, maintenance, and repair of the Department's automotive and miscellaneous equipment fleet to ensure operational readiness, safety, and reliability. The Section carries out these responsibilities in a 13,500-square-foot shop facility at the Department's administration office at 10710 Telge Road with a staff of 10 full-time and three part-time personnel as summarized in the following figure.

Figure 28—Fleet Services Organization



3D.4.3 Responsibilities and Services

Fleet Services responsibilities and services include:

- Development of procurement specifications for fire apparatus, light-duty vehicles, and other motorized/miscellaneous equipment.
- Inspection of fire apparatus during construction and prior to delivery.
- Inspection and acceptance of new fire apparatus, light-duty vehicles, and other motorized equipment upon delivery.
- Coordination with IT and Radio Services for upfitting of new fire apparatus and light-duty vehicles prior to being placed in service.
- Ensuring that all emergency response apparatus, light-duty vehicles, and miscellaneous motorized equipment are safe to operate and maintained to ensure operational readiness and reliability.

- Ensuring that routine preventive maintenance is performed on all fire apparatus, light-duty vehicles, and miscellaneous motorized equipment in conformance with manufacturer guidelines and industry standards.
- Management of the vehicle motor pool.
- Troubleshooting of operational vehicle problems and performing or coordinating appropriate repairs to ensure operational safety, readiness, and reliability.
- Testing and maintenance of fire apparatus and vehicle systems in conformance with applicable regulatory requirements and industry best practices.
- Coordination of warranty and manufacturer recall repairs for fire apparatus, light-duty vehicles, and miscellaneous/motorized equipment.
- Procurement and accountability of automotive parts and supplies.
- Training of Division personnel to ensure conformance with applicable regulatory requirements and proficiency in fleet troubleshooting and repairs.
- Disposal of surplus vehicles and shop equipment in conformance with Department policies and procedures.
- Maintenance of appropriate records.
- Vehicle registrations.
- Maintenance and repair of fire station backup electrical generator engines.
- Management of installation and repair of vehicle camera systems.
- Management of maintenance and repair of the Department's bulk fueling stations.

Best Practice References

Citygate utilized the following industry-recognized best practice guidelines and recommendations from the NFPA for this review:

- NFPA 1071 Standard for Emergency Vehicle Technician Professional Qualifications (2016 Edition)
- NFPA 1901 Standard for Automotive Fire Apparatus (2016 Edition)
- NFPA 1906 Standard for Wildland Fire Apparatus (2016 Edition)

- NFPA 1911 Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Emergency Vehicles (2017 Edition)
- NFPA 1912 Standard for Fire Apparatus Refurbishing (2016 Edition)
- NFPA 1914 Standard for Testing Fire Department Aerial Devices (2002 Edition)
- NFPA 1915 Standard for Fire Apparatus Preventive Maintenance Program (2000 Edition)
- NFPA 1917 Standard for Automotive Ambulances (2019 Edition)

3D.4.4 Fleet Summary

The Department owns and operates 145 vehicles as summarized in the following table.

Table 31—Fleet Summary

Fleet Category	Front-Line	Reserve	Total	Average Age (Years)
Suppression	**30**	**6**	**36**	
Engines	14	4	**18**	7.3
Rescues	3	1	**4**	6.1
Aerial Apparatus	4	1	**5**	8.0
Tankers	2	0	**2**	12.5
Boosters	7	0	**7**	13.2
EMS	**16**	**6**	**22**	
Medic Ambulances	16	6	**22**	5.6
Support Fleet	**87**	**0**	**87**	
Staff/Division Vehicles	36	n/a	**36**	n/a
Pool Vehicles	13	n/a	**13**	n/a
Specialty Vehicles	38	n/a	**38**	n/a
Total	**133**	**12**	**145**	

Source: Cy-Fair Fleet Services

Citygate's review finds the Department's primary response fleet to be appropriately sized and configured to protect the values at risk from expected hazards likely to impact the service area. The reserve response fleet is also appropriately sized and configured to maintain front-line operational capacity pursuant to the following recommended ratio of reserve to front-line response apparatus. Reserve apparatus are stored in a 6,000-square-foot, eight-bay attached building on the

east side of the administration building adjacent to the shop. Reserve apparatus are fully equipped for immediate staffing and response except for self-contained breathing apparatus (SCBA) and hand-held radios, and Citygate recommends adding the SCBAs to ensure immediate response capability as needed.

Table 32—Recommended Reserve-to-Front-Line-Vehicle Ratio

Vehicle Type	Suggested Reserve-to-Front-Line-Ratio
Engines	1:3–5
Wildland Engines (Boosters)	1:5
Rescues	1:3–5
Aerial Apparatus	1:3–5
Tankers	1:3–5
Ambulances	1:4–6
Command Vehicles	1:4–6

Findings and Recommendations

Finding #61: The Department's front-line operational response fleet is appropriately configured to protect the values at risk from expected hazards.

Finding #62: The Department's reserve response fleet is appropriately sized and configured to maintain front-line operational response capacity.

Finding #63: The Department's reserve fire apparatus lacks self-contained breathing apparatus.

Recommendation #50: Consider equipping reserve fire apparatus with self-contained breathing apparatus to ensure immediate response capability as needed.

3D.4.5 Vehicle Replacement

Expected Useful Service Life

The Department has established expected useful service life criteria for its vehicle fleet consistent with fleet management and fiscal best practices as summarized in the following table.

Table 33—Expected Useful Service Life

Vehicle Type	Years of Service			Miles/Hours
	First Out	Reserve	Total	
Engine – Structure	8	4–5	**12–13**	100,000/10,000
Booster – Wildland	12	0	**12**	100,000/10,000
Aerial Ladder/Tower	11	2–3	**13-14**	100,000/10,000
Rescue	9	4–5	**13–15**	100,000/10,000
Water Tanker	15	0	**15**	100,000/10,000
Medic Ambulance	5-6	1–2	**6–7**	110–140k miles
Staff Vehicle	n/a	n/a	n/a	100,000 miles
Pool Vehicle	n/a	n/a	n/a	100,000 miles

Source: Cy-Fair Fire

In addition to expected years of useful service life, the Department evaluates mileage/hours of use, overall condition, operational use and needs, and lifetime operational costs and reliability as additional factors considered in determining vehicle replacement. Additionally, it currently takes upwards of three years from the time of order for delivery of a new fire apparatus.

Findings

Finding #64: The Department has established expected useful service life criteria for each vehicle type consistent with fleet management and fiscal best practices.

Finding #65: The Department's expected useful vehicle service life criteria is generally consistent with other Citygate fire agency clients of similar size.

Vehicle Replacement

The District determines its annual financial needs in an approved budget, including capital improvement and replacement costs, then sets the tax rate to provide the needed revenue. The

Department maintains a rolling 15–20-year replacement plan for heavy fire apparatus and ambulances based on the expected useful service life criteria described above. To date, the District's annual budgets have funded this replacement plan. It should be noted that the cost for a new fire engine meeting Department specifications is currently estimated to be $1.3–1.45 million, and aerial apparatus are estimated to cost more than $2 million. While this review did not include a review of apparatus specifications, Citygate suggests they be reviewed for "needed" versus "nice to have" features and options should the District find itself in a fiscal position where it is unable to fund planned apparatus replacements.

Fiscal Year 2023–2024 Vehicle Replacement

The FY 23–24 approved budget funds replacement of the following vehicles:

- Four engines
- 11 ambulances
- Five ambulance remounts
- Three command sport utility vehicles
- Three half-ton pickup trucks
- Two vans
- One remount fleet service truck body
- One box truck (Quartermaster)

Findings and Recommendations

Finding #66: The Department has established a long-range vehicle replacement plan consistent with fiscal and fleet management best practices.

Finding #67: The District has funded annual vehicle replacement to maintain established service life criteria and overall fleet capacity and reliability.

Recommendation #51:	The Department should consider reviewing its fire apparatus specifications closely for "needed" versus "nice to have" features and equipment should the District find itself in a fiscal position where it is unable to fund planned apparatus replacements.

3D.4.6 Shop Capacity and Operations

Shop Configuration and Capacity

The fleet services shop occupies approximately 13,500 square feet of the Department's administration facility at 10710 Telge Road, with sufficient space and specialized equipment to service and repair all Department vehicles including:

- 12 service bays
- Two 30,000-pound drive-on lifts
- Two 20,000-pound four-post lifts
- Five sets of 18,000-pound wireless mobile lift columns
- Bulk lube and coolant storage with distribution throughout the shop
- Specialty tools and equipment
- Personal protective equipment (gloves, vision/hearing protection, etc.)
- Truck tire mounting and balancing equipment
- Small engine repair station
- Fire pump test pit
- Fabrication area.

Technicians provide their own basic hand tools/toolboxes and receive a monthly tool stipend. The Department provides any needed specialized tools and equipment. All six Emergency Vehicle Technician II positions are certified fire mechanics, and all technicians hold multiple Automotive Service Excellence (ASE) technical certifications. Technicians receive periodic training from

Pierce Manufacturing,[21] Ford Motor Company, Waterous fire pumps, Harrison generators, Detroit and Cummins diesel engines, and attend the annual Texas Association of Emergency Vehicle Technicians Training Conference (each technician attends biannually).

The shop also has an adjacent 1,100-square-foot parts room managed by a full-time Parts Specialist. The Parts Specialist is responsible for maintaining an approximately $600,000 parts inventory—to minimize vehicle down time for maintenance and common repairs, and to ensure immediate availability of hard-to-get or obsolete parts not available locally. The parts inventory is maintained in the Department's Collective Data software application that can also support barcoding. Parts used are charged and tracked on individual vehicle work orders. The parts room has restricted coded access and 24-hour camera surveillance to ensure security.

Shop hours are 6:00 am to 9:00 pm Monday through Thursday and 8:00 am to 5:00 pm on Friday. Two technicians are on-call after hours and on weekends/holidays with a service truck for immediate response as needed. The shop maintains three service trucks for field service/repairs as needed.

Inspection and Preventive Maintenance Intervals

The Department has adopted fire apparatus out-of-service criteria consistent with NFPA 1911 and industry-recognized best practice. Daily visual/operational checks of all fire apparatus are conducted and documented by on-duty personnel using a daily inspection checklist conforming with NFPA 1911 Chapter 7. Most heavy fire apparatus receive quarterly, semi-annual, and annual inspections as scheduled by the Service Writer, which includes progressive preventive maintenance services and repairs as needed. All medic ambulances are serviced monthly due to heavy use and high idle times, and specialty apparatus are inspected and serviced semi-annually depending on use. Light-duty staff and pool vehicles are serviced at least semi-annually depending on mileage. This periodic inspection and maintenance schedule meets or exceeds manufacturers' recommendations and recommended fire service fleet best practices.

Repair Procedures

All fleet maintenance and repairs are performed in the Department's Fleet Services shop except for the following, which are outsourced to maintain capacity for scheduled preventive maintenance.

- Transmission repair
- Major engine repairs

[21] Pierce Manufacturing is the custom fire apparatus manufacturer of most Department fire apparatus.

- Major suspension work
- Body/paint work.

Routine inspections and preventive maintenance are scheduled by the Service Writer in coordination with the District Chiefs. Station personnel can also submit requests for repairs online in Collective Data. Upon arrival at the shop facility, the Service Writer assigns the work order to a technician, who documents all work performed and parts used on the work order. Upon completion of the work, the work order is reviewed by the Service Writer for accuracy and closed.

Service Backlog

Quarterly preventive maintenance inspections and services are typically backlogged approximately 10 percent over a 12-month period due to unavailability of parts, large repairs, or vehicle upfitting projects, etc. According to the Fleet Manager, all vehicles are inspected and serviced at least annually in conformance with fleet management best practices.

Annual Equipment Performance Testing

The Department outsources the following annual equipment inspections and performance tests in conformance with industry-recognized recommended best practices.

- Fire pump
- Ground ladders
- Aerial devices
- Waterway flow tests
- Hydraulic fluid analysis
- Shop lifts
- Forklifts
- Scissors lift

Record Keeping

Fleet Services uses Collective Data, a configurable cloud-based fleet, asset, and inventory management software program. Upon acquisition, an inventory record is created for each capital fleet asset and all work performed, parts used, and modifications to the vehicle are recorded in that asset record over the lifetime until sold or otherwise removed from the asset inventory.

Growth/Expansion Capacity

According to the Fleet Manager, the shop facility could accommodate two to four additional heavy fleet apparatus and still maintain the current inspection/service schedule. Beyond that, additional shop space and staff would be needed, and the reserve apparatus storage building could readily be re-purposed for that use; however, that would require an alternative reserve apparatus storage solution.

3D.4.7 Fleet Services Evaluation

The Department's Fleet Services Section is appropriately staffed and organized to maintain the Department's vehicle fleet with an appropriate chain of command and supervisor to subordinate ratio. Technicians are appropriately qualified and certified to work on the various vehicle and apparatus types, and there is essentially no employee turnover suggesting a positive work environment. The shop area is neat, clean, and orderly, which is unusual for a heavy truck repair facility, also suggesting that shop personnel take pride in and care about their workplace. The parts room is very neat and well organized, with a substantial inventory of frequently used or anticipated parts to minimize vehicle downtime and maintain operational response capacity. After-hour and weekend/holiday services are available with two on-call technicians with service trucks.

Reserve apparatus are stored indoors and are fully equipped for response except for SCBAs which must be transferred from the out-of-service apparatus. This is highly desirable and commendable to ensure immediate availability for service and for surge response capacity if needed.

The shop is very well equipped and capable of performing all light-duty and heavy-duty vehicle upfitting, inspections, maintenance, and repairs except for major drivetrain repairs and body or paint work. The shop has adequate space for minor fleet expansion, beyond which additional shop space or a modification of current preventive maintenance procedures will be needed, such as outsourcing light-duty vehicle maintenance. The current eight-bay reserve apparatus storage building could readily be repurposed as a shop annex as needed or desired.

Scheduled inspection and preventive maintenance procedures meet or exceed all vehicle/apparatus manufacturers' recommendations and recognized industry best practices. Fire pumps, ladders, major apparatus vehicle systems, and specialty shop equipment are inspected and tested in accordance with industry standards and best practices. Shop and vehicle records are also maintained in accordance with fiscal and fleet management best practices.

Overall, Citygate finds the Department's Fleet Services Section to be very well organized, staffed, and equipped to maintain the Department's automotive fleet and other motorized equipment in a high state of operational readiness and safety with a very professional and competent staff.

Findings and Recommendations

Finding #68: Fleet Services is very well organized, staffed, and equipped to maintain the District's automotive fleet and other motorized equipment in a high state of operational readiness and safety with a very professional and competent staff.

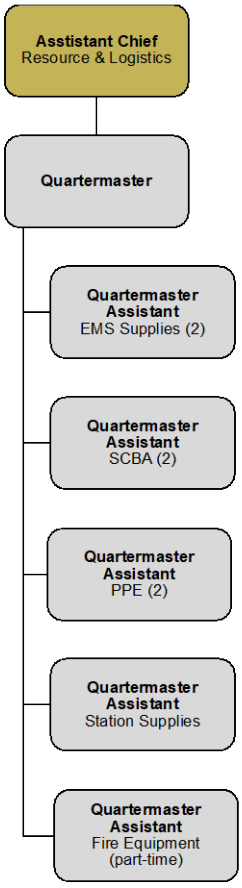
Recommendation #52: The District should anticipate need for additional vehicle technicians and shop space with any substantial fleet expansion.

3D.5 QUARTERMASTER

3D.5.1 Overview

The Quartermaster Section provides uniforms, personal protective equipment, firefighting, and fire station and EMS supplies for the entire Department with a staff of eight full-time and one part-time personnel, organized as shown in the following figure under the direction of the Quartermaster. Services are provided from the District's administration facility on Telge Road.

Figure 29—Quartermaster Section Organization



3D.5.2 Best Practice References

Citygate utilized the following industry-recognized best practice guidelines and recommendations from the NFPA for this review:

- NFPA 1851 Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting (2020 Edition)
- NFPA 1852 Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA) (2019 Edition)
- NFPA 1981 Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services (2019 Edition)
- NFPA 1982 Standard on Personal Alert Safety Systems (2018 Edition)

- NFPA 1989 Standard on Breathing Air Quality for Emergency Services Respiratory Protection (2019 Edition)
- Texas Administrative Code Title 37

3D.5.3 Supplies and Equipment

EMS Supplies

EMS supplies are maintained in an approximately 1,250-square-foot room within the warehouse section of the administration building and managed by two designated Quartermaster Assistants. The room requires employee ID card access and is equipped with security cameras. EMS equipment and supplies are neatly organized and maintained with a minimum/maximum inventory for each item, with drugs and whole blood stored in locked safes that are accessible to authorized personnel only.

Each station has a standardized EMS supply inventory. A Quartermaster Assistant visits each station weekly to review the EMS supply inventory before returning the following day to deliver backfill supplies. This procedure was implemented due to the limited storage space at most of the District's stations and is working well to ensure adequate backup EMS supplies are on hand at each station.

Station Supplies

Station supplies, including everything used in District facilities from cooking and eating tools to office supplies to cleaning products, are neatly organized and maintained in approximately 2,400 square feet of rack shelving on the north wall of the approximately 50,000-square-foot warehouse on the northwest side of the District's administration building. The open warehouse floor area is used for other purposes in addition to storage of station supplies, including firefighter Candidate Physical Ability Testing (CPAT), light-duty vehicle upfitting/storage, events, etc. and is generally accessible to all District personnel.

As with EMS supplies, a Quartermaster Assistant visits each station weekly to review the station supply inventory and then returns the following day to deliver backfill supplies. Emergency supply needs can also be picked up from the warehouse as needed during normal workday hours. As with EMS supplies, this process was implemented due to the limited storage space at most of the District's stations and is working well to ensure at least a minimum inventory of the most-used station supplies are on hand at each facility.

Fire Equipment

Fire equipment, including everything used on engines and ladders/towers, is neatly organized in an approximately 1,300-square-foot room on one end of the mezzanine on the south side of the

warehouse, and is managed by the part-time Quartermaster Assistant. According to the Quartermaster, this space is meeting current District needs.

Personal Protective Equipment

The Department maintains approximately 4,500 pieces of Personal Protective Equipment (PPE) including structural firefighting coats, pants, helmets, hoods, and gloves. All suppression personnel are issued a full set of structural PPE at time of hire, and the Quartermaster section maintains a supply of all PPE components in sizes to fit all personnel in an approximately 1,200-square-foot secure room adjacent to the main warehouse floor. Two full-time Quartermaster Assistants manage the PPE program, including distribution, cleaning, and repairs.

TCFP and best-practice standards require PPE be cleaned after any CBRNE,[22] hazardous material, or other incident where the PPE may have become contaminated. Cleaning procedures include preliminary exposure reduction, cleaning, disinfection, and/or sanitization after each use based on best-practice and manufacturer's guidelines.

The Department uses a two-tiered cleaning process where individual personnel are allowed to clean their own PPE at stations with extractors and dryers (stations 2, 5, 7, and 9), or they can request a Quartermaster Assistant pick up the PPE, clean it at the warehouse, and then return it to the station when completed. The Quartermaster Section has four extractors and four dryers for cleaning PPE in the main warehouse area.

The PPE Quartermaster Assistant also schedules an annual advanced cleaning in conformance with TCFP and best practice recommendations. In this case, the PPE is picked up at the station and a loaner set is left for the employee. It is then picked up at Headquarters by a third-party vendor who holds a Verified Service Provider certification to inspect, repair, and clean the PPE according to manufacturer recommendations and as outlined in NFPA 1851. Each piece of PPE is required to be cleaned at least every six months, or as needed based on use and exposure to contaminants. As of the most recent TCFP compliance inspection in February 2022, the Department was compliant with all PPE requirements.

The Department also provides ballistic vests and helmets on all response apparatus for use on active threat incidents where the fire department would be required to enter an active shooter or other potentially dangerous law enforcement incident.

SCBA Shop

The District's respiratory protection equipment is maintained in an approximately 830-square-foot room adjacent to the main warehouse floor. Two full-time Quartermaster Assistants who are also

[22] Chemical, Biological, Radioactive, Nuclear, or Explosive (CBRNE)

Scott-certified SCBA Technicians staff the shop from 7:00 am to 4:00 pm Monday through Friday and are responsible for maintaining the District's approximately 300 Scott brand SCBAs, including annual inspection and flow testing as required by TCFP, and routine maintenance and repairs. The technicians also perform annual mask fit testing for all personnel required to wear an SCBA in conformance with NFPA guidelines and TCFP regulations.

The Department also has 900 spare SCBA air cylinders that require hydrostatic testing—every five years for composite cylinders, and initially every 10 years for steel cylinders, and every five years thereafter until they reach the end of their service life (and must be replaced) as specified by the cylinder manufacturer.

The District also maintains six stationary and four mobile breathing air fill stations that are designed to provide purified compressed air at very high pressures. The four mobile compressors are on rescue units 3, 5, and 8, enabling SCBA air cylinders to be refilled at an incident. The six stationary compressors are located at stations 3, 5, 8, 10, and 11 as well as the administration building warehouse. All compressors are tested for air quality at least four times annually by a certified independent laboratory, in conformance with NFPA guidelines and TCFP regulations.

Uniforms

Some uniform components, including polo shirts, T-shirts, class A and B shirts, belts, and uniform accessories are provided by the Quartermaster Section. Uniform supplies are neatly organized in a secured room adjacent to the main warehouse floor.

New employees are sized prior to day of hire, and new uniforms ordered from the District's contract private-sector vendor and available for issue on the first day of employment. Replacement uniform components are ordered online by individual employees from the contract vendor up to their specific uniform allowance allotment. Additional uniform components above the uniform allotment can be ordered from the vendor at the employee's own expense. The contract vendor delivers the uniforms to the Quartermaster's office who then notifies the employee they are ready to be picked up.

3D.5.4 Staffing Capacity

Quartermaster Assistants are hourly employees, and Citygate's macro-level review of their workload suggests they are able to accomplish their assigned tasks and responsibilities within a normal, 40-hour workweek. The Quartermaster confirmed that his assistants are not regularly working overtime other than for emergencies, and the Section has some extra capacity for cross-training and process improvements.

All Quartermaster Assistants are cross-trained to perform the key tasks in at least one area other than their primary assignment; however, there is no redundant capability for the Quartermaster's

key functions and tasks. The current Quartermaster Section organizational structure provides no advancement opportunities and no succession plan for the Quartermaster function.

3D.5.5 Quartermaster Section Review

Citygate's review found the Quartermaster section to be very well organized, staffed, and equipped to support the District's EMS and station supplies, fire equipment, PPE, SCBA, and uniform needs.

Challenges facing the Quartermaster Section include:

- Transitioning to station personnel conducting weekly EMS and station supply inventories.
- Inadequate size of station supply storage rooms.
- Lack of adequate security for many higher-cost or sensitive inventory items.
- Warehouse floor use by other divisions disrupts workflow and facilitates drop-in visits and supply requests.
- Multiple non-integrated software applications utilized for warehouse inventory and workflow management.
- Multiple requisition portals.
- Cumbersome procurement process with no access to budget information or order status.
- Working to integrate technology into workflow processes.
- Staffing capacity as the District continues to add personnel and stations.

3D.5.6 Quartermaster Section Findings and Recommendations

Finding #69: The Quartermaster Section is very well organized, staffed, and equipped to support the District's EMS and station supplies, fire equipment, PPE, SCBA, and uniform needs.

Finding #70: All Quartermaster section personnel are cross-trained to ensure redundant capacity of all key section processes and services except for the Quartermaster position.

Finding #71: The current Quartermaster section organizational structure provides no advancement opportunities and no succession plan for the Quartermaster function.

Finding #72: Many areas of the Quartermaster section lack adequate security for higher-cost or sensitive inventory items.

Finding #73: Warehouse floor space use by other divisions disrupts Quartermaster section workflow and facilitates drop-in visits and supply requests.

Finding #74: Multiple portals are used to initiate supply requisitions.

Finding #75: Multiple non-integrated software applications are utilized for warehouse inventory and workflow management.

Finding #76: The Quartermaster Section is compliant with all TCFP regulations for personal protective equipment/clothing, self-contained breathing apparatus, breathing air, and personal alert safety systems.

Recommendation #53: The District should consider creating a Quartermaster Section second-in-command position to provide a succession development plan for the next District Quartermaster when the current incumbent retires.

Recommendation #54: The District should consider creating additional Quartermaster Section job classification(s) to provide advancement opportunities for section staff.

Recommendation #55: The District should consolidate the supply requisition process to a single portal.

Recommendation #56: The District should explore a single integrated software solution for the Quartermaster section.

Recommendation #57: The District should explore opportunities to simplify the procurement process and provide all managers with real-time budget, requisition, and order information.

SECTION 3E—OVERALL HEADQUARTERS SERVICES ASSESSMENT AND PERSONNEL RECOMMENDATIONS

3E.1 HEADQUARTERS SERVICES ASSESSMENT

3E.1.1 Headquarters Programs: Positives

- Technical support services – Dispatch, Fleet, IT, and Quartermaster
- Committed to safety
- Committed to best practices

3E.1.2 Headquarters Programs: Issues in Need of Additional Attention (Not by Priority)

- Chief officers working for two employers/agencies
- Absence of any technical office support capacity (clerical)
- No analytical staff to provide data analysis
- No formal succession plan and career development plan outside of job descriptions and promotional testing requirements

3E.1.3 Additional Staffing Capacity Needed

The following table summarizes the additional recommended staffing capacity needed for the District's headquarters support organization with suggested priority.

Table 34—Additional Recommended HQ FTE Summary

Division/Function	General Position Description	Additional Recommended FTE	Suggested Priority
Office of the Fire Chief		**4**	
Office of the Fire Chief	Senior Office Technical Support	1	1
	Senior Management Analyst	1	1
	District Chief – Professional Standards	1	3
	Clerk of the Board	1	1
Administration Division		**14**	
Administration Division Office	Mid-Level Technical Office Support	1	1
	Senior Management Analyst	1	2
	Admin. Fire Captain – SOGs / Position Descriptions	1	3
Dispatch Center	Dispatcher	4	3
Human Resources	HR Technical Specialist	3	1/2/3
	Entry-Level Technical Office Support	1	3
Information Technology	Radio Technician	1	2
	Mid-Level CAD Analyst	1	1
	Help Desk Technician	1	3
Operations Division		**7**	
Chief of Operations	Mid-Level Technical Office Support	1	1
EMS	Entry/Mid-Level Technical Office Support	1	2
Suppression	Entry/Mid-Level Technical Office Support	1	2
Health & Safety	District Chief – H&S Officer	1	2
Community Risk Reduction	Community Risk Reduction Manager	1	3
Suppression Training	Training Officer	2	2/3
Resource and Logistics		**1**	
Resource/Logistics Asst. Chief	Mid-Level Technical Office Support	1	1
	Total	**26**	

SECTION 4—STRATEGIC FISCAL REVIEW

4.1 INTRODUCTION

Essential to the long-term fiscal viability of any tax or fee-supported public agency are adequate revenues to support the expenditures needed to provide programs and services that best meet community needs and expectations. Resources and their use need to be supported by effective fiscal planning—including strong and effective budgeting practices, documented fiscal policies and procedures, adequate and delineated reserves, and managed debt.

4.2 BUDGET PROCESS

The District operates on a calendar year fiscal cycle, with a Preliminary Budget adopted by the Board of Commissioners in August as required before establishing the tax rate for the following year, and a Final Budget adopted on or before October 31 for the following budget year.

The District's budget document currently consists only of a series of spreadsheets without narrative information, charts, or graphs to assist the reader in understanding the overall goal of the spending plan. Items such as how the estimates were developed, the distinction between the functions, mission/objectives that the numbers are trying to achieve, discussion of accomplishments and issues currently faced and will be faced in the future, etc. Citygate's review finds this budget process and resultant documentation less informative than desired and not in conformance with municipal government best practices.

The Government Finance Officers Association (GFOA) recommends that government agencies strive for broader consumption and greater comprehension of their budget document. To accomplish this, a budget document consisting of the following six major sections is recommended.[23]

1. Introduction and Overview
2. Financial Structure, Policy, and Process
3. Financial Summary
4. Capital Expense and Debt
5. Departmental Information

[23] https://www.gfoa.org/materials/making-the-budget-document-easier-to-understand

6. Document-Wide Criteria (glossary and statistical/supplemental section); similar topics should be placed in the same section

Governments allocate scarce resources to programs and services through the budget process. As a result, it is one of the most important activities undertaken by governments. As the focal point for key resource decisions, the budget process is a powerful tool. The quality of decisions resulting from the budget process and the level of their acceptance depends on the characteristics of the budget process that is used.

A budget process that is well-integrated with other activities of the organization, such as the planning and management functions, will provide better financial and program decisions and lead to improved operations. A process that effectively involves all stakeholders, elected officials, administrators, employees and their representatives, citizen groups, and business leaders—and reflects their needs and priorities—will serve as a positive force in maintaining good public relations and enhancing citizens' and other stakeholders' overall impressions of the organization.

In 1995, the GFOA, a nationally recognized authority on municipal government financial operations, and seven other state and local government associations created the National Advisory Council on State and Local Budgeting (NACSLB). The NACSLB was charged with developing a set of recommended state and local government budgeting practices. With the completion of this task in December 1997, budgeting framework and recommended budget practice statements endorsed by the GFOA[24] include:

- ***Definition of the Budget Process***: The budget process consists of activities that encompass the development, implementation, and evaluation of a plan for the provision of services and capital assets.
- ***Mission of the Budget Process***: To help decision makers make informed choices about the provision of services and capital assets and to promote stakeholder participation in the process.

Key characteristics of the GFOA budget process include:

- Incorporating a long-term perspective
- Establishing linkages to broad organizational goals
- Focusing budget decisions on results and outcomes
- Involving and promoting effective communication with stakeholders; and

[24] https://www.gfoa.org/materials/making-the-budget-document-easier-to-understand

- Providing incentives to government management and employees.

Some of the recommended budget practices which, in Citygate's view, are most relevant include:[25]

- Development of a budget calendar.
- Identifying stakeholder concerns, needs, and priorities.
  - Conducting strategic planning meeting(s) prior to budget process initiation to determine the priorities/objectives of elected officials. This meeting should include input from residents as to their priorities and expectations.
- Evaluation of community conditions, external factors, opportunities, and challenges.
- Development and adoption of financial policies which can be used to achieve the overall operational goals of the agency. Examples of these policies include:
  - Stabilization (reserve) funds
  - Budget development (samples not all inclusive)
    - Revenue/expenditure projections
    - Capital needs
    - Performance measures and benchmarks
    - Use of one-time or unexpected revenues
    - Long-term fiscal planning
- Standardized department presentations to elected officials to ensure that consistent pertinent information is presented by all departments as a base to beginning the budget process.
  - Recommended information
  - Department name and division/program names
  - Actual for previous two years, revised current year, and recommended new budget year amounts by division and total department.

[25] https://www.gfoa.org/materials/recommended-budget-practices-a-framework-for-improved

- Discussion of major changes in dollars from current revised year to recommended year.
- Major accomplishments of current year
- Major goals/objectives for upcoming year
- Major issues that will need to be addressed in the upcoming year and how they will be addressed through the recommended budget.

- Maximized coordination and understanding of numbers between budget staff and respective department staff.
- Determining what level of detail elected officials require to make informed budget decisions.
- A budget review should be conducted regularly throughout the year, with a more formal and detailed review completed at least semi-annually; the mid-year review should include a review and update on budget objectives/performance measures and adjustments made accordingly.
- A budget estimate process that should not include a simple review of prior-year activity, but a review of the activity of multiple prior years to develop trend information. Additionally, known, and potential impacts that can be identified and measured should be used to develop cost estimates to include discussions with service providers, vendors, revenue generators, resource agencies, colleagues, etc.
- Development and consistent utilization of financial systems that provide information required to make sound operational decisions.
- Training of departmental budget/administrative personnel to ensure consistent knowledge and recording of financial information.
- Department meetings to gather budget needs requests from subordinate levels that should be required to justify requests and show the measurable benefits of the request; after a final decision by the department head, subordinate managers should be briefed so they understand the department's priorities and why.

4.2.1 Budget Process Findings and Recommendations

Finding #77: The District's budget document does not conform with the best practice recommendations of the Government Finance Officers Association (GFOA) by providing detailed fiscal and related information to ensure transparency of District services and communicate an overall financial picture.

Recommendation #58: The District should expand its public budget process and documentation to include additional components and information as recommended by the GFOA.

4.3 Fiscal Policies and Procedures

GFOA-recommended best practices include formal written financial policies and procedures to provide a strategic, long-term approach to financial management. Some examples of the benefits of formal financial policies include:

- Clarification of strategic intent for financial management
- Definition of financial boundaries
- Management of risks to financial condition
- Compliance with established public management best practices.

A key component of effective financial policies is systematic monitoring, reviewing, and updating. Financial policies and procedures should be monitored to ensure compliance; reviewed to ensure the policies are still relevant and meet the goals, objectives, and legal requirements of the agency; and updated at least every three years pursuant to an established review schedule.

While the District has written policies for purchases, sales, reimbursements, and capital asset definitions, responsibilities, and guidelines, it lacks a more comprehensive set of fiscal policies meeting recognized best practice recommendations for public agencies. A critical factor in achieving budget stabilization is the establishment of and compliance with comprehensive formal written financial policies and procedures. These policies should drive the fiscal activities of the District to maintain fiscal stability and health. Creation of these policies should be completed by referencing recognized industry best practices. Citygate recommends using the best practice

recommendations established by the GFOA. Financial policies should be formally adopted by the Board of Commissioners and maintained in a policy manual that guides the fiscal operations of the District.

Following are some examples of best practice financial policy recommended by the GFOA:

- Budget/forecasting
- Debt management
- Capital planning
- Economic development incentives
- Grants
- Investment
- Revenue control
- Fund balance
- Internal control.

In conjunction with fiscal policies, the District should create an accounting procedures manual that outlines financial operational procedures. The basis of financial procedures is established in the District's by-laws; however, the accounting procedures manual should provide additional specificity as to authorized procedures including:

- Purchasing
- Accounts payable (including purchasing cards)
- Cash receipt and handling
- Accounting
- Accounts receivable
- EMS billing
- Permitting
- Personnel
- Payroll

Following are excerpts from the GFOA website:

> *Every government should document its accounting policies and procedures. Traditionally, such documentation has taken the form of an accounting policies and procedures manual. Thanks to advances in technology, even more effective methods are now also available for this purpose.*
>
> *An appropriate level of management to emphasize their importance and authority should promulgate accounting policies and procedures. The documentation of accounting policies and procedures should be evaluated annually and updated periodically, no less than once every three years, according to a predetermined schedule. Changes in policies and procedures that occur between these periodic reviews should be updated in the documentation promptly as they occur. A specific employee should be assigned the duty of overseeing this process. Management is responsible for ensuring that this duty is performed consistently.*
>
> *The documentation of accounting policies and procedures should be readily available to all employees who need it. It should delineate the authority and responsibility of all employees, especially the authority to authorize transactions and the responsibility for the safekeeping of assets and records. Likewise, the documentation of accounting policies and procedures should indicate which employees are to perform which procedures. Procedures should be described as they are intended to be performed rather than in some idealized form. Also, the documentation of accounting policies and procedures should explain the design and purpose of control related procedures to increase employee understanding of and support for controls.*
>
> The GFOA website provides further details regarding the best practice recommendations and rationale.[26]

4.3.1 Fiscal Policies and Procedures Findings and Recommendations

Finding #78: While the District has some financial policies, it lacks a more comprehensive set of fiscal policies meeting recognized best practice recommendations for public agencies.

[26] http://www.gfoa.org/best-practices

Recommendation #59: The District should establish a comprehensive set of fiscal policies and accounting procedures in conformance with recommended best practices of the GFOA.

4.4 REVENUES

The District's calendar year (CY) 2023 budget reflects most of its revenue (95.5 percent) from the following sources:

- Ad valorem property taxes
- Sales tax
- EMS fees

The remaining 4.5 percent is expected from a combination of the following sources.

- Interest on investments
- Contract services
- Leases
- Insurance proceeds
- Southeast Texas Regional Advisory Council (SETRAC) *(reimbursement for regional deployments)*
- Donations
- Other miscellaneous sources

The following table summarizes General Fund revenue sources for CY 21, the most recent audited financial report.

Table 35—General Fund Revenue Summary (CY 2021)

Revenue Category	Amount Received	Percentage of Total Collected
Sales Tax	$45,209,809	57.04%
Property Tax	$25,588,906	32.29%
EMS Fees	$6,943,329	8.76%
Other	$1,516,647	1.91%
Total	**$79,258,691**	**100.00%**

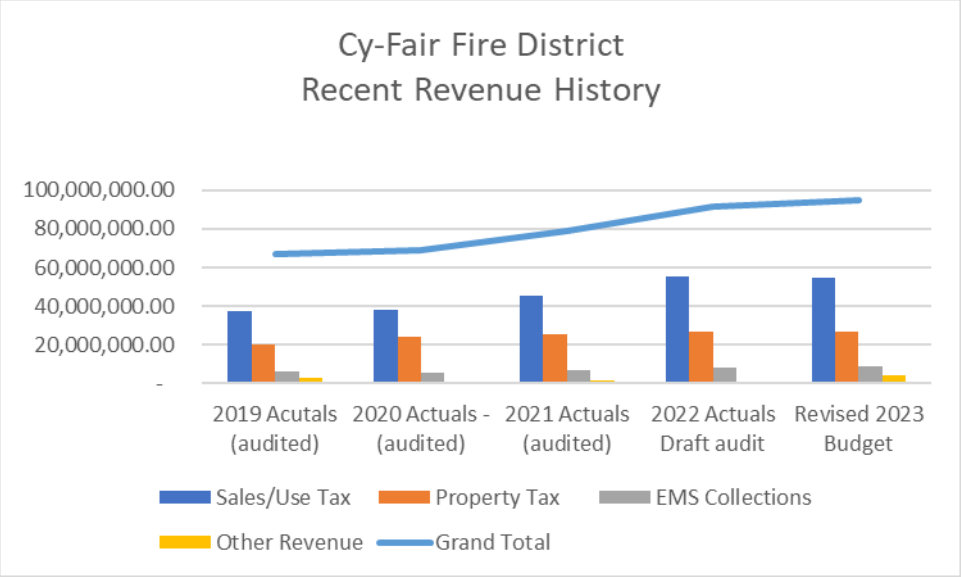
Source: McCall Gibson Swedlund Barfoot PLLC Audited Financial Report (June 23, 2022)

The following table and figure summarize actual District revenues over the most recent four years plus revised projected revenues for the current budget year. Other revenues fluctuate between CY 19 and CY 22 due to various factors such as one-time revenues related to interest earnings, insurance proceeds, and gains on sales of assets which do not repeat in future years. The large increase in CY 23 revised projected "Other" revenues is primarily caused by an anticipated increase in interest earnings.

Table 36—Recent Revenue Summary (2019–2023)

Revenue Source	2019 Audited	2020 Audited	2021 Audited	2022 Draft Audit	2023 (Revised) Projected
Property Tax	$20,133,376	$24,476,746	$25,676,223	$26,495,741	$27,022,932
Sales Tax	$37,434,321	$37,979,444	$45,209,809	$55,459,354	$54,972,377
EMS Fees	$6,253,324	$5,385,765	$6,943,329	$8,452,397	$9,084,360
Other Revenue	$3,069,069	$5,360,118	$806,776	$777,808	$4,281,644
Total Revenues	**$66,890,090**	**$73,202,073**	**$78,636,137**	**$91,185,300**	**$95,361,313**
Change	----	+9.4%	+7.4%	+15.9%	+4.6%

Figure 30—Recent Revenue Trend (2019–2023)



Property tax levies are approved by the District's Board of Commissioners in September to take effect the following calendar year. Under Texas law, property tax rates are established as follows.

- **NNR (No New Revenue) Rate** – The NNR tax rate is calculated based on the rate that when applied to the current property taxable value (excluding new property) would generate the same revenue as received in the prior year. The rate is then applied to all applicable taxable properties including new property. Calculation: Prior year tax levy revenue divided by current year net taxable value times 100.

- **Voter-Approved Rate** – The maximum tax levy that can be applied without new voter approval. The voter-approved tax rate is split into two separate sub-rates as follows.

  - **Maintenance and Operations (M&O) Tax Rate**: The M&O portion is the tax levy that is needed to raise the same amount of taxes that the taxing unit levied in the prior year plus the applicable percentage allowed by law. This rate accounts for such things as salaries, utilities, and day-to-day operations. The current, voter-approved maximum M&O tax rate is .06 per $100 assessed valuation.

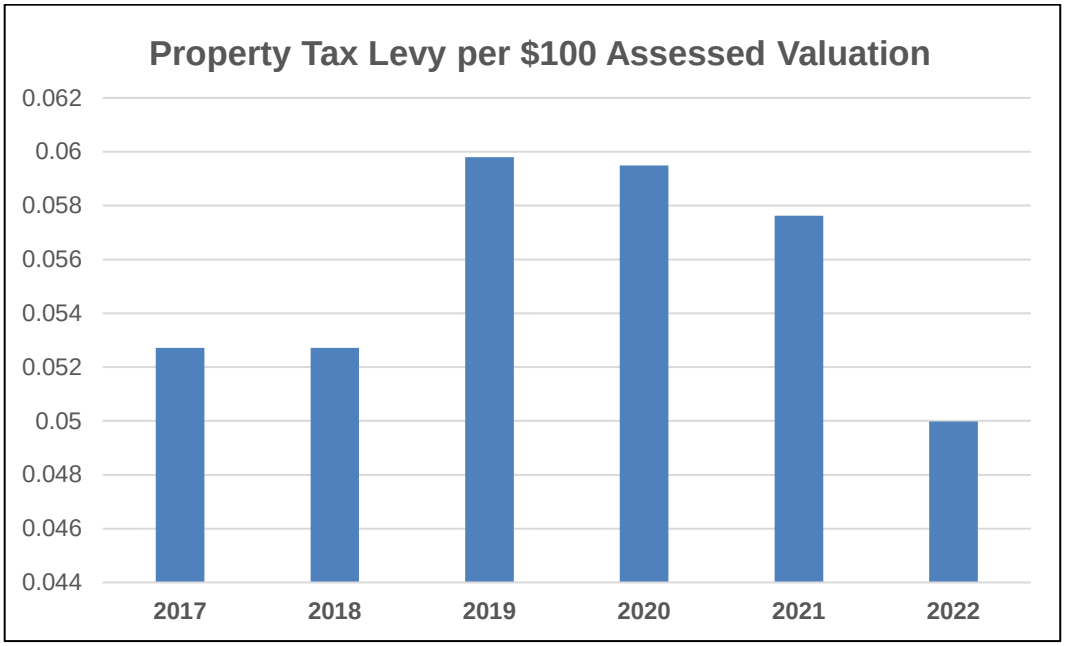
  - **Debt Rate**: The debt rate includes the debt service necessary to pay the taxing unit's debt payments in the coming year. This rate accounts for principal and interest on bonds and other debt secured by property tax revenue.

The following table reflects the District's property tax levy rates since 2017.

Table 37—Property Tax Levy History (2017–2022)

Property Tax	2017	2018	2019	2020	2021	2022
Levy per $100 property valuation	0.05271	0.05271	0.0598	0.059492	0.057628	0.049984
Change		**0.00%**	**+13.45%**	**-0.52%**	**-3.13%**	**-13.26%**

Figure 31—Property Tax Levy History (2017–2022)



Property tax revenues have averaged approximately $24.2 million for the period 2019 through 2022 (CY 22 amounts are per draft audit). Budget versus actual property tax revenue collections variances have averaged approximately 2.1 percent annually between 2019 and 2022, indicating efficient budgeting in this category. Annual growth in property tax revenues between 2020 and 2022 has averaged approximately 9.9 percent, including a CY 19 to CY 20 anomaly of approximately 21.5 percent. The average annual growth over the last couple of years has been about 4.1 percent.

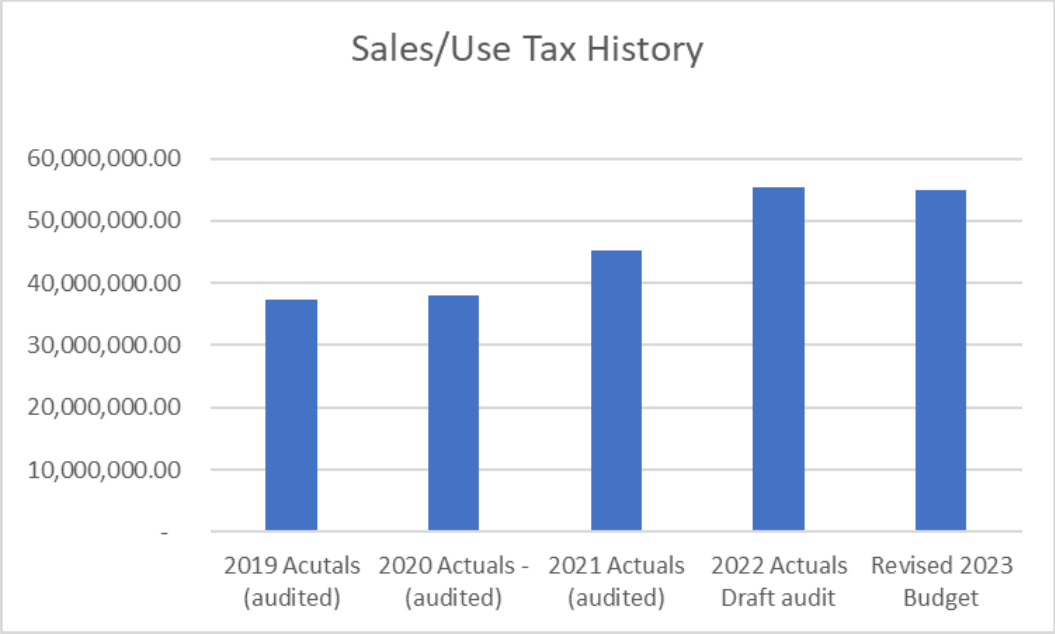
In May 2013, District voters approved a maximum 1 percent sales and use tax within the District boundaries pursuant to Chapter 775 of the Texas Health and Safety Code and Texas Tax Code. The District contracts with HdL Business Group to provide sales tax analysis and forecasting services. Based on HdL's August 2023 report, for the first half of the calendar year, construction and manufacturing represented the largest sales tax business group at approximately 41 percent of

total sales tax collections. The general retail business group is the next largest at roughly 15 percent. The District experienced significant growth in the construction and manufacturing sectors (approximately 40 percent) year over year between 2021 and 2022 but only experienced about a 2.8 percent increase in this group when comparing the first half of the 2022 and 2023 calendar years. The following table and figure summarize the District's recent sales tax revenue history.

Table 38—Sales and Use Tax History

Revenue Category	2019 Actual	2020 Actual	2021 Actual	2022 Draft Audit	2023 (Revised) Projected
Sales/Use Tax	$37,434,321	$37,979,444	$45,209,809	$55,459,354	$54,972,377
Change		**+1.46%**	**+19.04%**	**+22.67%**	**-0.88%**

Figure 32—Recent Sales Tax Revenue History



In reviewing sales tax collection activity, Citygate found that in CY 21, actual sales tax collections were approximately $45.2 million, which was about $6.7 million above budget; CY 22 draft audited actual sales tax collections were approximately $55.5 million, which was about $14.7 million above budget. Although the original CY 23 budget estimate for sales tax was only $51.7 million—an approximately 6.7 percent decrease from the prior year's actual collections—District staff has revised this original estimate to approximately $55 million to be more in-line with HdL's estimate while remaining conservative.

Given the fact that sales tax revenues represent over half of District revenues, staff should ensure that they thoroughly understand the analysis performed by HdL and the resulting sales tax revenue estimate to determine the potential impact on current and future budgets. Citygate was informed by District staff that monthly fiscal reports are provided to departments and the Commission. Citygate recommends that (if they are not included already) these monthly fiscal reports include recommended budget revisions based on current, trending information to ensure that the fiscal condition of the District is reported and understood in a timely manner. Additionally, the District should conduct a more detailed mid-year fiscal review process each year.

EMS fee revenues have been budgeted at $6 million for the past three budget years and for CY 23, yet actual collections have averaged about $6.93 million over the last three years and have grown to $6.9 and $8.5 million respectively over the last two years, as summarized in Table 39 to follow. District staff informed Citygate that the original CY 23 budget estimate was intentionally budgeted lower due to the potential of lowering EMS rates—which has not occurred but is being discussed by the Board of Commissioners. As of May 2023, the District has already collected approximately $4.2 million for this revenue source versus an annual budget estimate of $6 million, indicating that the budget estimate will again be exceeded. Consequently, District staff recommended a revised EMS collections amount of approximately $9.1 million for CY 23, which is more in-line with current trends. Conservative budget estimates, although prudent, should be based on realism to ensure effective budgeting. Citygate encourages the District to formalize the EMS fee-setting process and base future estimates on realistic and actual trends to help improve budget forecasting.

4.4.1 Revenues Findings and Recommendations

Finding #79: The District lacks a formal EMS fee-setting policy and typically budgets EMS revenue significantly lower than what is received.

Recommendation #60: The District should establish a more formal EMS fee-setting process to help improve budget forecasting. The basis for the policy should be to recover 100 percent of the full cost from third party insurance payors. Federal and state aid does not pay full cost and when combined with "cannot pay / indigent" write-offs the net collection is less than 100 percent.

Recommendation #61: Ensure that the sales tax revenue analysis and estimate from HdL Business Group is thoroughly understood to determine the potential impact on current and future budgets.

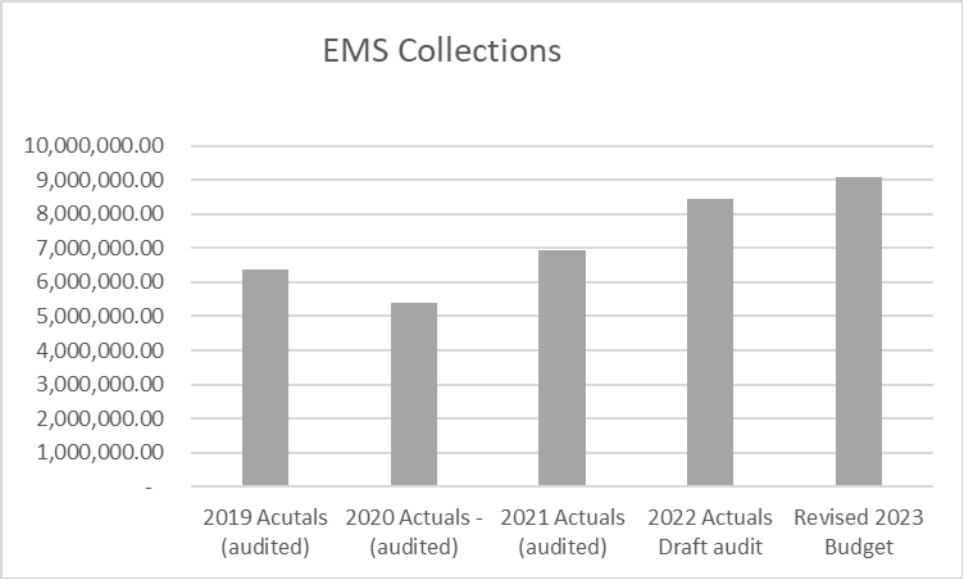
Recommendation #62: Base revenue estimates—especially sales tax and EMS collection estimates—on realistic and actual trends to improve budget forecasting.

Recommendation #63: Monthly fiscal reports should include recommended budget revisions based on current, trending information to ensure that the fiscal condition of the District is reported and understood in a timely manner. In addition, a more detailed mid-year fiscal review process should be conducted each year.

Table 39—Recent EMS Fee Revenue History

Revenue Category	2019 Actual	2020 Actual	2021 Actual	2022 Unaudited	2023 Projected
EMS Fees	$6,362,338	$5,385,764	$6,943,329	$8,452,397	$6,000,000
Change		**-15.35%**	**+28.92%**	**+21.73%**	**-29.01%**

Figure 33—Recent EMS Fee Revenue History



As Table 36 shows, nearly 58 percent of revised projected CY 23 revenue is from sales tax, while approximately 28 percent is from property tax. The remaining 14 percent is from EMS fees and other sources. Of the different revenue sources used to support local government services, secured property taxes are typically more reliable and predictable over time than sales tax revenues, but are also subject to fluctuations such as economic factors affecting property values or legislative changes. Supplemental property taxes can also fluctuate when the local market intersects with factors affecting the local/regional economy.

4.5 EXPENDITURES

The following table summarizes recent historical District expenditures by category.

Table 40—Expenditure History

Expenditure Category	2019 Actual	2020 Actual	2021 Actual	2022 Actual	2023 Revised Budgeted
Wages and Benefits	$25,236,556	$33,289,633	$36,923,444	$48,944,010	$55,700,762
Services and Supplies	$8,412,185	$11,096,544	$12,307,815	$16,314,670	$18,566,921
Capital Expense	$24,101,506	$24,427,459	$13,995,196	$14,715,729	$29,595,063
Total Expenditures	**$57,750,247**	**$68,813,636**	**$63,226,454**	**$79,974,409**	**$103,862,746**
Change		19.2%	-8.1%	26.5%	29.9%

4.5.1 Personnel Costs

Personnel costs in the above table represent unadjusted General Fund audited expenditures. The audit, however, does not segregate the expenditure categories listed in the table except for capital expense. Consequently, Citygate used 75 percent for wages and benefits and 25 percent for services and supplies respectively for the operating expenditures reflected in each audited year. This assumption is based on the CY 22 unaudited actual breakdown percentages. As the table shows, wage and benefit costs have increased nearly 94 percent from approximately $25.2 million in CY 19 to approximately $48.9 million in CY 22. This increase is due to the merger of the Volunteer Fire Department with Emergency Services District #9 in November 2019, and the additional personnel costs associated with the directive from the District Board of Commissioners to staff 13 stations within three years. For Revised CY 23, personnel costs are anticipated to be approximately 75 percent of the District's operating budget.

4.5.2 Services and Supplies Costs

As shown in Table 40, services and supplies costs have increased approximately 94 percent from approximately $8.4 million in CY 19 to approximately $16.3 million in CY 22. This increase is

also due to the merger of the Volunteer Fire Department with Emergency Services District #9 in November 2019, and the additional services and supplies costs associated with the directive to staff 13 stations within three years. For CY 23, services and supply costs are anticipated to be approximately 24.5 percent of the District's operating budget, with some of the increase due to increased training and program costs such as self-contained breathing apparatus (SCBA), information technology and communication software, and additional ambulances.

4.5.3 Capital Expense

The current process used by the District to develop and budget for capital costs involves identifying current year, subsequent year, and third year (and beyond) needs and estimated costs. During the project analysis process, Citygate was provided with a revised summary of potential future capital projects for each of the next five years. That information is included in the Fiscal Planning section of this report.

The District lacks a formal, comprehensive Capital Improvement Plan (CIP) to identify and plan for capital expenses in conformance with recognized fiscal best practice for public agencies. Capital projects tend to span multiple fiscal years and—absent a formal process to identify needs, monitor activity, and identify necessary revisions—effective identification and tracking of issues early enough to develop action plans to address resulting issues can be difficult.

GFOA best practice steps for multi-year capital planning include:[27]

- Identify needs.
- Determine fiscal impacts.
- Prioritize capital requests.
- Develop comprehensive financial plan.
- Integrate environment, social, and governance consideration in planning.

Citygate Model

Citygate has developed a CIP model that can be used by the District to identify and plan for future capital asset renewal/replacement. The model includes a recommended CIP development process and model formal document that can be used to consolidate various project costs, potential funding sources, and other pertinent project information such as project history description, using a five-year window in a single document. This CIP document includes a project cost and funding summary supported by the detail for each identified and recommended project. Samples of the CIP

[27] https://www.gfoa.org/materials/multi-year-capital-planning

process, project detail form, and project summary were provided to District staff. This CIP process and associated document can assist the District in making informed decisions to maintain strong fiscal health and stability.

The following table summarizes District capital expenditures over the past four calendar years.

Table 41—Capital Expenditure History

Capital Expense Category	2019 Actual	2020 Actual	2021 Actual	2022 Draft Audit	2023 Revised Budget
Equipment	$653,604	$662,443	$379,533	$389,337	$783,002
Facilities	$12,830,736	$13,004,261	$7,450,516	$7,642,980	$15,370,932
Vehicles	$10,617,166	$10,760,755	$6,165,147	$6,683,412	$13,441,129
Total	**$24,101,506**	**$24,427,459**	**$13,995,196**	**$14,715,729**	**$29,595,063**
Percent of Total Expenditures	**41.7%**	**35.5%**	**22.1%**	**18.4%**	**29.4%**

As was the case with overall expenditures, capital expenditures reflected in the audit do not reflect the level of detail included in the above table. Thus, Citygate applied the same categorical ratios as reflected in the District's unaudited CY 22 actual amounts to the audited amounts of prior years. District capital expenditures fluctuate based on need but have averaged (based on Citygate's assumption) approximately $19.3 million per year between CY 19 and CY 22, or approximately 29.4 percent of the District's total expenditure budget. As the table shows, a significant capital investment was made in CY 19 and CY 20 when compared to CY 21 and CY 22. The average for CYs 21 and 22 was only about $14.4 million per year. The significant increase in the CY 23 revised budget is due to new station construction and vehicle purchases bringing the percentage of the District's total expenditure budget for capital expenses to approximately 29.4 percent.

The District has a practice of budgeting capital expenditures in a calendar year even though it is unlikely that **all** anticipated capital expenditures will be made in that calendar year. Thus, a comparison of revised budgeted CY 23 expenditures to prior years' actual expenditures is not an accurate comparison; however, an encumbrance or carryover process should be used in developing the anticipated remaining capital expense in future years to reflect appropriate resource allocation.

While the District has developed informal cost and expected service life projections for vehicles and some major equipment, as previously discussed, best practices recommend a comprehensive, multiple-year CIP for all capital assets.

4.6 REVENUES VERSUS EXPENDITURES

As illustrated in the following table, annual operating revenues have historically exceeded operating expenditures by an average of approximately $28.4 million between CY 19 and CY 22. When capital expenditures are included, revenues have only exceeded expenditures by an average of approximately $9.1 million annually, primarily due to average capital expenditures of approximately $19.3 million over the same period.

The variance between the averages is due to the practice of budgeting total capital expenditures in one year (as previously discussed) and increases in operating expenses of approximately $9 million caused by the items previously discussed, with approximately $3.8 million of this increase related to the Suppression program.

Table 42—Revenue versus Expenditure History

Category	2019 Actual	2020 Actual	2021 Actual	2022 Actual	2023 Revised Budget
Revenues	$66,890,090	$73,202,073	$78,636,137	$91,185,300	$95,361,313
Operating Expenditures	$33,648,741	$44,386,177	$49,231,258	$65,258,680	$74,282,682
Surplus/(Deficit)	**$33,241,349**	**$28,815,896**	**$29,404,879**	**$25,926,620**	**$21,078,631**
Capital Expenditures	$24,101,506	$24,427,459	$13,995,196	$14,715,729	$29,595,063
Net Surplus/(Deficit)	**$9,139,843**	**$4,388.437**	**$15,409,683**	**$11,210,891**	**($8,516,432)**

4.6.1 Revenues versus Expenditures Findings and Recommendations

Finding #80: The District's annual capital expense budget does not reflect that all expenditures are not anticipated to be made in one year. This practice results in a misconception that the budget will require use of reserves in a specific year that is more than likely not the case, thus misleading the budget reader.

Recommendation #64: To improve the accuracy of the budget document and enhance long-term capital planning, the District should develop a more formal and accurate capital improvement budget process and multi-year plan that accurately estimates the actual fiscal year of the expenditure.

Recommendation #65:	The District should adopt a multifaceted revenue forecast policy that sets forth the assumptions that can be used year-over-year as a part of a comprehensive financial forecasting model.

4.7 FISCAL RESERVES

As of the CY 22 draft audit, the District reflected unassigned reserves of approximately $124.4 million. It is important to note, however, that the District currently lacks a comprehensive fiscal reserve policy in conformance with best practices for public agencies. The District does, however, have a Commission-approved investment policy that sets minimum reserve levels by category. Fiscal best practices recommend a formal written fiscal reserve policy with clearly identified fund balance and/or reserve designations as required by GASB 54. Best practice also recommends designating the goal levels and components of any unassigned fund balance reserves be included in the formal fund balance reserve policy. To make this determination, an analysis of the unassigned fund balance should be completed to determine priorities for use.

A key component of the of a best practice reserve policy is the delineation of a stabilization reserve with the goal of maintaining a certain percentage of a fund's annual operating budget for the purpose of stabilizing the delivery of services during periods of operational budget deficits. The budget stabilization reserve should include the following components as applicable:

- **Economic Uncertainty Reserve** – Minimum of 25 percent of budgeted General Fund expenses to be maintained to mitigate the effects of major economic uncertainties, local disasters, and other severe financial hardships resulting from unforeseen changes in revenues and/or expenditures.

- **Exposures Reserve** – Minimum of 2 percent of budgeted General Fund expenses for the purpose of setting aside resources for potential costs not covered by the agency's insurance programs, such as claim costs within the agency's deductibles, self-insured retentions, and major costs associated with disasters and other events that will not be reimbursable from insurance or federal and state governments.

- **Emergency Reserve** to mitigate unforeseen events not covered by the Economic Uncertainty and Exposures Reserves, e.g., events such as natural disaster expenditures of epic proportion—such as a "200-year flood" event or a catastrophic conflagration fire.

Any appropriation of these budget stabilization fund balance reserves below the minimum established level should be accompanied by findings articulating the need for the use of the reserves and a plan for the replenishment of the reserves within a reasonable time.

In addition to the budget stabilization fund balance reserve, other recommended fund balance reserve designations include:

- **Capital Project / Replacement Reserve** – Minimum of 10 percent of total anticipated five-year capital project / replacement needs. In addition to capital projects necessitated by growth or other safety concerns, setting aside funds for replacement of existing capital to strategically address these needs is an industry best practice.

- **Unassigned Reserve** is a repository for all unallocated funds not otherwise mandated in the reserve categories previously mentioned.

Appropriation or use of funds from any of these reserves, or any variance from the stipulations established within this policy, should require an action of the Board. The Board action should be accompanied by a statement of findings supporting the appropriation of reserves (or modification) and a plan for replenishing the reserve within a reasonable period when the appropriation causes a reserve to fall below minimum funding levels.

4.7.1 Fiscal Reserves Findings and Recommendations

Finding #81: The District has not established fiscal reserve policies conforming to best practice guidelines for public agencies.

Recommendation #66: The District should establish formal fiscal reserve designations with related use policies consistent with recognized fiscal best practices for public agencies.

The following table shows the District's end-of-year fund balance/reserve history from CY 19 through the CY 22 draft audit.

Table 43—Audited Fund Balance/Reserve History

Fund Balance	2019	2020	2021	2022 Draft Audit
Non-spendable		$1,402,150	$949,603	$2,056,469
Restricted				
Committed	$6,717,805			
Assigned	$5,596,134	$17,109,840	$4,112,917	
Unassigned	$85,537,813	$80,650,353	$110,132,060	$124,392,823
Total	**$94,851,752**	**$99,162,343**	**$115,194,580**	**$126,449,292**
Unassigned as a Percent of Annual Operating Expenditures	**245%**	**182%**	**224%**	**191%**

As previously discussed, the fund balance reserve policy should clearly define reserve categories and minimum balances as well as the allowable uses of the reserve. Page 15 of the District's investment policy does provide general direction in regard to reserves levels consisting of:

- **Emergency Operating Reserves** – Three months of operating expenses, excluding capital expenditures.
- **Capital Asset Replacement Reserves** – Monies set aside to replace all capital investments based on the expected life of the asset.

Besides the rationales previously discussed for the establishment of reserves, having adequate reserves help ensure long-term fiscal stability and resiliency to meet the District's operating mission. Based on both Citygate's experience and the District's current Board-approved reserve minimums, it is suggested that the District consider the following basic allocations of the unassigned/undesignated fund balance for inclusion in a formal reserve policy:

Economic Uncertainty Reserve

Minimum of 25 percent of budgeted General Fund expenditures.

In Citygate's experience, this minimum level is a general best practice. Assuming the CY 23 revised budgeted operating expenditures of approximately $74.3 million, this would equate to approximately $18.6 million—which is approximately three months of operating expenditures and is consistent with the levels required by the District's investment policy. It should be stressed that the appropriate level of General Fund reserves is determined by several factors, such as a risk assessment of the agency, including the jurisdiction's potential to experience a major disaster likely to cause longer-term impacts to revenues, such as a hurricane, tornado, or flooding. Jurisdictions with these factors should consider a higher minimum percentage.

Exposures Reserve / Emergency Reserve

Minimum of 2 percent of budgeted General Fund operating expenditures.

In Citygate's experience, this is also an appropriate reserve level for items such as large lawsuits or other legal costs that are not covered by insurance programs, in addition to major natural and other disasters. Based on revised budgeted operating expenditures, this would equate to approximately $1.5 million, or approximately 0.25 months of operating expenditures.

Capital Project / Replacement Reserve

Minimum of 10 percent of total anticipated five-year capital project / replacement needs.

Capital projects required by growth or other safety concerns, in addition to setting aside funds for replacement of existing capital to strategically address these needs, is an industry best practice. Although a capital reserve is required by the District's investment policy, it simply states that monies should be set aside to replace all capital assets based on their useful life. Per GFOA:

> *"Reserves may be used to proactively manage capital assets, for instance by annually setting aside 20% of a five-year asset's replacement costs so that funding is available when replacement is necessary. In contrast, reserves can also be available for unforeseen or catastrophic capital needs. In either case, the development and use of capital reserves should be supported by clear policies identifying how the reserve will be formed, how it may be used, and other considerations."*

However, based on Citygate's experience and discussions with District staff, 10 percent of the five-year capital costs is suggested as initial level. Per District staff, anticipated capital needs will total approximately $139 million over the next five years. Based on an initial reserve level of 10 percent, a capital project / replacement reserve would be approximately $13.9 million.

As reflected in the following table, the total reserves that would be designated—per Citygate's suggestion and based on the revised CY 23 budget—would be approximately $34 million, leaving the current fund balance of approximately $70.4 million remaining as unassigned fund balance.

Table 44—Unassigned Fund Balance Allocations

Unassigned Fund Balance Allocations	Amount
Economic Uncertainty Reserve	$18,600,000
Exposures Reserve/Emergency Reserve	$1,500,000
Capital Project/Replacement Reserve	$13,900,000
Total Committed Allocation	**$34,000,000**

4.8 DEBT

The District has no current or anticipated debt service; however, this may change subsequent to the development of a long-term CIP.

4.9 UNFUNDED OR UNDERFUNDED FISCAL LIABILITIES

Per its CY 21 final audit document, the District provides pension benefits through the Texas County and District Retirement System (TCDRS) and the Length of Service Awards Plan (LOSAP). As of CY 20, the District had over-funded its TCDRS liability by approximately $556,000; however, the LOSAP liability was approximately $17.5 million as of CY 21. The District has significant unassigned reserves which could be allocated to address these liabilities, as discussed in the previous fiscal reserve section. It must be stressed, however, that available reserves should be determined after addressing long-term operational and capital needs.

4.9.1 Unfunded or Underfunded Fiscal Liabilities Findings and Recommendations

Finding #82: The District has not fully funded its pension liability.

Recommendation #67: The District should consider utilizing available reserve funds to fully fund some or all of its anticipated pension liability as funds are available after determination of funding for long-term operating and capital needs.

4.10 FISCAL PLANNING

Conservative planning is essential; however, absent a formal plan of action that includes realistic assumptions and rationales, wide budget fluctuations can result, which indicate a fiscal situation that is unplanned and/or haphazard. While the District, at least generally and informally, forecasts future capital needs, it does not conduct any type of long-term financial forecast for operations. Completing such a forecast will help the District maintain a long-term focus on financial planning through the early identification of potential fiscal issues, providing the necessary time to develop appropriate action plans to address them.

Citygate and District staff have developed a basic financial plan model that can be used by the District to assist in maintaining a long-term focus when developing strategies and implementing financial decisions. The model includes prior years' fiscal data and operational information,

current year fiscal projections and related information, and projections for the next five years. The model is developed using Microsoft Excel and can be amended by the District as needed. Citygate has populated the model with the appropriate District general ledger accounts and District staff has formulated the initial financial assumptions based on past activity and known or anticipated future activity. Based on the assumptions input, a summary of operational results and effects on operational reserves is calculated automatically through the model.

The model was provided to District staff.

4.10.1 Fiscal Planning Findings and Recommendations

Finding #83:	The District does not currently engage in comprehensive near-term and long-range fiscal planning to ensure long-term fiscal health and sustainability consistent with recognized fiscal best practices for public agencies.

Recommendation #68:	Using the model provided to District staff, the District should establish a comprehensive near-term and long-range fiscal planning process to ensure long-term fiscal health and sustainability consistent with recognized fiscal best practices for public agencies.

4.10.2 Additional Facility Costs

Accurate and timely fiscal projections allow the District to develop a plan to maintain long-term fiscal stability and viability. Per Section 2 of this report, and based on the need for additional stations to provide improved response time performance in several areas of the District to facilitate desired outcomes for urban/suburban density communities, the following tables summarize estimated initial facility and equipment costs for a *single* new fire station facility.

Table 45—Estimated Cost for a +/- 10,000 SF 2-Bay Facility

Cost Factor	Engine Only	Engine and Ambulance
Land[1]	$1,000,000	$1,000,000
Building[2]	$5,210,000	$5,210,000
Response Apparatus[3]	$1,753,411	$2,576,268
Total	**$7,963,411**	**$8,786,268**

[1] 1.0 – 1.5-acre parcel
[2] Includes design and construction costs @ $521.00/sf
[3] Includes all equipment

Table 46—Estimated Cost for a +/- 15,000 SF 3-Bay Facility

Cost Factor	Engine Only	Engine and Ambulance	Engine and Truck	Engine, Truck, and Ambulance
Land[1]	$1,500,000	$1,500,000	$1,500,000	$1,500,000
Building[2]	$7,815,000	$7,815,000	$7,815,000	$7,815,000
Response Apparatus[3]	$1,753,411	$2,576,268	$3,853,692	$4,676,549
Total	**$11,068,411**	**$11,891,268**	**$13,168,692**	**$13,991,549**

[1] 1.0 – 1.5-acre parcel
[2] Includes design and construction costs @ $521.00/sf
[3] Includes all equipment

Table 47—Estimated Cost for a +/- 20,000 SF 4-Bay Facility

Cost Factor	Engine Only	Engine and Ambulance	Engine and Truck	Engine, Truck, and Ambulance
Land[1]	$2,000,000	$2,000,000	$2,000,000	$2,000,000
Building[2]	$10,615,000	$10,615,000	$10,615,000	$10,615,000
Response Apparatus[3]	$1,753,411	$2,576,268	$3,853,692	$4,676,549
Total	**$14,368,411**	**$15,191,268**	**$16,468,6923**	**$17,291,549**

[1] 1.0 – 1.5-acre parcel
[2] Includes design and construction costs @ $521.00/sf
[3] Includes all equipment

The following table summarizes estimated annual staffing and operations and maintenance costs by facility size.

Table 48—Estimated Annual Staffing and Operations & Maintenance Costs

Cost Factor	Engine Only	Engine and Ambulance	Engine, Truck, and Ambulance
Staffing – Full Time[1]	$1,339,352	$2,126,532	$3,534,081
Operations & Maintenance[2]	$104,443	$130,334	$138,219
Total	**$1,443,795**	**$2,256,866**	**$3,672,300**

[1] Engine and truck are four-person staffing; ambulance is two-person staffing
[2] Estimated annual cost

4.11 Overall Fiscal Evaluation

4.11.1 Initial Fiscal Forecast Model Assumptions

Revenues

Per the revised CY 23 budget recently approved by the Board, approximately 95 percent of District revenues consist of property taxes, sales taxes, and EMS collections. The following is a discussion of the forecasting revenue assumptions for the next five years developed by District staff and deemed reasonable per Citygate's review.

- **Property Taxes** – Tax base growth rate of 1 percent per year over the next five years. This assumption is based on a conservative estimate, taking into account the most recent growth activity and general interest rate environment. The NNR rate was used as a default in the model; however, District staff estimates that if the CY 23 voter-approved rate was used, approximately $4.6 million of additional revenue would result.

- **Sales Taxes** – Growth rate: 3 percent per year over the next five years, based on District sales tax consultant estimates and current and prior activity.

- **EMS Collections** – Growth rate: 2.5 percent per year over the next five years, based on conservative estimate and current and prior activity.

- **Other Revenues** – Growth rate: 1 percent per year over the next five years, based on a general conservative estimate given the de minimis nature of these revenues.

Expenditures

Per the recently revised budget estimates, operating Expenditures (wages, benefits, services, and supplies) make up approximately 72 percent of the revised CY 23 budget. The following is a discussion of the forecasting operating expenditures assumptions for the next five years developed by District staff and deemed reasonable per Citygate's review.

- **Wages and Benefits** – Growth rates: 4 percent per year for CYs 2024–26 and 3 percent per year for CYs 2027–28 for wages; 4 percent per year over the next five years for benefits; based on current labor agreements and increased staffing that will be required for District growth.

- **Services and Supplies** – Growth rate: 3 percent per year for the next five years, based on current consumer price index information.

- **Capital Expenditures**, consisting of facilities, land, and equipment-related assumptions, are identified as follows:

  - **Sustaining Capital Expenditures** – based on anticipated needs to support existing operations.

    - **2024** – $11,704,476
    - **2025** – $12,182,490
    - **2026** – $1,861,036
    - **2027** – $5,835,764
    - **2028** – $10,615,000
    - **Total** – **$42,198,766**

  - **Expansion Capital Expenditures** – based on anticipated needs to support operational expansion due to growth.

    - **2024** – $19,225,497
    - **2025** – $16,364,886
    - **2026** – $22,052,839
    - **2027** – $24,102,165
    - **2028** – $14,941,846
    - **Total** – **$96,687,233**

Total capital expenditure costs over the next five years are currently estimated at approximately $139 million. Per staff, it is assumed that the funding for these capital expenditures will come from the District's fund balance. Consequently, a minimum amount, such as the amount Citygate suggested previously, should be set aside to help ensure capital needs are addressed and to reflect prudent fiscal planning. The actual capital reserve amount should be adjusted annually as capital needs and costs are better defined.

The following table reflects the five-year operations forecast based on the assumptions previously discussed.

Table 49—Five-Year Operational Forecast

Category	2024	2025	2026	2027	2028
Revenues	$102,250,129	$94,531,237	$96,748,502	$99,025,416	$101,363,681
Operating Expenditures	$80,765,762	$84,377,874	$90,324,895	$98,478,960	$109,360,103
Surplus/(Deficit)	**$21,484,367**	**$10,153,363**	**$6,423,607**	**$546,456**	**($7,996,421)**
Capital Expenditures	$30,929,973	$28,547,376	$23,913,875	$29,937,929	$25,556,846
Net Surplus/(Deficit)	**($9,445,606)**	**($18,394,013)**	**($17,490,268)**	**($29,391,473)**	**($33,553,267)**

The following table reflects the impacts on District fund balance assuming the operational forecast activity listed in Table 49 and assuming the fund balance reserve allocations suggested by Citygate.

Table 50—Five-Year Fund Balance Forecast

Category	2024	2025	2026	2027	2028
Beginning Total Fund Balance	**$142,141,966**	**$132,696,360**	**$114,302,347**	**$96,812,079**	**$67,420,606**
Net Operating Surplus/(Deficit)	**($9,445,606)**	**($18,394,013)**	**($17,490,268)**	**($29,391,473)**	**($33,553,267)**
Ending Total Fund Balance	**$132,696,360**	**$114,302,347**	**$96,812,079**	**$67,420,606**	**$33,867,338**
Suggested Fund Balance Allocations					
Economic Uncertainty Reserve	$20,191,441	$21,094,469	$22,581,224	$24,619,740	$27,340,026
Exposures Reserve / Emergency Reserve	$1,615,315	$1,687,557	$1,806,498	$1,969,579	$2,187,202
Capital Project / Replacement Reserve	$13,888,600	$13,888,600	$13,888,600	$13,888,600	$13,888,600
Total Reserve Allocations	**$35,695,356**	**$36,670,626**	**$38,276,322**	**$40,477,919**	**$43,415,828**
Unassigned Fund Balance	**$97,001,004**	**$77,631,721**	**$58,535,757**	**$26,942,686**	**($9,548,489)**

As the table shows, the model forecasts spending down unassigned fund balance to address operational growth (including capital and maintenance of fiscally prudent fund balance reserves)

while maintaining the NNR property tax rate structure. Per the model, this methodology is sustainable until CY 28, when the unassigned fund balance will turn negative, requiring new revenues, expenditure reductions, or some combination of both. A benefit of the model is that it will assist the District in focusing on operation impacts over the long term, which will provide time to develop strategies to address the issues anticipated in CY 28 or other years. The model should also be used to test financial assumptions to gauge their long-term impacts as part of determining property tax rates. It is also designed to be dynamic and interactive, so that as the District's financial circumstances change, model assumptions can be updated to allow the District to see long-term impacts immediately.

Overall, Citygate's fiscal review finds that the District is currently fiscally sound with prudent management. However, growth-driven additional facilities and staffing will be needed to provide services meeting community needs and expectations equitably to all neighborhoods. Funding these will impact current fiscal reserves and, in the future, possibly tax rates as the type and extent of growth is better understood.

While the Commission and executive management are committed to bringing the District into high conformance with recognized public agency best practices and operational standards, doing so will require a comprehensive set of fiscal policies and accounting procedures; designated fiscal reserve funds and related policies; a comprehensive, long-range CIP; and long-range fiscal planning.

Finally, given the current and future size of what will be one of the largest non-city public service agencies in the State of Texas, Citygate further suggests that the District consider establishing a fraud prevention hotline to identify and address potential fiscal fraud.

APPENDIX A—RISK ASSESSMENT

A.1 COMMUNITY RISK ASSESSMENT

SOC ELEMENT 3 OF 8
COMMUNITY RISK ASSESSMENT

The third element of the Standards of Coverage (SOC) process is a community risk assessment. Within the context of an SOC study, the objectives of a community risk assessment are to:

- Identify the values at risk to be protected within the community or service area.
- Identify the fire and non-fire hazards with the potential to adversely impact the community or service area.
- Quantify the overall risk associated with each hazard.
- Establish a foundation for current/future deployment decisions and risk-reduction/hazard-mitigation planning and evaluation.

A hazard is broadly defined as a situation or condition that can cause or contribute to harm. 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.

A.1.1 Risk Assessment Methodology

The methodology employed by Citygate to assess community risks as an integral element of an SOC deployment analysis incorporates the following elements:

- Identification of geographic risk planning sub-zones appropriate to the community or jurisdiction.
- Identification and quantification, to the extent data is available, of the specific values to be protected within the community or service area.
- Identification of the fire and non-fire hazards to be evaluated relative to services provided by the fire agency.
- Determination of the probability of occurrence for each hazard.
- Determination of the probable impact severity of a hazard occurrence.

- Determination of overall risk by hazard using the following template.

Table 51—Overall Risk Template

Probability of Occurrence	Probable Impact Severity				
	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	*Low*	*Low*	*Low*	*Moderate*	*High*
Unlikely	*Low*	*Low*	*Low*	*Moderate*	*High*
Possible	*Low*	*Low*	*Moderate*	*High*	*Extreme*
Probable	*Low*	*Low*	*Moderate*	*High*	*Extreme*
Frequent	*Low*	*Moderate*	*High*	*Extreme*	*Extreme*

For this assessment, Citygate used the following data sources to understand the hazards and values to be protected in the Cy-Fair Fire Department (Department) service area:

- Esri and U.S. Census Bureau population and demographic data
- Department and County geographical information systems data
- Harris County Multi-Hazard Mitigation Action Plan
- Department data and information.

A.1.2 Risk Assessment Summary

Citygate's evaluation of the values at risk and hazards likely to impact the service area yields the following:

- The Department serves a diverse urban/suburban population with densities ranging from less than 1,500 to more than 11,000 people per square mile over a varied land use pattern.
- The Department's service area population is projected to increase substantially over the next decade.
- The service area has a large inventory of residential and non-residential buildings to protect.
- The Department also has significant economic and other resource values to be protected, as identified in this assessment.

- The Department and Harris County have multiple mass emergency notification options available to communicate emergency information to the public.
- The service area's risk for seven hazards related to emergency services provided by the Department range from **Low** to **High**, as summarized in the following table.

Table 52—Overall Risk by Hazard and Station Area

Hazard	Station Area						
	Sta. 1	Sta. 2	Sta. 3	Sta. 4	Sta. 5	Sta. 6	Sta. 7
Building Fire	*High*	*Moderate*	*High*	*Moderate*	*Moderate*	*High*	*Moderate*
Vegetation/Wildland Fire	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*
Medical Emergency	*High*	*High*	*High*	*High*	*High*	*High*	*High*
Hazardous Materials	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*High*	*Moderate*	*Moderate*
Technical Rescue	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Aviation Incident	*Low*	*Moderate*	*Low*	*Moderate*	*Moderate*	*Low*	*Low*
Marine Incident	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*

Hazard	Station Area					
	Sta. 8	Sta. 9	Sta. 10	Sta. 11	Sta. 12	Sta. 13
Building Fire	*High*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*High*
Vegetation/Wildland Fire	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*
Medical Emergency	*High*	*High*	*High*	*High*	*High*	*High*
Hazardous Materials	*High*	*High*	*High*	*High*	*High*	*Moderate*
Technical Rescue	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Aviation Incident	*Moderate*	*Moderate*	*Moderate*	*Low*	*Low*	*Low*
Marine Incident	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*

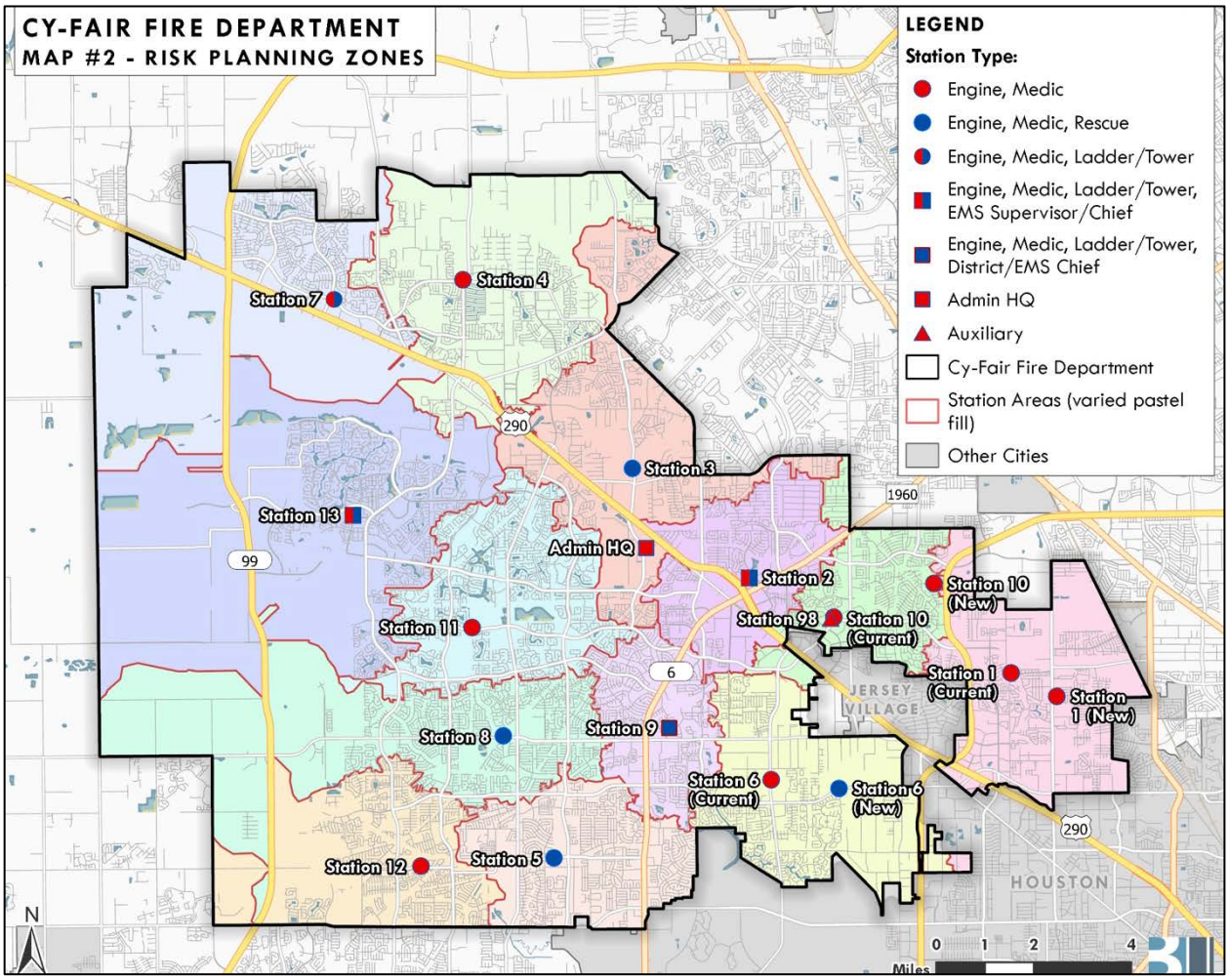
A.1.3 Risk Planning Zones

The Commission on Fire Accreditation International (CFAI) recommends that jurisdictions establish geographic risk planning zones to better understand risk at a sub-jurisdictional level. For example, portions of a jurisdiction may contain predominantly moderate-risk building occupancies, such as detached single-family residences, while other areas contain high- or maximum-risk occupancies, such as commercial and industrial buildings with a high hazard fire load. If risk were to be evaluated on a jurisdiction-wide basis, the predominant moderate risk could

outweigh the high or maximum risk and may not be a significant factor in an overall assessment of risk. If, however, those high- or maximum-risk occupancies are a larger percentage of the risk in a smaller planning zone, then it becomes a more significant risk factor.

Another consideration in establishing planning zones is that the jurisdiction's record management system must also track the specific zone for each incident to be able to appropriately evaluate service demand and response performance relative to each specific zone. For this assessment, Citygate utilized 13 planning zones corresponding with existing fire station first-due response areas, as shown on the following map.

Figure 34—Risk Planning Zones



A.1.4 Values at Risk to Be Protected

Values at risk, broadly defined, are tangibles of significant importance or value to the community or jurisdiction potentially at risk of harm or damage from a hazard occurrence. Values at risk

typically include people, critical facilities/infrastructure, buildings, and key economic, cultural, historic, and/or natural resources.

People

Residents, employees, visitors, and travelers in a community or jurisdiction are vulnerable to harm from a hazard occurrence. Particularly vulnerable are specific at-risk populations, including those unable to care for themselves or self-evacuate in the event of an emergency. At-risk populations typically include children less than 10 years of age, the elderly, people housed in institutional settings, households below the federal poverty level, and people living unsheltered. The following table summarizes key demographic data for the Department's service area.

Table 53—Key Demographic Data – Cy-Fair, TX

Demographic[1]	2022
Population	**528,948**
Under 10 years	15.60%
10 – 14 years	8.00%
15 – 64 years	67.30%
65 – 74 years	6.30%
75 years and older	2.80%
Median age	33.7
Daytime population	466,672
Housing Units	**179,599**
Owner-Occupied	68.40%
Renter-Occupied	27.10%
Vacant	4.50%
Average Household Size	3.08
Median Home Value	$245,391
Ethnicity	
White	37.50%
Black/African American	16.70%
American Indian	1.10%
Asian	11.50%
Pacific Islander	0.10%
Other / Two or More Races	33.10%
Hispanic Origin	37.90%
Diversity Index	87.5
Education (population over 24 yrs. of age)	**335,211**
High School Graduate or Equivalent	90.10%
Undergraduate Degree	40.80%
Graduate/Professional Degree	12.30%
Employment (population over 15 yrs. of age)	**276,231**
In Labor Force	96.10%
Unemployed	3.90%
Median Household Income	$91,545
Population Below Poverty Level[1]	16.40%
Disabled Population[1]	6.80%
Population without Health Insurance Coverage[1]	22.40%

Source: ESRI and U.S. Census Bureau
[1] Harris County data; no data available for ESD-9

Of note from the previous table is the following:

- Nearly 25 percent of the population is under 10 years or over 65 years of age.
- The service area population is predominantly White (38 percent), followed by Black / African American (17 percent) and Asian (11 percent), with 33 percent of the population identifying as "other" or with two or more racial identities. 38 percent of the population identifies with a Hispanic ethnicity or background.
- Of the population over 24 years of age, more than 90 percent has completed high school or equivalency.
- Of the population over 24 years of age, 41 percent has an undergraduate, graduate, or professional degree.
- Of the population 15 years of age or older, more than 96 percent is in the workforce; 4 percent are unemployed.
- Median household income is slightly more than $91,500.
- The population below the federal poverty level is 16.4 percent.
- More than 22 percent of the population does not have health insurance coverage.

Although no projected growth data specific to the Department's service area was available, the population for all of Harris County is projected to increase 15.5 percent over the next 25 years to 2048, for an annualized growth rate of approximately 0.62 percent.[28] Population growth in the 11 zip codes all or partially within the service area was 8.13 percent[29] over the past five years, or an annualized rate of approximately 2 percent. It is reasonable to assume the district will continue to experience substantial growth over the coming years, with more than 13,000 dwelling units and 283,000 square feet of commercial development currently planned, approved, or under construction, including 16 apartment complexes with nearly 4,000 total dwelling units.[30]

Buildings

The service area has nearly 180,000 residential housing units[31] and more than 14,000 businesses[32] including manufacturing, research, technology, office, professional services, retail sales,

[28] Source: Texas Demographic Center website.
[29] Source: U.S. Census Bureau.
[30] Source: Cy-Fair Fire Department.
[31] Source: Esri Community Analyst – Community Profile (2022).
[32] Source: Esri Community Analyst – Business Summary (2022).

restaurants/bars, motels, churches, schools, storage, government facilities, healthcare facilities, and other occupancy types.

Building Occupancy Risk Categories

The CFAI identifies the following four risk categories that relate to building occupancy:

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

Moderate Risk – 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 building occupancies where loss of life or property damage is limited to the single building.

High Risk – 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.

Maximum Risk – includes buildings or facilities with unusually high risk requiring an Effective Response Force (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.

Evaluation of the building inventory in the Department's service area identified 884 high/maximum-risk building uses as they relate to the CFAI building fire risk categories, as summarized in the following table.

Table 54—Building Occupancy Inventory by Risk Category

Building Occupancy Classification		Number[1]	Risk Category[2]
A-1	Assembly	11	***High***
H	Hazardous	126	***Maximum***
I	Institutional	80	***High***
R-1	Hotel/Motel	52	***High***
R-2	Multi-Family Residential	567	***High***
R-4	Assisted Living	48	***High***
	Total	**884**	

[1] Source: Cy-Fair Fire Department
[2] CFAI *Standards of Cover* (Fifth Edition)

Critical Facilities/Infrastructure

The US Department of Homeland Security defines Critical Infrastructure / Key Resources as those physical assets essential to the public health and safety, economic vitality, and resilience of a community, such as lifeline utilities infrastructure, telecommunications infrastructure, essential government services facilities, public safety facilities, schools, hospitals, airports, etc. Department staff identified 411 critical facilities and infrastructure as summarized in the following table. A hazard occurrence with significant impact severity affecting one or more of these facilities would likely adversely impact critical public or community services.

Table 55—Critical Facilities

Critical Facility Category	Number
Communications	109
Cultural/Historic	1
Education	88
Government Services	6
Other	25
Public Safety	21
Recreation	5
Transportation	8
Utility	152
Total	**411**

Source: Cy-Fair Fire Department

Economic Resources[33]

With a service area adjoining the fourth largest city in the U.S. and the largest city in Texas, and a population of more than a half million people, the Department serves a robust, diverse economy, with more than 14,000 businesses employing more than 152,000 employees in sectors including services, retail and wholesale trade, construction, healthcare and social assistance, and accommodations and food services.

Natural Resources

The service area includes multiple local/regional parks, riparian areas, bodies of water, and open spaces to protect.

[33] Source: Esri Community Analyst Business Summary (2022).

Cultural/Historic Resources

As a large, northwestern suburban area of the Houston metropolis, the Department's service area also has an inventory of cultural and historic resources to protect.

A.1.5 Hazard Identification

Citygate utilizes prior risk studies where available, fire and non-fire hazards as identified by the CFAI, and agency/jurisdiction-specific data and information to identify the hazards to be evaluated for this study. The 2020 Harris County Multi-Hazard Mitigation Action Plan (Volume 1) identifies the following ten hazards likely to impact the county:

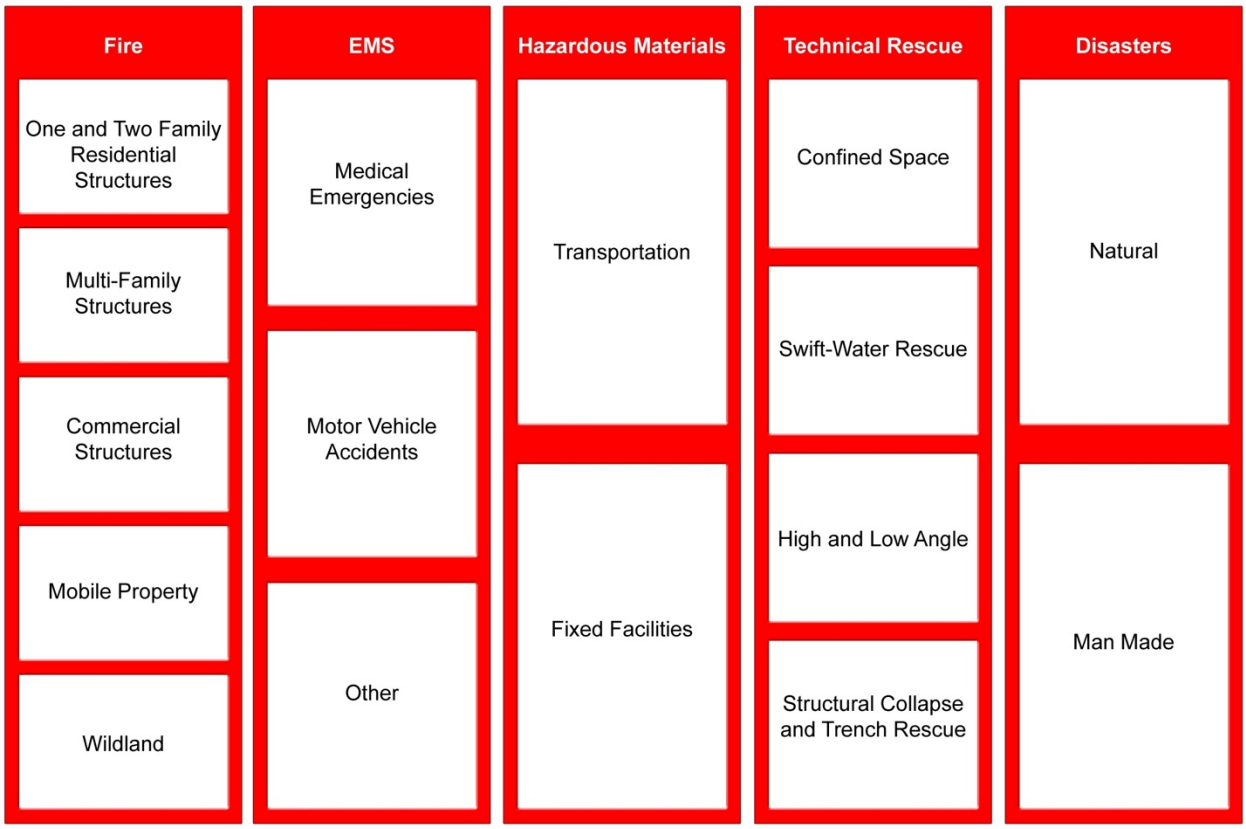
1. Coastal erosion
2. Dam/Levee failure
3. Drought
4. Earthquakes
5. Flooding
6. Hurricanes and coastal storms
7. Mass movement (landslides, sinkholes, and subsidence)
8. Severe weather
9. Tsunami
10. Wildfire

The County Multi-Hazard Mitigation Action Plan further identifies toxic release / hazardous materials and energy pipeline failure as additional hazards of concern whose risk is difficult to quantify due to a lack of data or well-established assessment parameters. The County Plan does not include any hazard data specific to Emergency Services District #9 – Cy-Fair Fire Department.

Although the Department has no responsibility to mitigate any hazards other than possibly for wildfire, it does provide services related to many hazards, including fire suppression, emergency medical services, technical rescue, and hazardous materials response.

The CFAI groups hazards into fire and non-fire categories, as shown in the following figure. Identification, qualification, and quantification of the various fire and non-fire hazards are important factors in evaluating how resources are or can be deployed to mitigate those risks.

Figure 35—Commission on Fire Accreditation International Hazard Categories



Source: CFAI *Standards of Cover* (Fifth Edition).

Subsequent to review and evaluation of the hazards identified in the Harris County Multi-Hazard Mitigation Action Plan, and the fire and non-fire hazards as identified by the CFAI as they relate to services provided by the Department, Citygate evaluated the following seven hazards for this assessment:

1. Building fire
2. Vegetation/wildfire
3. Medical emergency
4. Hazardous material release/spill
5. Technical rescue
6. Aviation incident
7. Marine Incident

A.1.6 Service Capacity and Capabilities

Service capacity refers to an agency's available response force; the size, types, and condition of its response fleet and any specialized equipment; core and specialized performance capabilities and competencies; resource distribution and concentration; availability of automatic or mutual aid; and any other agency-specific factors influencing its ability to meet current and prospective future service demand and response performance relative to the risks to be protected.

The Department's service capacity for fire and non-fire risk consists of 77 personnel on duty daily staffing 11 engines, 2 ladder/tower trucks, 2 rescues, 14 paramedic ambulances, one fire suppression District Chief, two EMS Supervisors, and one EMS District Chief, all operating from the Department's 13 fire stations.[34] The Department also has 2 tankers, 7 wildland booster engines, 9 evacuation/rescue boats, 3 evacuation transporter apparatus, 1 fire Gator, and 1 EMS Gator that can be cross-staffed and deployed as needed with on-duty or call-back personnel. Boats are deployed from stations 3, 6, 7, 8, 11, and 12, and are cross-staffed by on-duty or off-duty personnel as needed.

All response personnel are trained to one of the following levels:

- The Emergency Medical Responder (EMR) or Basic Emergency Medical Technician (EMT-Basic) level, capable of providing Basic Life Support (BLS) pre-hospital emergency medical care.
- The Intermediate Emergency Medical Technician (EMT-Intermediate) level, capable of providing some advanced pre-hospital medical interventions as authorized by the Medical Director.
- The Paramedic 1 / Paramedic 2 level, capable of providing Advanced Life Support (ALS) pre-hospital emergency medical care.

Ground ambulance transportation service is provided by the Department, and all Department EMS personnel are single-role employees providing only EMS services. Staffed fire suppression resources, including engines, ladder/towers, and rescues, also are equipped to provide BLS EMS services.

Response personnel are also trained to the US Department of Transportation Hazardous Material First Responder Operational level to provide initial hazardous material incident assessment, hazard isolation, and support for either the Harris County Fire Marshal's Office or the City of Houston Fire Department's Hazardous Material Response Team.

[34] The number of engines, rescues, and ambulances staffed varies by shift and available staffing.

All response personnel are further trained to the Confined Space Awareness level, with some personnel trained to provide rope or trench rescue, vehicle extrication, and surface/swift water rescue with a minimum of two (of three) heavy rescue units staffed daily.

A.1.7 Probability of Occurrence

Probability of occurrence refers to the probability of a future hazard occurrence over a specific time period. Because the CFAI agency accreditation process requires annual review of an agency's risk assessment and baseline performance measures, Citygate recommends using the 12 months following completion of an SOC study as an appropriate period for the probability of occurrence evaluation. The following table describes the five probability of occurrence categories and related general characteristics used for this analysis.

Table 56—Probability of Occurrence Categories

Probability	General Characteristics	Expected Frequency of Occurrence
Rare	• Hazard ***may occur*** under unusual conditions.	>10 years
Unlikely	• Hazard ***could occur*** infrequently. • No recorded or anecdotal evidence of occurrence. • Little opportunity, reason, or means for hazard to occur.	2–10 years
Possible	• Hazard ***should occur*** occasionally. • Infrequent, random recorded or anecdotal evidence of occurrence. • Some opportunity, reason, or means for hazard to occur.	3–23 months
Probable	• Hazard will ***probably occur*** regularly. • Regular recorded or strong anecdotal evidence of occurrence. • Considerable opportunity, reason, or means for hazard to occur.	2–8 weeks
Frequent	• Hazard is ***expected to occur*** frequently. • High level of recorded or anecdotal evidence of regular occurrence. • Strong opportunity, reason, or means for hazard to occur. • Frequent hazard recurrence.	Daily to weekly

Citygate's SOC assessments use recent, multiple-year incident response data to determine the probability of hazard occurrence for the ensuing 12-month period.

A.1.8 Impact Severity

Consequence severity refers to the magnitude or reasonably expected loss a hazard occurrence has on people, buildings, lifeline services, the environment, and the community as a whole. The

following table describes the five consequence severity categories and general characteristics used for this analysis.

Table 57—Consequence Severity Categories

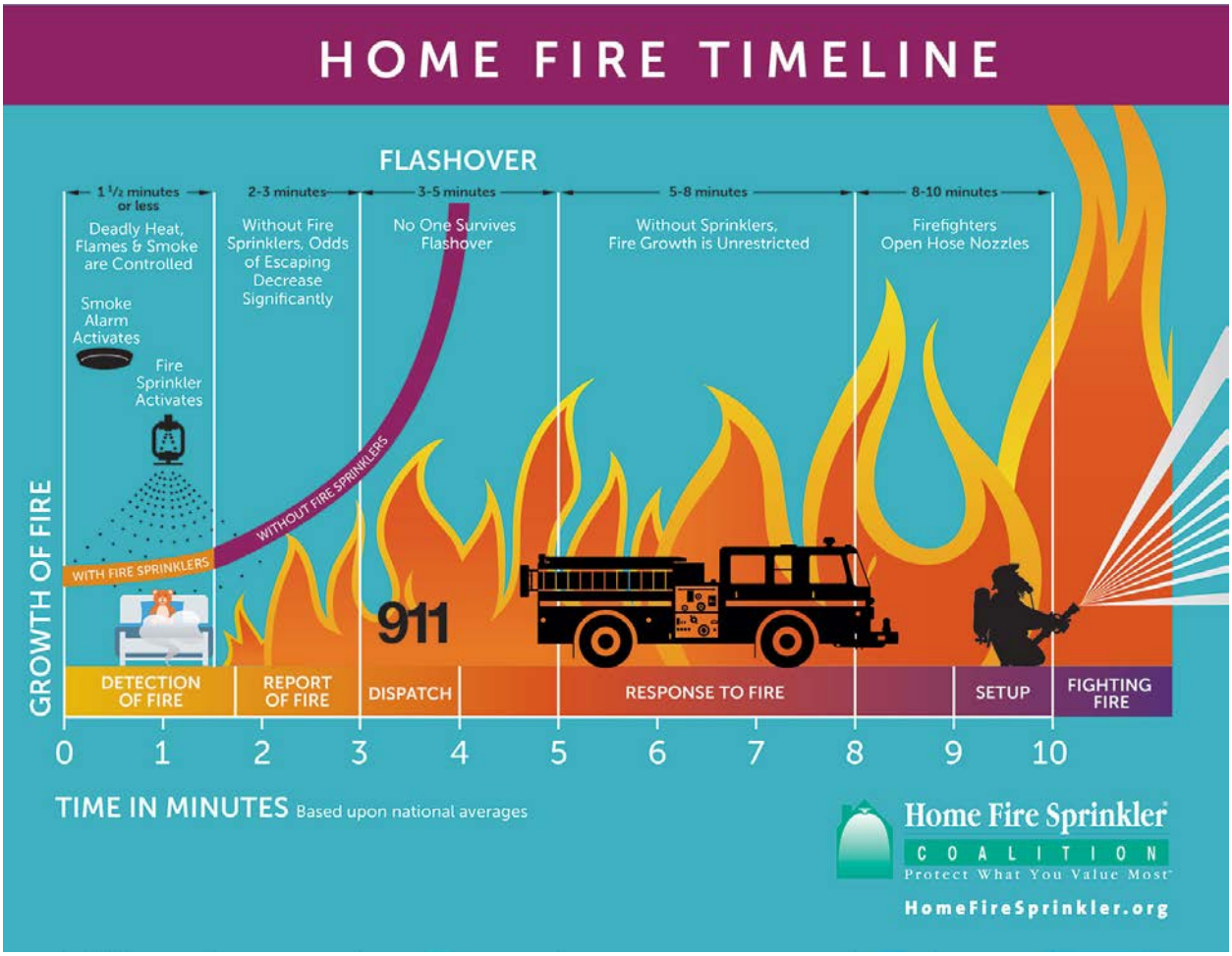
Category	General Characteristics
Insignificant	• No injuries or fatalities • Few to no persons displaced for short duration • Little or no personal support required • Inconsequential to no damage • Minimal to no community disruption • No measurable environmental impacts • Minimal to no financial loss • No wildland Fire Hazard Severity Zones (FHSZs)
Minor	• Few injuries; no fatalities; minor medical treatment only • Some displacement of persons for less than 24 hours • Some personal support required • Some minor damage • Minor community disruption of short duration • Small environmental impacts with no lasting effects • Minor financial loss • No wildland FHSZs
Moderate	• Medical treatment required; some hospitalizations; few fatalities • Localized displaced of persons for less than 24 hours • Personal support satisfied with local resources • Localized damage • Normal community functioning with some inconvenience • No measurable environmental impacts with no long-term effects, or small impacts with long-term effect • Moderate financial loss • Less than 25% of area in *Moderate* or *High* wildland FHSZ
Major	• Extensive injuries; significant hospitalizations; many fatalities • Large number of persons displaced for more than 24 hours • External resources required for personal support • Significant damage • Significant community disruption; some services not available • Some impact to environment with long-term effects • Major financial loss with some financial assistance required • More than 25% of area in *Moderate* or *High* wildland FHSZ; less than 25% in *Very High* wildland FHSZ
Extreme	• Large number of severe injuries requiring hospitalization; significant fatalities • General displacement for extended duration • Extensive personal support required • Extensive damage • Community unable to function without significant external support • Significant impact to environment and/or permanent damage • Catastrophic financial loss; unable to function without significant support • More than 50% of area in *High* wildland FHSZ; more than 25% of area in *Very High* wildland FHSZ

A.1.9 Building Fire Risk

One of the primary hazards in any community is building fire. Building fire risk factors include building size, age, construction type, density, occupancy, height above ground level, required fire flow, proximity to other buildings, built-in fire protection/alarm systems, available fire suppression water supply, building fire service capacity, fire suppression resource deployment (distribution/concentration), staffing, and response time. Citygate used available data from the Department in determining its building fire risk.

The following figure illustrates the building fire progression timeline and shows that 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, can occur as early as three to five minutes from the initial ignition. Human survival in a room after flashover is extremely improbable.

Figure 36—Building Fire Progression Timeline



Source: http://www.firesprinklerassoc.org.

Population Density

Population density within the service area ranges from less than 1,500 to more than 11,000 people per square mile. Although risk analysis across a wide spectrum of other Citygate clients shows no direct correlation between population density and building fire *occurrence*, it is reasonable to conclude that building fire *risk* relative to potential impact on human life is greater as population density increases, particularly in areas with high-density, multiple-story buildings.

Water Supply

A reliable public water system providing adequate volume, pressure, and flow duration in close proximity to all buildings is a critical factor in mitigating the potential impact severity of a community's building fire risk. Potable water within the Department's service area is provided by 110 separate Municipal Utility Districts (MUD) and, according to Department staff, available fire flow is either nonexistent or inadequate in about 25 percent of the service area—as identified on the "Tanker Streets" map. As such, 3,500-gallon water tankers are automatically included in the Department's Computer-Aided Dispatch (CAD) for fire responses in these areas. In areas with hydrants, available fire flow may not be adequate or reliable, and Department procedures also preclude the use of private (black) hydrants due to liability concerns.

Response Capacity

The following table summarizes the Department's multiple-unit ERF for various categories of building fires.

Table 58—Building Fire ERF Resources

Building Fire ERF	Effective Response Force	Total Personnel
Modified Box Alarm	2 Engines or Engine + Aerial, District Chief, Safety Officer	**8**
Full Box Alarm	3 Engines, 1 Aerial, 1 Rescue, District Chief, Safety Officer	**17**
Heavy Box Alarm	4 Engines, 1 Aerial, 1 Rescue, 2 District Chiefs, Safety Officer	**21**
Highrise	5 Engines, 2 Aerials, 1 Rescue, 3 District Chiefs, Safety Officer	**28**

Building Fire Service Demand

For the five-year period from January 1, 2018, through December 31, 2022, the Department experienced 1,097 building fire incidents comprising 0.68 percent of total service demand over the same period, as summarized in the following table.

Table 59—Building Fire Service Demand

Hazard	Year	Station							
		1	2	3	4	5	6	7	8
Building Fire	2018	23	24	12	7	14	16	11	20
	2019	25	24	15	10	19	15	9	14
	2020	21	21	11	10	28	11	5	25
	2021	17	27	17	16	14	15	6	23
	2022	15	20	14	10	18	18	10	20
	Total	**101**	**116**	**69**	**53**	**93**	**75**	**41**	**102**
Percent Total Station Demand		0.71%	0.63%	0.68%	0.51%	0.56%	0.84%	0.63%	0.60%

Hazard	Year	Station						Total	Percent Total Annual Demand
		9	10	11	12	13	Other		
Building Fire	2018	16	26	10	16	5	12	**212**	0.76%
	2019	15	20	16	15	8	7	**212**	0.73%
	2020	16	17	8	16	6	20	**215**	0.71%
	2021	17	20	13	22	9	18	**234**	0.62%
	2022	21	18	10	21	4	25	**224**	0.60%
	Total	**85**	**101**	**57**	**90**	**32**	**82**	**1,097**	**0.68%**
Percent Total Station Demand		0.66%	0.66%	0.72%	0.45%	0.67%	0.55%	6.51%	

As the table illustrates, building fire service demand varied significantly by station area, with Station 2 having the highest demand and Station 13 the lowest.

Building Fire Risk Assessment

The following table summarizes Citygate's assessment of building fire risk by station area.

Table 60—Building Fire Risk Assessment

Building Fire Risk	Station Area						
	1	2	3	4	5	6	7
Probability of Occurrence	*Probable*	*Probable*	*Probable*	*Probable*	*Probable*	*Probable*	*Possible*
Impact Severity	*Major*	*Moderate*	*Major*	*Moderate*	*Moderate*	*Major*	*Moderate*
Overall Risk	***High***	***Moderate***	***High***	***Moderate***	***Moderate***	***High***	***Moderate***

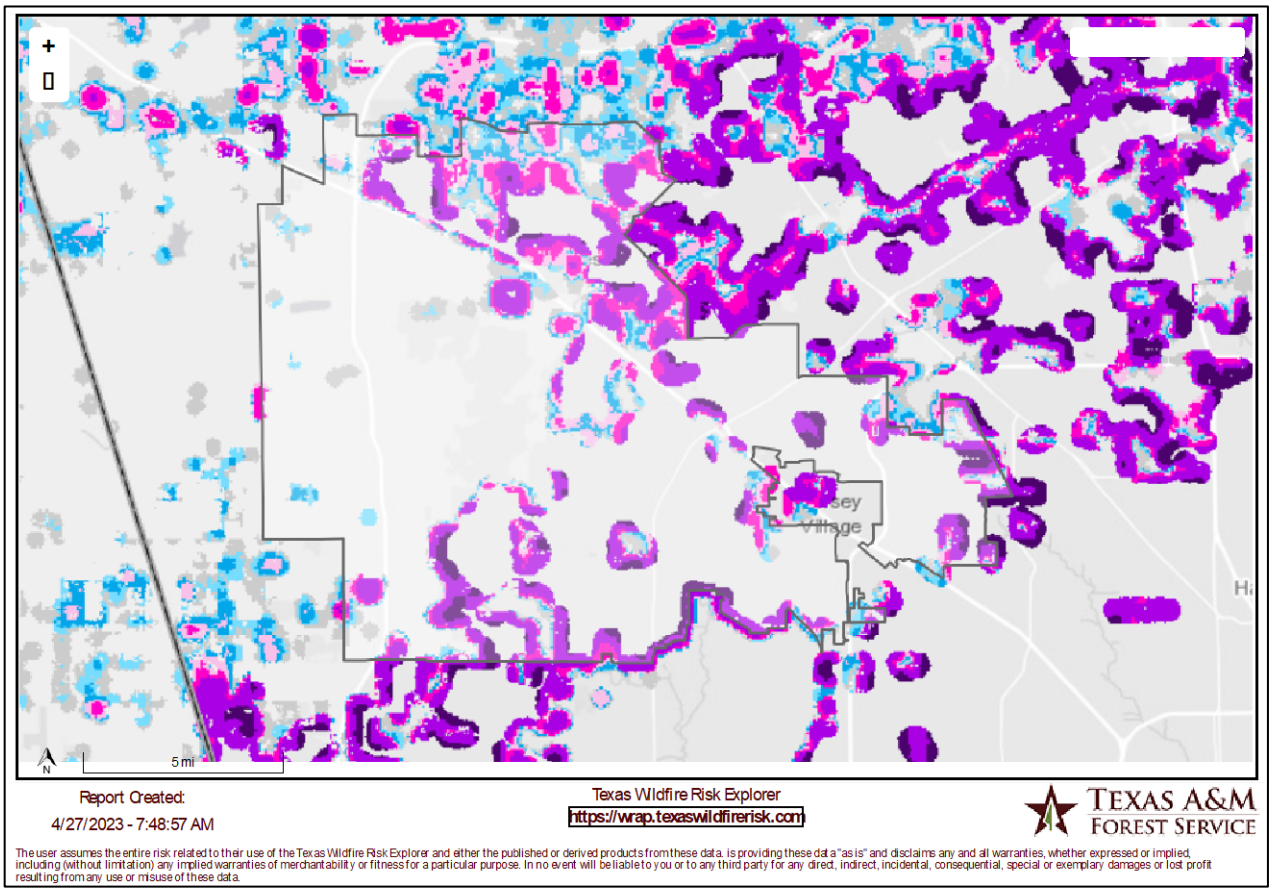
Building Fire Risk	Station Area					
	8	9	10	11	12	13
Probability of Occurrence	*Probable*	*Probable*	*Probable*	*Probable*	*Probable*	*Possible*
Impact Severity	*Major*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Major*
Overall Risk	***High***	***Moderate***	***Moderate***	***Moderate***	***Moderate***	***High***

A.1.10 Vegetation/Wildfire Risk

Vegetation/wildfire risk factors include vegetative fuel types and configuration, wildland–urban interface (WUI) areas, weather, topography, prior service demand, water supply, mitigation measures, and vegetation/wildfire response capacity.

The Texas A&M Forest Service Wildfire Risk Explorer website identifies dwelling-unit density in (or intermixed with) undeveloped wildland vegetative fuels as shown in the following map, with the darker purple color denoting densities of one dwelling unit or greater per two to three acres.[35]

Figure 37—Wildland-Urban Interface (WUI) Housing Densities



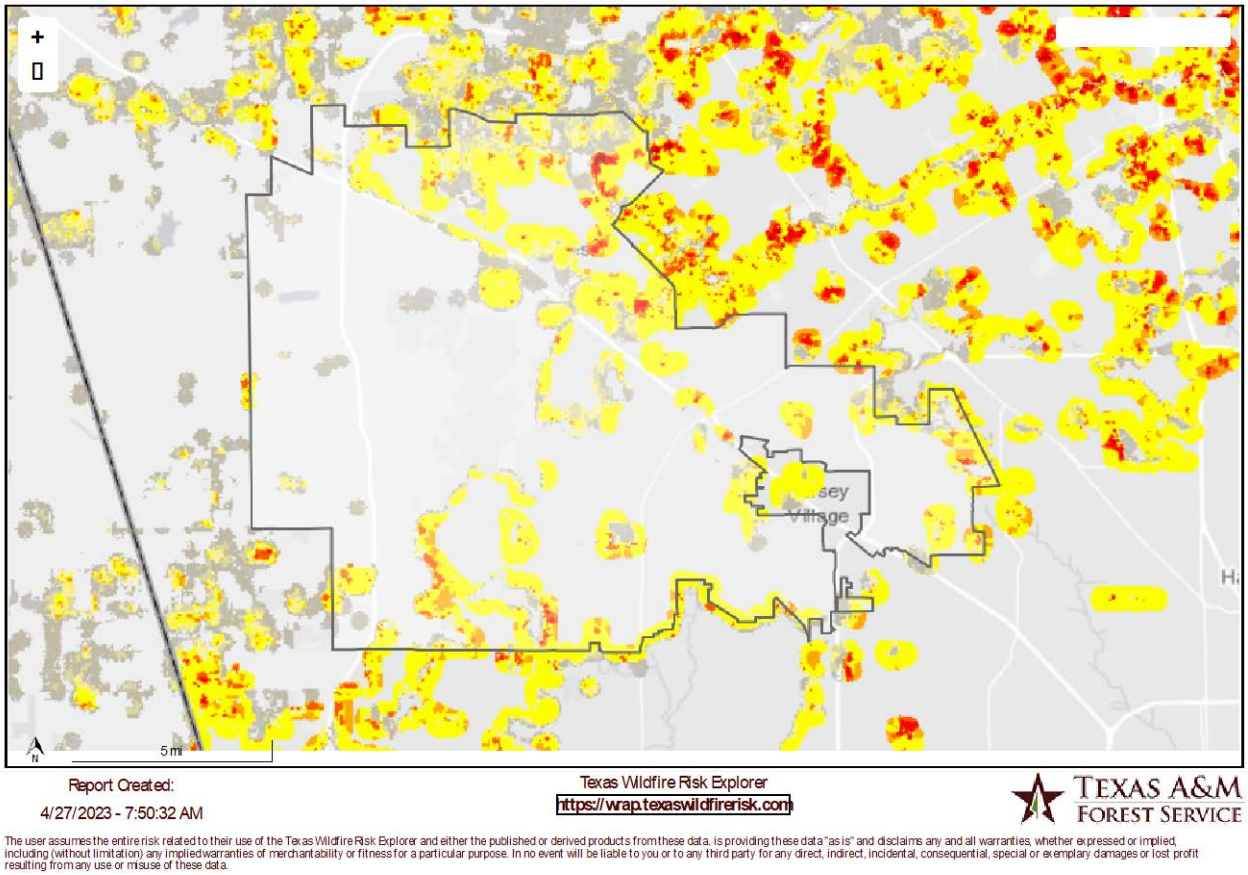
Wildfire Impacts

The Texas A&M Forest Service wildfire risk website further identifies the potential impact of a wildfire on people and homes within the service area as shown in the following map, with the

[35] Source: Texas A&M Forest Service, Texas Wildfire Risk Explorer website

yellow shades denoting moderate potential impact and the orange and red shades denoting greater potential impact.

Figure 38—Potential Wildfire Impact



Vegetative/Wildfire Fuels

Vegetative fuel factors influencing fire intensity and spread include fuel type (vegetation species), height, arrangement, density, and moisture. Vegetative fuels within the service area, in addition to decorative landscape species, consist of a mix of annual grasses and weeds, invasive species, and mixed deciduous and conifer tree species. Of particular importance is the presence of pine, red cedar, juniper, live oak, and pinyon pine species due to their potential to support passive and active crown burning. Once ignited, vegetation fires can burn intensely and contribute to rapid fire spread under the right fuel, weather, and topographic conditions.

Weather

Weather elements including temperature, relative humidity, wind, and lightning also affect vegetation/wildland fire potential and behavior. High temperatures and low relative humidity dry

out vegetative fuels, creating a situation where fuels will more readily ignite and burn more intensely. Wind is the most significant weather factor influencing vegetation/wildland fire behavior, with higher wind speeds increasing fire spread and intensity. Fuel and weather conditions most conducive to vegetation/wildfires generally occur from spring through late fall months; however, above-normal temperatures, drought, and winds can increase that period on either end.

Topography

Vegetation/wildland fires tend to burn more intensely and spread faster when burning uphill and up-canyon, except for a wind-driven downhill or down-canyon fire. The service area's flat topography has minimal impact on vegetation/wildfire behavior and spread.

Water Supply

Another significant vegetation/wildfire impact severity factor is water supply immediately available for fire suppression. As noted in the building fire risk section, potable water within the Department's service area is provided by 110 separate Municipal Utility Districts (MUD) and, according to Department staff, available fire flow is either nonexistent or inadequate in about 25 percent of the service area—as identified on the "Tanker Streets" map. As such, 3,500-gallon water tankers are automatically included in the Department's CAD for fire responses in these areas.

Wildfire Hazard Mitigation

Hazard mitigation refers to specific actions or measures taken to prevent a hazard from occurring and/or to minimize the severity of impacts resulting from a hazard occurrence. While none of the hazards subject to this study can be entirely prevented, measures *can* be taken to minimize the impacts when those hazards do occur. The Department has not undertaken any wildfire mitigation initiatives to date.

Vegetation/Wildfire Response Capacity

The following table summarizes the Department's multiple-unit ERF for vegetation/wildfires.

Table 61—Vegetation/Wildfire ERF

Fire Type	Effective Response Force	Total Staffing
Grass	1 Engine, 1 Booster	**5**
Brush	2 Engines, 1 Booster, District Chief, Safety Officer	**10**
Wildland	2 Engines, 2 Boosters, 2 Tankers, District Chief, Safety Officer	**14**

Vegetation/Wildfire Service Demand

The Department responded to 517 vegetation/wildfires over the five-year study period, comprising 0.32 percent of total service demand over the same period, as summarized in the following table.

Table 62—Vegetation/Wildfire Service Demand

Hazard	Year	Station							
		1	2	3	4	5	6	7	8
Vegetation/Wildfire	2018	17	4	10	11	8	4	7	6
	2019	4	3	7	9	6	6	7	11
	2020	7	7	5	9	4	5	12	9
	2021	14	3	4	9	2	1	3	5
	2022	27	13	9	18	11	14	10	19
	Total	**69**	**30**	**35**	**56**	**31**	**30**	**39**	**50**
Percent Total Station Demand		0.48%	0.16%	0.34%	0.54%	0.19%	0.34%	0.60%	0.30%

Hazard	Year	Station						Total	Percent Total Annual Demand
		9	10	11	12	13	Other		
Vegetation/Wildfire	2018	8	9	6	7	4	1	**102**	0.36%
	2019	3	4	6	8	9	1	**84**	0.29%
	2020	3	5	6	5	1	6	**84**	0.28%
	2021	1	1	3	5	1	1	**53**	0.14%
	2022	7	8	13	15	12	18	**194**	0.52%
	Total	**22**	**27**	**34**	**40**	**27**	**27**	**517**	**0.32%**
Percent Total Station Demand		0.17%	0.19%	0.27%	0.30%	0.46%	2.14%		

Vegetation/Wildfire Risk Assessment

The following table summarizes Citygate's assessment of vegetation/wildfire risk by station area.

Table 63—Vegetation/Wildfire Risk Assessment

Vegetation/Wildfire Risk	Station Area						
	1	2	3	4	5	6	7
Probability of Occurrence	*Probable*	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*
Impact Severity	*Minor*	*Minor*	*Minor*	*Minor*	*Minor*	*Minor*	*Minor*
Overall Risk	***Low***	***Low***	***Low***	***Low***	***Low***	***Low***	***Low***

Vegetation/Wildfire Risk	Station Area					
	8	9	10	11	12	13
Probability of Occurrence	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*
Impact Severity	*Minor*	*Minor*	*Minor*	*Minor*	*Minor*	*Minor*
Overall Risk	***Low***	***Low***	***Low***	***Low***	***Low***	***Low***

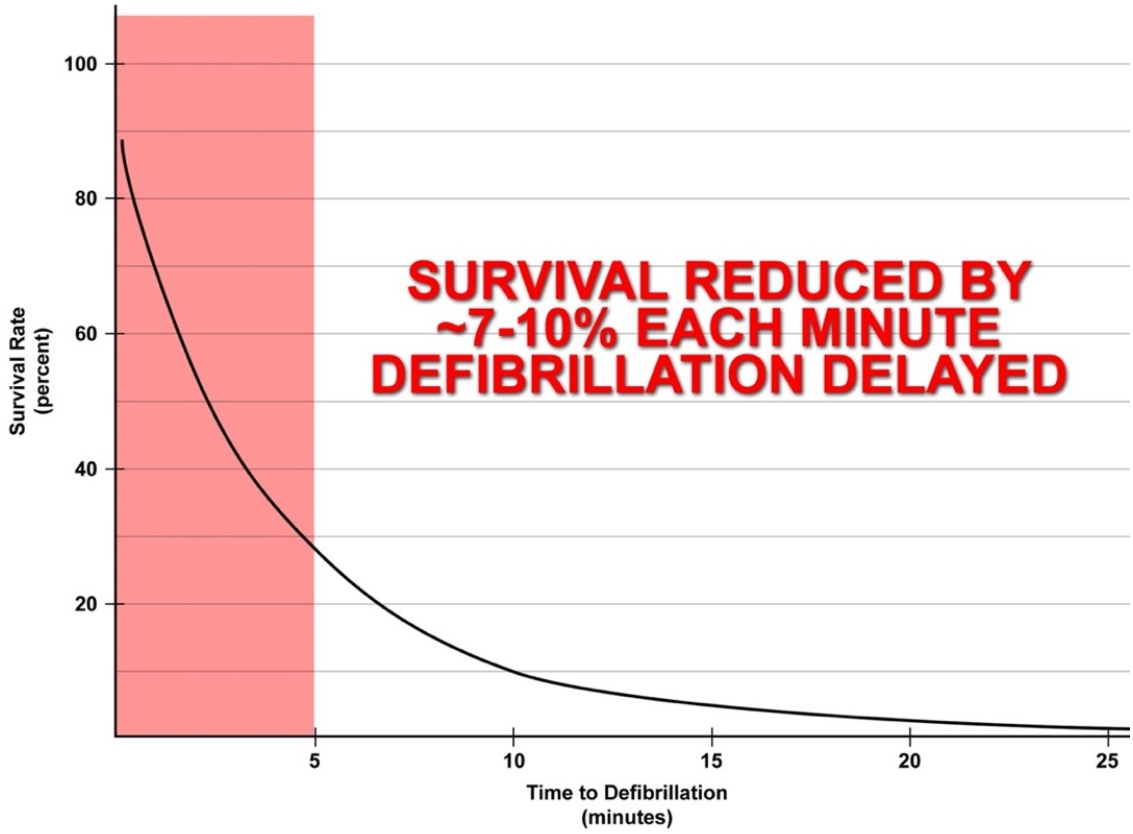
A.1.11 Medical Emergency Risk

Medical emergency risk in most communities is predominantly a function of population density, demographics, violence, health insurance coverage, and vehicle traffic.

Medical emergency risk can also be categorized as either a medical emergency resulting from a traumatic injury or a health-related condition or event. Cardiac arrest is one serious medical emergency among many where there is an interruption or blockage of oxygen to the brain.

The following figure 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 interventions.

Figure 39—Survival Rate versus Time to Defibrillation



Population Density

The service area's population density ranges from less than 1,500 to more than 11,000 people per square mile as shown in Map #2a (**Volume 2—Map Atlas**). Risk analysis across a wide spectrum of other Citygate clients shows a direct correlation between population density and the *occurrence* of medical emergencies, particularly in high urban population density zones.

Demographics

Medical emergency risk tends to be higher among older, poorer, less educated, and uninsured populations. As shown in Table 53, 9.1 percent of the service area population is 65 and older, 10 percent of the population over 24 years of age has less than a high school education or equivalent, more than 16 percent of the population is at or below poverty level, and more than 22 percent of the population does not have health insurance coverage.[36]

[36] Source: ESRI and US Census Bureau.

Vehicle Traffic

Medical emergency risk tends to be higher in those areas of a community with high daily vehicle traffic volume, particularly those areas with high traffic volume traveling at high speeds. The service area's road transportation network includes highways 6, 8, 99, and 29, with an aggregate annual average daily traffic volume of more than 373,000 vehicles.[37]

Medical Emergency Service Demand

Medical emergency service demand over the five-year study period includes nearly 116,000 calls for service comprising 71.4 percent of total service demand over the same period, as summarized in the following table.

Table 64—Medical Emergency Service Demand

Hazard	Year	Station							
		1	2	3	4	5	6	7	8
Medical Emergency	2018	1,909	2,432	1,195	1,116	2,124	1,096	686	2,234
	2019	1,773	2,478	1,262	1,325	2,211	1,175	797	2,495
	2020	1,866	2,423	1,163	1,279	2,263	1,155	799	2,353
	2021	2,297	2,894	1,490	1,592	2,745	1,264	1,069	2,799
	2022	2,439	3,145	1,603	1,752	2,862	1,418	996	2,939
	Total	**10,284**	**13,372**	**6,713**	**7,064**	**12,205**	**6,108**	**4,347**	**12,820**
Percent Total Station Demand		72.22%	72.28%	65.83%	68.57%	73.84%	68.60%	67.07%	75.97%

Hazard	Year	Station						Total	Percent Total Annual Demand
		9	10	11	12	13	Other		
Medical Emergency	2018	1,698	1,814	1,766	1,652	554	53	**20,329**	72.63%
	2019	1,777	1,981	1,678	1,775	590	96	**21,413**	73.58%
	2020	1,779	1,914	1,541	1,794	627	111	**21,067**	69.64%
	2021	2,099	2,347	1,936	2,282	921	190	**25,925**	68.98%
	2022	2,057	2,243	2,260	2,372	1,033	139	**27,258**	72.75%
	Total	**9,410**	**10,299**	**9,181**	**9,875**	**3,725**	**589**	**115,992**	**71.43%**
Percent Total Station Demand		72.52%	73.01%	71.70%	73.64%	64.07%	46.78%		

[37] Source: Texas Department of Transportation Traffic Web Viewer (2021 data).

Medical Emergency Risk Assessment

The following table summarizes Citygate's assessment of Cy-Fair's medical emergency risk by hazard sub-type.

Table 65—Medical Emergency Risk Assessment

Medical Emergency Risk	Station Area						
	1	2	3	4	5	6	7
Probability of Occurrence	*Frequent*	*Frequent*	*Frequent*	*Frequent*	*Frequent*	*Frequent*	*Frequent*
Impact Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Overall Risk	***High***	***High***	***High***	***High***	***High***	***High***	***High***

Medical Emergency Risk	Station Area					
	8	9	10	11	12	13
Probability of Occurrence	*Frequent*	*Frequent*	*Frequent*	*Frequent*	*Frequent*	*Frequent*
Impact Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Overall Risk	***High***	***High***	***High***	***High***	***High***	***High***

A.1.12 Hazardous Material Risk

Hazardous material risk factors include fixed facilities that store, use, or produce hazardous chemicals or waste; underground pipelines conveying hazardous materials; aviation, railroad, maritime, and vehicle transportation of hazardous commodities into or through a jurisdiction; vulnerable populations; emergency evacuation planning and related training; and specialized hazardous material service capacity.

Fixed Hazardous Materials Facilities

For this assessment, the Department identified 99 facilities that present significant risk, meeting Tier II reporting requirements for hazardous chemicals pursuant to the federal Emergency Planning and Community Right-to-Know Act (EPCRA) and Texas Community Right-to-Know Act (TCRA). In addition, high-pressure natural gas distribution pipelines are located throughout the service area.

Transportation-Related Hazardous Materials

The service area also has transportation-related hazardous material risk due to its road transportation network that includes highways 6, 8, 99, and 29, with an aggregate annual average

daily traffic volume of more than 373,000 vehicles daily including traffic from large trucks, some of which transport hazardous materials.

The service area also has transportation-related hazardous material risk due to multiple train movements into and through the service area daily, some of which are transporting hazardous commodities.

Population Density

Because hazardous material emergencies have the potential to adversely impact human health, it is logical that the higher the population density, the greater the potential population exposed to a hazardous material release or spill. As shown in Map #2b (**Volume 2—Map Atlas**), the service area population density ranges from less than 1,500 to more than 11,000 people per square mile.

Vulnerable Populations

Persons vulnerable to a hazardous material release/spill include those individuals or groups unable to self-evacuate, generally including children under the age of 10, the elderly, and persons confined to an institution or other setting where they are unable to leave voluntarily.

Emergency Evacuation Planning, Training, Implementation, and Effectiveness

Another significant hazardous material impact severity factor is a jurisdiction's shelter-in-place / emergency evacuation planning and training. In the event of a hazardous material release or spill, time can be a critical factor in notifying potentially affected persons, particularly at-risk populations, to either shelter-in-place or evacuate to a safe location. Essential to this process is an effective emergency plan that incorporates one or more mass emergency notification capabilities, as well as pre-established evacuation procedures. It is also essential to conduct regular, periodic exercises involving these two emergency plan elements to evaluate readiness and to identify and remediate any planning and/or training gaps to ensure ongoing emergency incident readiness and effectiveness.

Harris County has a free subscription mass emergency notification system (Ready Harris) to provide emergency alerts, notifications, and other emergency information to email accounts, cell phones, smartphones, tablets, and landline telephones. The Department's chief officers can request an emergency alert through the Harris County Sheriff's Office. The Ready Harris website includes emergency preparation information and current emergency alerts, and the Department also utilizes social media to communicate emergency information to the public. Harris County has established emergency evacuations zones and evacuation routes accessible through the Ready Harris website.

The Department also maintains a Department Operations Center (DOC) to manage large-scale emergencies at its Administrative Headquarters facility. This facility also includes a full backup dispatch center.

Hazardous Material Service Demand

The Department experienced nearly 3,000 hazardous material incidents over the five-year study period, comprising 1.83 percent of total service demand over the same period, as summarized in the following table.

Table 66—Hazardous Material Service Demand

Hazard	Year	Station							
		1	2	3	4	5	6	7	8
Hazardous Material	2018	44	43	38	38	56	45	29	68
	2019	44	35	30	31	58	36	17	66
	2020	35	50	43	26	67	38	16	49
	2021	49	30	41	34	61	42	23	70
	2022	44	33	36	40	75	46	30	114
	Total	**216**	**191**	**188**	**169**	**317**	**207**	**115**	**367**
Percent Total Station Demand		1.52%	1.03%	1.84%	1.64%	1.92%	2.32%	1.77%	2.17%

Hazard	Year	Station						Total	Percent Total Annual Demand
		9	10	11	12	13	Other		
Hazardous Material	2018	52	30	40	45	26	0	**554**	1.98%
	2019	33	34	45	49	23	0	**501**	1.72%
	2020	50	33	31	44	27	2	**511**	1.69%
	2021	59	61	66	76	41	2	**655**	1.74%
	2022	58	61	66	102	40	5	**750**	2.00%
	Total	**252**	**219**	**248**	**316**	**157**	**9**	**2,971**	**1.83%**
Percent Total Station Demand		1.94%	1.55%	1.94%	2.36%	2.70%	0.71%		

As the table shows, hazardous material service demand increased slightly more than 35 percent over the five-year study period including a 14.5 percent increase in 2022 from the previous year.

Hazardous Materials Risk Assessment

The following table summarizes Citygate's assessment of hazardous material risk by station area.

Table 67—Hazardous Material Risk Assessment

Hazardous Material Risk	Station Area						
	1	2	3	4	5	6	7
Probability of Occurrence	*Probable*	*Probable*	*Probable*	*Probable*	*Frequent*	*Probable*	*Probable*
Impact Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Overall Risk	***Moderate***	***Moderate***	***Moderate***	***Moderate***	***High***	***Moderate***	***Moderate***

Hazardous Material Risk	Station Area					
	8	9	10	11	12	13
Probability of Occurrence	*Frequent*	*Frequent*	*Frequent*	*Frequent*	*Frequent*	*Probable*
Impact Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Overall Risk	***High***	***High***	***High***	***High***	***High***	***Moderate***

A.1.13 Technical Rescue Risk

Technical rescue risk factors include active construction projects; structural collapse potential; confined spaces, such as tanks and underground vaults; industrial machinery use; transportation volume; and natural hazard potential including earthquake, flood, hurricane, landslide, tornado, and tsunami.

Construction Activity

There is continual residential, commercial, industrial, and infrastructure construction activity occurring within the service area.

Confined Spaces

There are numerous confined spaces within the service area, including tanks, vaults, open trenches, etc.

Transportation Volume

Another technical rescue risk factor is transportation-related incidents requiring technical rescue. This risk factor is primarily a function of vehicle, railway, maritime, and aviation traffic. Vehicle traffic volume is the greatest of these factors within the service area, with highways 6, 8, 99, and 290 having an aggregate annual average daily traffic volume of more than 373,000 vehicles. There are also multiple daily train movements within the service area.

Natural Hazard Potential[38]

The 2020 Harris County Multi-Hazard Mitigation Action Plan identifies earthquakes, flooding, hurricanes, coastal storms, and severe weather as the natural hazards most likely to impact the County relative to probability of occurrence, geographic area affected, and probable extent.

Technical Rescue Service Demand

The Department responded to 374 technical rescue incidents over the five-year study period, comprising 0.23 percent of total service demand for the same period, as summarized in the following table.

Table 68—Technical Rescue Service Demand

Hazard	Year	Station							
		1	2	3	4	5	6	7	8
Technical Rescue	2018	5	5	7	4	6	7	4	4
	2019	5	14	5	3	7	1	10	7
	2020	4	9	3	7	7	4	7	3
	2021	5	15	8	2	5	6	2	6
	2022	11	11	10	6	6	5	2	6
	Total	**30**	**54**	**33**	**22**	**31**	**23**	**25**	**26**
Percent Total Station Demand		0.21%	0.29%	0.32%	0.21%	0.19%	0.26%	0.39%	0.15%

Hazard	Year	Station						Total	Percent Total Annual Demand
		9	10	11	12	13	Other		
Technical Rescue	2018	11	4	5	8	3	1	**74**	0.26%
	2019	2	7	6	5	3	3	**78**	0.27%
	2020	2	2	5	6	7	0	**66**	0.22%
	2021	3	3	15	8	3	0	**81**	0.22%
	2022	4	3	3	2	4	2	**75**	0.20%
	Total	**22**	**19**	**34**	**29**	**20**	**6**	**374**	**0.23%**
Percent Total Station Demand		0.17%	0.13%	0.27%	0.22%	0.34%	0.48%		

[38] Source: 2020 Harris County Multi-Hazard Mitigation Action Plan.

As the table shows, technical rescue service demand was very low and consistent over the five-year study period.

Technical Rescue Risk Assessment

The following table summarizes Citygate's assessment of technical rescue risk by station area.

Table 69—Technical Rescue Risk Assessment

Technical Rescue Risk	Station Area						
	1	2	3	4	5	6	7
Probability of Occurrence	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*
Impact Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Overall Risk	***Moderate***	***Moderate***	***Moderate***	***Moderate***	***Moderate***	***Moderate***	***Moderate***

Technical Rescue Risk	Station Area					
	8	9	10	11	12	13
Probability of Occurrence	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*
Impact Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Overall Risk	***Moderate***	***Moderate***	***Moderate***	***Moderate***	***Moderate***	***Moderate***

A.1.14 Aviation Incident Risk

Aviation Incident Risk Factors

Aviation incident risk factors include commercial, passenger, and general aviation facilities and aircraft activity into, from, and over the service area.

Airports

The only airport within the service area is Dry Creek Airport, located in the north-central section of the service area on the east side of Skinner Road north of U.S. Route 290. It is a privately owned grass strip general aviation airport with limited aircraft activity restricted to use by Dry Creek Estate homeowners. The West Houston Airport is a privately owned public use general aviation facility with approximately 300 aircraft operations daily and is located just south of the service area—approximately 3.8 miles south of Station 5.[39] David Wayne Hooks Memorial Airport—located approximately 16 miles northeast of the service area near Tomball on the south side of

[39] Source: West Houston Airport website.

State Route 99 east of State Route 249—is the largest general aviation facility in Texas, with two asphalt runways, an FAA control tower, and more than 275,000 aircraft operations annually.

Aviation Incident Service Capacity

The Department has no aviation-specific service capacity beyond its daily all-risk response capacity as described in Section A.1.6.

Aviation Incident Service Demand

There were 13 aircraft-related incidents over the five-year study period comprising 0.01 percent of total service demand for the same period, as summarized in the following table.

Table 70—Aviation Incident Service Demand

Hazard	Year	Station							
		1	2	3	4	5	6	7	8
Aviation Incident	2018	0	0	0	0	0	0	0	1
	2019	0	0	0	0	0	0	0	0
	2020	0	0	0	0	0	0	0	0
	2021	0	2	0	0	0	0	0	0
	2022	0	0	0	2	1	0	0	0
	Total	**0**	**2**	**0**	**2**	**1**	**0**	**0**	**1**
Percent Total Station Demand		0.00%	0.01%	0.00%	0.02%	0.01%	0.00%	0.00%	0.01%

Hazard	Year	Station						Total	Percent Total Annual Demand
		9	10	11	12	13	Other		
Aviation Incident	2018	1	1	0	0	0	0	**3**	0.01%
	2019	0	1	0	0	0	0	**1**	0.00%
	2020	0	0	0	0	0	1	**1**	0.00%
	2021	2	0	0	0	0	1	**5**	0.01%
	2022	0	0	0	0	0	0	**3**	0.01%
	Total	**3**	**2**	**0**	**0**	**0**	**2**	**13**	**0.01%**
Percent Total Station Demand		0.02%	0.01%	0.00%	0.00%	0.00%	0.16%		

Aviation Incident Risk Assessment

The following table summarizes Citygate's assessment of aviation incident risk by station area.

Table 71—Aviation Incident Risk Analysis

Aviation Incident Risk	Station Area						
	1	2	3	4	5	6	7
Probability of Occurrence	*Unlikely*	*Possible*	*Unlikely*	*Possible*	*Possible*	*Unlikely*	*Unlikely*
Impact Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Overall Risk	***Low***	***Moderate***	***Low***	***Moderate***	***Moderate***	***Low***	***Low***

Aviation Incident Risk	Station Area					
	8	9	10	11	12	13
Probability of Occurrence	*Possible*	*Possible*	*Possible*	*Unlikely*	*Unlikely*	*Unlikely*
Impact Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Overall Risk	***Moderate***	***Moderate***	***Moderate***	***Low***	***Low***	***Low***

A.1.15 Marine Incident Risk

Marine incident risk factors include open water and near-shore recreational activities and watercraft storage and use in or on waterways within the service area.

Bodies of Water/Waterways

The service area has numerous small bodies of water and waterways including Addicks and Barker Reservoirs and Bear Creek Park.

Boating and Recreational Activity

Several newer residential developments within the service area have man-made lakes with private boat docks and water-based recreational activities.

Marine Incident Service Demand

Over the five-year study period, there were 12 marine incidents comprising 0.01 percent of total service demand, as summarized in the following table.

Hazard	Year	Station							
		1	2	3	4	5	6	7	8
Marine Incident	2018	0	0	0	0	0	0	0	0
	2019	0	0	0	0	0	0	1	0
	2020	0	0	0	1	1	1	0	0
	2021	0	1	0	0	0	0	1	1
	2022	0	0	1	0	0	0	1	0
	Total	**0**	**1**	**1**	**1**	**1**	**1**	**3**	**1**
Percent Total Station Demand		0.00%	0.01%	0.01%	0.01%	0.01%	0.01%	0.05%	0.01%

Hazard	Year	Station						Total	Percent Total Annual Demand
		9	10	11	12	13	Other		
Marine Incident	2018	0	0	0	0	1	0	**1**	0.00%
	2019	0	0	0	0	0	0	**1**	0.00%
	2020	0	0	0	0	0	0	**3**	0.01%
	2021	1	0	0	0	0	0	**4**	0.01%
	2022	0	0	0	0	1	0	**3**	0.01%
	Total	**1**	**0**	**0**	**0**	**2**	**0**	**12**	**0.01%**
Percent Total Station Demand		0.01%	0.00%	0.00%	0.00%	0.03%	0.00%		

Marine Incident Risk Assessment

The following table summarizes Citygate's assessment of marine incident risk by station area.

Marine Incident Risk	Station Area						
	1	2	3	4	5	6	7
Probability of Occurrence	*Unlikely*	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*
Impact Severity	*Minor*	*Minor*	*Minor*	*Minor*	*Minor*	*Minor*	*Minor*
Overall Risk	***Low***	***Low***	***Low***	***Low***	***Low***	***Low***	***Low***

Marine Incident Risk	Station Area					
	8	9	10	11	12	13
Probability of Occurrence	*Possible*	*Possible*	*Unlikely*	*Unlikely*	*Unlikely*	*Possible*
Impact Severity	*Minor*	*Minor*	*Minor*	*Minor*	*Minor*	*Minor*
Overall Risk	***Low***	***Low***	***Low***	***Low***	***Low***	***Low***