EAST PIERCE FIRE & RESCUE

Community Risk Assessment: Standards of Cover

January 2023

"Where Compassion and Action Meet"

East Pierce Fire & Rescue
Standard of Cover Study

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2 Introduction

This document reports on a Standard of Cover analysis [17] describing the environment, operations, challenges and opportunities facing East Pierce Fire-Rescue (EPFR), serving Washington State's Pierce County Fire Protection District #22 (FPD#22). The report represents the results of six months' collaborative effort between EPFR members and command staff and technical and strategic consultants from Levrum, Inc. of Corvallis, Oregon.

2.1 Glossary of Terms

Acceptable Risk: A level of risk that is recognized, known, and accepted by the authority having jurisdiction (AHJ). This is developed based upon local needs and conditions as the cost of implementing effective risk reduction exceeds the likely loss.

Adopted: To formally accept and implement.

Alarm (Call) Answering Time: A measure of the time interval between when an emergency phone call begins alerting the Public Safety Answering Point (PSAP) and when the call is answered by dispatch personnel.

Alarm (Call) Processing Time: A measure of the time interval between when a dispatcher answers an emergency call and when the fire station or units in the field are alerted to the incident.

Alarm (Call) Transfer Time: A measure of the time interval between when an emergency phone call is answered by a primary PSAP and then transferred to a secondary PSAP.

Apparatus: A general term for fire units to include engines, trucks, and medic units that are needed for a particular activity or purpose.

Authority Having Jurisdiction (AHJ): The government body (Board of Directors, City Council, Board of Supervisors) responsible for the adherence to policies and by-laws permitting the actions of the agency.

Area of Responsibility (AOR): a geographical area for which an entity has primary response duty. The entity can be a fire department/district or a single station. In the case of a station, an AOR is may also be called a "station district" or "first due area."

Base Year: For this study, the most recent complete year for which incident and response data was available, running from 1-Jun-2021 to 31-May-2022.

Baseline: A measure of actual performance to meet the agency's goals and objectives. This measure is based upon data analysis and critical observations.

Benchmark: A goal or target that can be measured and compared to the baseline. This objective comparison is used to support and quantify excellent performance.

Call: a synonym for "Incident" (see below).

Capabilities: An assessment of fire and emergency services including trained personnel, equipment, apparatus, and fixed facilities to respond and mitigate incidents. The assessment of the availability and reliability of critical public infrastructure such as water supply and road network.

Capacity: An examination of the infrastructure's ability to handle incidents. This includes the road network, water supply and space needed to mitigate incidents.

Commission on Fire Accreditation International (CFAI): An all-hazard, quality improvement model based on risk analysis and self-assessment that promotes the establishment of community-adopted performance targets for fire and emergency service agencies.

Community Risk Assessment (Analysis): An objective appraisal of a community's fire, rescue, and emergency threats. The appraisal accounts for all relevant facts that impact risk to identify an agency's standard of cover.

Concentration: The geographic spacing of resources so that an effective response force can arrive within time frames defined in performance expectations.

Consequence Assessment: The study of potential impacts or loss that a response area or community could experience.

Crew: All personnel on an apparatus who will perform critical tasks to mitigate an incident.

Critical Tasks (Critical Tasking): The evaluation and process to assign resources to specific tasks to mitigate a fire, rescue, hazardous materials, or EMS incidents.

Deployment: The placement of resources to mitigate emergencies. Deployment includes personnel, apparatus, and fire stations.

Distribution: The geographical location of personnel and apparatus for initial intervention. Expressed as a measure of time from fire stations.

Effective Response Force (ERF): The minimum amount of personnel and apparatus that must reach an emergency in the maximum defined total response time and is capable of intervention on any all-risk hazard. The ERF is derived from the community risk assessment and critical tasking analysis and will vary according to the needs of each type of incident

Geographic Planning Zone: Any organized response area by size. A geographic planning zone could be defined by fire station zones, census tracts, square miles, or target hazards.

Incident: an event to which a fire/EMS agency is called to respond.

Interval: The duration elapsed between two milestones in the progression of an incident.

Level of Service: The type and amount of service that the AHJ has established to meet the community's needs. Levels of service should be determined through an objective and documented process considering the community's risk and the ability to fund the services.

Milestone: The time at which a specified event occurred during the progression of an event, e.g., a specific unit being dispatched to the incident, departing for the incident or arriving at the incident scene.

National Fire Protection Association (NFPA): A global self-funded nonprofit organization, established in 1896, devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. NFPA sets relevant standards and codes to fulfill its mission.

Outcomes: Results that follow an applied activity.

Percentile: A way to measure data distributions in one-hundredth parts. For example, 95/100 would equal the 95th percentile. Percentiles are often used to quantify the proportion of data samples above or below a certain value – e.g., in the fire service, saying that the 90th percentile of turnout time is 85 seconds means that 90% of turnout times are 85 seconds or less. Performance results are typically reported as percentiles.

Personnel: The individuals who comprise a crew.

Population Density: the number of people inhabiting a specific unit of area, often given in individuals per square mile.

Response: the activities a single unit undertakes regarding a single incident. An incident will have one response per unit assigned to the incident, and each response may contain multiple individual actions such as being dispatched, going enroute, arriving on-scene, transporting a patient, clearing the incident, returning to quarters, etc.

Unit: the combination of a fire/EMS apparatus and an assigned crew.

Urban: Populated or settled areas of census tracts with a minimum of 2,500 people. Urbanized areas (UAs) must contain 50,000 or more people and urban clusters contain between 2,500 to 50,000 people.

Rural: Population, housing and lands not included in an urban area

Probability: The likelihood of an emergency occurring.

Public Safety Answering Point (PSAP): The physical location where emergency calls are first answered by trained dispatchers. Also referred to as communications and dispatch centers.

Reliability: A measure of a test or analysis that is free from measurement errors. A way to determine if data is dependable and trusted.

Response: Any number of apparatus and personnel that travel to an incident.

Response Time: The time required by a single unit or apparatus to reach an incident scene, after it is notified or dispatched. This interval is the sum of the turnout time and travel time intervals.

Risk: Any exposure to danger, harm or loss including risk to life and property. Measured considering the probability of an incident occurring, the impact to the agency and the consequence to the community. Risk classes are designated as low, moderate, high, and maximum.

Standards of Cover: Written policies that establish the distribution and concentration of agency resources.

Total Response Time: A measure of the interval between when a dispatcher answers an emergency call in the PSAP and when the fire units arrive at the scene of the incident. This interval is the sum of the call processing, turnout, and travel time intervals.

Travel Time: A measure of the time interval between when an apparatus and crew depart the fire station or field location and when the fire units arrive at the scene of the incident.

Turnout Time: A measure of the time interval between when the crew is alerted of a call by the dispatch center and when the crew departs the fire station.

Unit: A general term to describe a specific, single apparatus.

United States Fire Administration (USFA): The lead federal agency for fire data collection, public fire education, fire research and fire service training.

2.2 Revision History

Date	Author	Revision Content
8/17/2022	C Niedner	Initial outline draft
9/18/2022	C Niedner	Preliminary characterization data
10/7/2022	E Nickel, J Worley, Team	Risk assessment
10/18/2022	C Niedner	Road and target hazard coverage analysis
10/19/2022	E Nickel	Executive summary
10/24/2022	Team	Introduction to EPFR Planning Committee
11/7/2022	Team	Presented draft to EPFR Planning Committee
12/23/2022	C Niedner	Future workload modeling
1/5/2023	Team	Final draft to EPFR Planning Committee

2.3 Executive Summary

East Pierce Fire Rescue (EPFR) serves approximately 100,500 residents living in and around Bonney Lake, Sumner, Lake Tapps, the Ridge Communities, South Prairie, Tehaleh, Edgewood, and Milton. The District covers approximately 153 square miles and protects residents from six full-time staffed stations, one facility on Lake Tapps for the marine rescue unit, one logistics station, and one training facility.

EPFR is a career agency with full-time emergency personnel serving the community. The District provides fire, rescue, and emergency medical services (EMS) response, including basic life support (BLS) and advanced life support (ALS).

As part of strategic assessment and planning, EPFR has committed to analyzing the community risk, matching District assets to the risk, and creating a vision of continued excellence to serve the community in the future.

EPFR's service area, based on population density, is of two classifications: urban and rural. The community's risk classifications should influence how response resources are distributed now and in the future. Since urban areas are anticipated to develop to greater population densities, especially with Pierce County's Urban Growth Boundary, response performance objectives should be established for

both urban and rural areas. In addition, the Tehaleh Development will bring an additional 35,000 residents and adds service demands to the southern end of the District.

Sample service level policies and benchmarks objectives are included in the recommendations and appendices. These define the quality and quantity of service expected by the community and consistently pursued by the District.

The Description of Community Served section provided a general overview of the organization, including governance, lines of authority, finance, capital, and human resources, as well as an overview of the service area, including population and geography served. The Review of Services Provided section detailed the organization's core services based on general resource/asset capability, and essential staffing complements.

An overview of community risk was provided to identify the risks and challenges faced by EPFR. Geospatial characteristics, topographic and weather risks, transportation network risks, physical assets, and critical infrastructure were reviewed. As a factor of risk, community populations and demographics were evaluated against historical and projected service demand. Population and service demand has increased over the past decade and will continue to grow in the future.

Evaluating risk using advanced geographic information systems (GIS) provided an increased understanding of community risk factors and led to an improved deployment policy.

Critical tasking assignments were completed for incident types ranging from a basic medical emergency to a high-rise structure fire during the analysis of service level objectives. Critical tasking requires a review of on-scene staffing requirements to mitigate the effects of an emergency. These tasks ultimately determine the resource allocation necessary to achieve a successful operation. The results of the analysis indicate that a moderate risk structure fire required a minimum of sixteen personnel.

The review of historical system performance evaluated each component of the emergency incident sequence, including call processing, turnout, and travel time. Beyond the response time of the initial arriving units the additional components of effective response force, reliability, and call concurrency were evaluated.

Based on the analysis and considering community expectations, improvement recommendations were developed to improve the delivery of fire and emergency services to the community by EPFR. Not all will be implemented at once. Some may wait until economic conditions

allow their implementation. However, all the recommendations were offered to chart a course to improve capability and service.

2.4 Charter and Objectives

The Standard of Cover study described in this report was developed in collaboration with East Pierce Fire & Rescue internal staff and Levrum Inc. The project began in the spring of 2022 with the following objectives:

- Develop a through, data-based review of current and recent EPFR operations and performance.
- Give an all-risk assessment of the community served.
- Measure performance against a nationally recognized performance standard.
- Analyze system resilience and identify potential performance gaps.
- Identify possible solutions to strategic issues identified.
- Make comprehensive strategic recommendations.
- Document observations, findings, and recommendations in a foundational document upon which strategic planning and policy decisions can be based.

2.5 Participants

A primary goal of this Standard of Cover is to build a shared understanding among a wide range of stakeholders interested in the well-being and future of East Pierce Fire and Rescue. This section identifies these participants and stakeholders.

2.5.1 Stakeholders and Interested Parties

Party	Relationship to EPFR SOC Study
Levrum, Inc	Strategic partner in data analysis and development team. Leveraged expertise in keeping project on task.
EPFR Board of Commissioners	Elected governance board who provided overarching direction for the study. Who was offered regular updates and reviewed the final document for acceptance.
EPFR Internal Project Team	Provided guidance and project management. Established timelines and worked on the operational and administrative matters for SOC.
EPFR Operations Staff	Provided information on EPFR operational response and assisted in identifying target hazards. Provided individual station resource lists and critical tasking information.
IAFF Local 3520	Labor body representing EPFR operations staff. Reviewed data and all documents and participated in meetings.
Washington Surveying & Rating Bureau (WSRB)	Provides fire protection classes and loss classes for Washington State including information on property risk and liability factors. Provided target hazard data for SOC project.

South Sound 911	Regional emergency dispatch center. Helped provide input and advice on PSAP matters and raw study data.

2.5.2 Project Team

Primary participants in the project team include:

- Fire Chief (ret.) Eric Nickel, EFO: Chief Nickel led the strategic analysis portion of the study. Chief Nickel is a 33-year veteran of the fire service and has served as Fire Chief in three California cities and led or participated in more than 20 Standard of Cover studies.
- Carl Niedner: Mr. Niedner led the data analysis portion of the study. He has had a 38-year career in software development and data analysis, has served 35 years as a volunteer firefighter, and currently serves as Vice President of Product Development at Levrum, Inc.
- Division Chief (ret.) Douglas Baily: Chief Baily provided business administration and oversight for the study and editorial reviews of the study material. Chief Baily is a 38-year fire service veteran and serves as President of Levrum, Inc.
- Levrum, Inc.: Levrum is an Oregon-based company focused on providing advanced predictive analytics software and analysis services to North American fire/EMS agencies.
- Deputy Chief Bill Mack: DC Mack is a 30-year fire service veteran and managed the study's EPFR aspects. He assisted in communication with elected officials and internal EPFR people. He wrote, edited, and reviewed many areas of the document.
- Assistant Chief of Operations Kevin Stabenfeldt: AC Stabenfeldt is a 20-year fire service veteran with over 17 years of that with East Pierce. He assisted in collecting critical tasking data for the operations division. He coordinated and assisted in compiling information regarding target hazards throughout the fire district.
- Firefighter/Data Analyst Joe Worley: FF Worley is a 27-year fire service veteran with over 16 years with East Pierce and is the fire district data analyst. He collected historical data from SS911 Dispatch Center, processed the data, provided the analytic analysis, and built graphics and charts for the report.

2.6 Acknowledgments

Person	Rank/Position	Organization	Contribution(s)
All Members	Commissioner	East Pierce Fire & Rescue	Oversight
Jon Parkinson	Fire Chief	East Pierce Fire & Rescue	Project vision, strategic guidance
Bill Mack	Deputy Chief	East Pierce Fire & Rescue	Project manager, strategic guidance, advice, and management of EPFR aspects of the study
Kevin Stabenfeldt	Assistant Chief of Operations	East Pierce Fire & Rescue	Project team lead and internal stakeholder coordination management.

Joe Worley	Data Analyst	East Pierce Fire & Rescue	EPFR data team lead, communicated with external data needs, and collected run data from SS911
Jeff Moore	Assistant Chief of Logistics	East Pierce Fire & Rescue	Internal stakeholder input
Justin Doyle	Battalion Chief – Operations A Shift	East Pierce Fire & Rescue	Critical tasking operations
Mike McGinnis	Battalion Chief – Operations B Shift	East Pierce Fire & Rescue	Critical tasking operations
Rick Goetz	Battalion Chief – Operations C Shift	East Pierce Fire & Rescue	Critical tasking operations
Matt Gilbert	Battalion Chief – Training	East Pierce Fire & Rescue	Internal stakeholder input
Brad Dyson	Battalion Chief – EMS	East Pierce Fire & Rescue	Critical tasking EMS
Jason Sanders	Captain	East Pierce Fire & Rescue	Target Hazards – Station 111
Adam Lathrop	Lieutenant	East Pierce Fire & Rescue	Target Hazards – Station 112; Critical tasking HazMat
Troy Sterrenburg	Lieutenant	East Pierce Fire & Rescue	Target Hazards – Station 113; Critical tasking Water Rescue
Matt Jewitt	Captain	East Pierce Fire & Rescue	Target Hazards – Station 114, 122; Critical tasking Water Rescue
Mike Westland	Lieutenant	East Pierce Fire & Rescue	Target Hazards – Station 116; Critical tasking Technical Rescue
Tim Jewitt	Lieutenant	East Pierce Fire & Rescue	Target Hazards – Station 118, 124; Critical tasking Wildland
Eric Cunningham	Fire Protection Analyst	Washington Survey & Rating Bureau	Target Hazard rating; Data collection
Jessica Gwilt	Senior Planner	Pierce County Planning and Public Works/Long Range Planning	Provided data for projected growth

2.7 Description of Community Served

EPFR serves over 100,000 residents living around Bonney Lake, Sumner, Lake Tapps, the Ridge Communities, South Prairie, Tehaleh, Edgewood, and Milton. EPFR service area population has generated an annual growth rate of 1.8%, close to .5% higher than the rest of Pierce County. The District covers over 153 square miles and protects residents from six fully staffed fire stations.

All uniformed firefighters are cross trained as either emergency medical technicians (EMTs) or paramedics and can respond to medical emergencies and fires. EPFR takes an all-hazard approach to emergency response and has extensive experience handling various calls for service. In 2020 EPFR was the main authority having jurisdiction (AHJ) of one of the largest wildfires in Western Washington history, burning close to 500 acres, threatening hundreds of homes, causing emergency evacuations of thousands of residents, and requiring hundreds of first responders' attention over multiple operational periods and covering more than two weeks. EPFR also has rural terrain, rivers, large lakes, and many other hazards that create technical rescue responses and give technical rescue teams experience in rope, dive, swift water, and hazmat responses. Additionally, EPFR provides fire prevention, commercial business inspections, public education, investigation, behavioral health and community paramedic services.

While there are large areas of the jurisdiction that are rural, most of the population, growth, and call volume area is densely populated. A wide range of facilities, including single-family residences, apartments complexes, commercial, retail, industrial complexes, and numerous educational facilities, characterizes the response area. EPFR includes significant freight and passenger rail corridors, a large natural gas pipeline, a major interstate, and several freeways.

2.7.1 Legal Basis

The Revised Code of Washington (RCW) is the compilation of all permanent laws in force. Fire Districts are defined and codified in Title 52.

The RCW also codifies key official obligations, including the roles of the Fire Commissioners (Section 52.14), Finances (Section 52.16), Benefit Charges (52.18), and Performance Measures (Section 52.33)[1]

2.7.2 History of the Agency

East Pierce Fire & Rescue was formed over twenty years ago when Fire District 24 merged with the City of Bonney Lake Fire Department and the Lake Tapps Fire Department in 2000. Since then, EPFR has continued to expand through numerous annexations of neighboring fire and rescue jurisdictions:

- Pierce County Fire District 12 and South Prairie Fire District #20 (2006)
- City of Sumner and Pierce County Fire District #1 (2008)
- City of Edgewood (2010)
- City of Milton (2011)

In addition, demand has continued to grow due to population and employment growth, which has notably ramped up due to residential and commercial needs for service.

As a result of these mergers, annexations, and internal growth within the service area, EPFR now serves an area of approximately 153 square miles and a resident population of over 100,000 people.

Service is provided from a network of ten facilities, six are staffed 24/7/365 with career firefighters. Four facilities provide support for operations and include a training facility, a marine unit facility, and an apparatus repair and maintenance facility. These buildings were acquired through various mergers and annexations. This means that these station locations result from decisions made by all the predecessor's departments and do not necessarily represent the optimal arrangement to meet EPFR's current needs.

[1] Revised Code of Washington, Title 52 Fire Protection Districts, Chapters 52.02 to 52.33, Title 52 RCW: FIRE PROTECTION DISTRICTS (wa.gov)

In addition, most of these facilities are approaching the end of their useful lives and need significant capital reinvestment. The current Capital Facilities Plan (CFP) published in 2017 has identified and prioritized these facility needs. In late 2018 voters approved a Capital Facilities bond which will be used to fund the purchase of equipment and finance the District's capital needs. Some of the capital changes that are underway with EPFR include:

- The purchase of a new Ladder Truck, six Fire Engines, and three Medic Units.
- The replacement of Stations 112, 114, 118.
- Construction of a new headquarters Station 111 in Bonney Lake to replace the existing leased facility shared with Bonney Lake Police Department.
- The addition of a new Station 117 which will provide much needed service and protection of the Tehaleh development.

EPFR has completed work on an updated Capital Facilities plan and a revised Strategic Planning document. It is finishing up its foundational document library by publishing and completing the Community Risk Assessment – Standard of Cover (CRR-SOC) document.

2.7.3 Financial Basis

EPFR raises revenue and pays expenses following Title 84.52 (Property Taxes, Levy of Taxes). The calendar year budget is presented by staff to the Board of Commissioners and adopted annually by resolution. Significant sources of EPFR revenue are itemized below.

Assessed Valuation
Property taxes are the primary revenue source. All property taxes are based on assessed valuation.

The assessed valuation includes three elements:

1. Assessed value of the property that has previously been on the tax role of the District.
2. Assessed value of new construction and improvements to real property.
3. Assessed value of private utilities that cross county boundaries established by the Department of Revenue.

The Pierce County Assessor handles property assessments and notifies the District of the values every fall.

Regular Tax Levy
Fire Protection Districts may levy up to $1.50 per thousand dollars of assessed valuation. This $1.50 is comprised of:

- RCW 52.16.130 ($.50) General levy limit
- RCW 52.16.140 ($.50) General levy may exceed the limit
- RCW 52.16.160 ($.50) Ad Valorem Tax (must have one full-time, paid employee or contracts for the services of at least one full-time, paid employee).

EPFR currently levies $1.50 per thousand dollars of assessed valuation.

Emergency Medical Service (EMS) Levy
Fire Protection Districts and Regional Fire Authorities also have the authority to levy an additional fifty cents ($.50) per thousand dollars of assessed value to provide emergency medical services for six years, ten years, or on a permanent basis. EPFR levies for a ten-year EMS Levy.

Excess Tax Levy
An excess levy exceeds the $1.50 regular tax levy limits. East Pierce Fire & Rescue Unlimited Tax General Obligation (UTGO) Bond of 2018 & 2022 is an example of an excess tax levy.

Other Non-Tax Revenue Sources

- Transport Billing Revenue – The District contracts with a transport billing service. They bill insurance companies to recover the costs of transporting patients for EPFR. EPFR does not bill out-of-pocket expenses to citizens living within the Fire District's borders.
- GEMT Revenue – Ground Emergency Medical Transport (GEMT) is a Federally funded supplemental program passed in 2015-16. GEMT provides cost recovery to publicly owned, qualified ambulance providers for transporting patients with federal or state insurance plans (Medicaid).
- Staffing For Adequate Fire and Emergency Response (SAFER) Grant Reimbursement – In 2022, the District received a SAFER grant through the Federal Emergency Management Agency (FEMA) that allowed it to hire additional firefighters. SAFER reimburses EPFR 100% of the added personnel costs for three years. Reimbursement will begin in 2023.
- Miscellaneous Revenue – Other revenue includes interest earnings, contracts, mitigation fees, and billing for training classes provide to other agencies.

2.7.4 Area Description

East Pierce Fire & Rescue encompasses approximately 153 square miles in Pierce County and services the communities in and around Bonney Lake, Edgewood, Lake Tapps, Milton, the Ridge Communities, Sumner, and Tehaleh. The District's service area includes the Town of South Prairie through an interlocal agreement. An estimated 100,000 residents live within the District. The 2010 – 2020 annual growth rate was 1.8%, which is expected to slow to 1.6% between 2020 and 2025.

Year	2010	2020	2025
Population	83,366	100,508	108,916
Pecent change		21%	8%
Average Annual Growth Rate		1.8%	1.6%

Figure 1- Growth Over Time

The median age of the District has increased over the past decade. The census report shows that in 2020 the median age for EPFR service area was 39.1, compared to 37.7 in 2010. Of all the households in 2018, 7.8% were single persons aged 65 or older.

EPFR's service area is a relatively wealthy community, with a median household income of over $100,000 in 2020, compared to Pierce County as a whole ($77,326). Nearly 7% of the population lives in poverty, representing more than 6,000 persons. [2]

2.8 Services Provided

2.8.1 Fire Suppression

East Pierce Fire & Rescue provides high-quality fire suppression services within the response boundaries and response to requests for assistance from neighboring agencies. Fire suppression services are provided from six fixed-facility fire stations. Primary suppression response is from six full-time staffed Engine companies, one Ladder truck, and one command officer. Each apparatus has a minimum of three personnel assigned 24/7/365.

2.8.2 Emergency Medical Services

To handle increasing demands for EMS services staff, the suppression companies listed, and an additional four medic units (paramedic ambulances) staffed with firefighter-EMTs and firefighter-paramedics. EPFR provided both Basic Life Support (BLS) and Advance Life Support (ALS) responses to care for the sick and injured throughout the service area.

[2] Sources: US Census American Community Survey, 2014-2018; US Census, 2010; ESRI, 2021; BERK, 2021

2.8.3 Rescue Operations

EPFR members provide rescue responses to a variety of incident types. Teams are maintained by department personnel and require additional training beyond mandatory firefighting and EMS training. Relationships have also been established with Washington State Disaster Response teams, FEMA teams, and county special response teams like Pierce County Special Operations Response Teams (PCSORT). Water Rescue – This team provides surface, dive, and swift water rescue services to the many bodies of water in the surrounding area. As part of the response capabilities, EPFR has a rescue boat that is housed at Station 122 and is in a rapid response-ready capacity. Members of this team routinely practice skills and techniques at the team level and in drills with partnering agencies.

- Technical Rescue – This team responds to dangerous rescue situations such as building collapses, confined-space entrapments, trench, machine, and vehicle rescues, and high-angle rope incidents. The EPFR team is a participating Pierce County Technical Rescue Team member. Together they form a regional response to emergencies throughout Pierce County.

2.8.4 Hazardous Materials

EPFR Hazardous Materials (HazMat) team members are extensively trained and equipped to respond to and mitigate various hazardous materials-related incidents. Being prepared is very important, considering the EPFR response area is home to two major rail lines, an interstate, a large industrial complex, two major pipelines, and a couple of busy highways. EPFR is also a participating partner in the Pierce County Hazardous Incident Team (PCHIT). This multi jurisdiction response team includes West Pierce Fire & Rescue members, Graham Fire & Rescue, Gig Harbor Fire and Medic One, and Central Pierce Fire & Rescue.

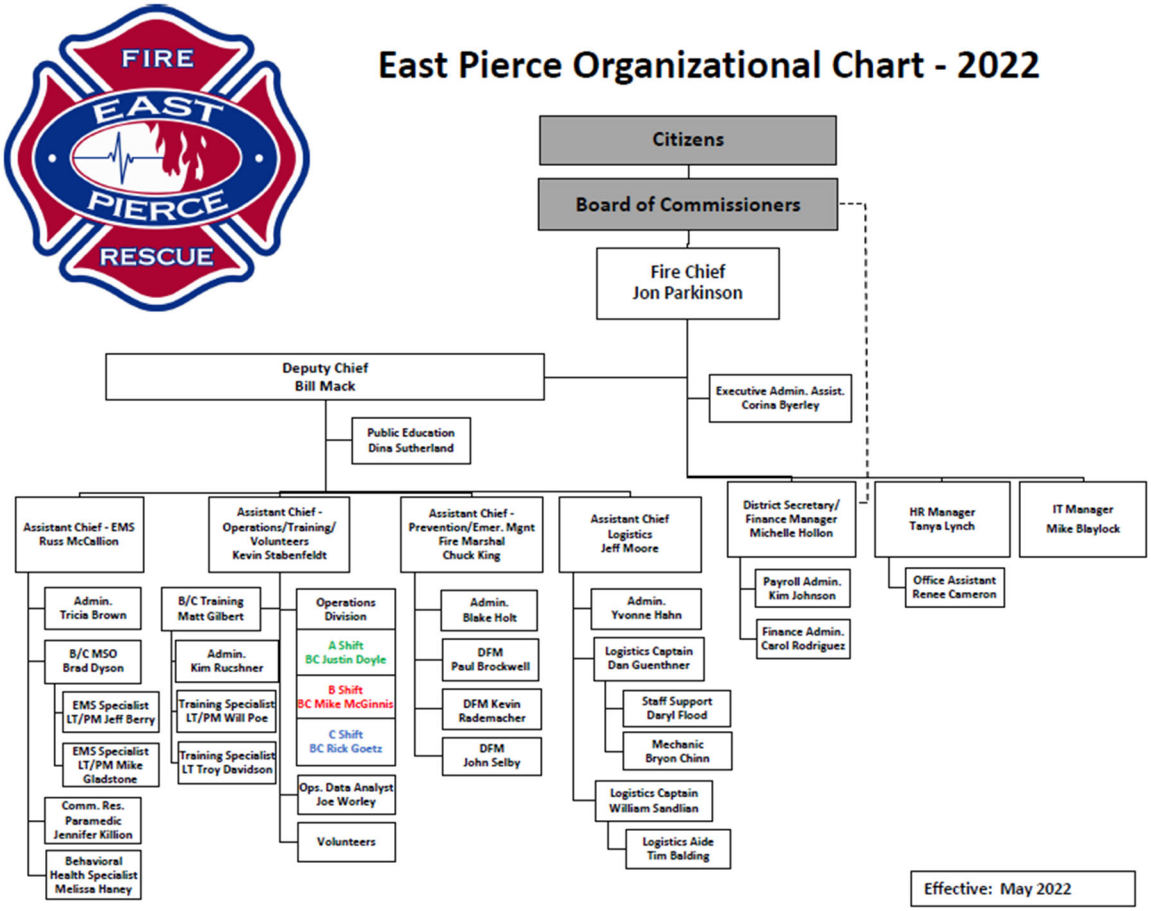
2.8.5 Wildland Firefighting

Some EPFR firefighters also serve on the wildland firefighting team. Special "red card" qualifications, certifies completion of training specific to wildfire firefighting. These firefighters are trained in special tactics, strategies, and techniques when fighting wildfires. Because of the remote locations and urban interface, these teams will often use chainsaws, hand tools, and portable water pumps to handle these

unique types of fires. These team members may also respond to help on larger Federal or State managed wildfires. These events are funded by the Federal government or Washington State Department of Natural Resources.

2.9 Current Staffing and Deployment Strategy

EPFR exists to serve the citizens of its service area and is accountable to them through an elected Board of Fire Commissioners. The EPFR Fire Chief serves at the discretion of the board to lead and administer the fire district. The Deputy Chief oversees the administration and management of four service delivery divisions: Operations Division, EMS Division, Fire Prevention Division, and Logistics Division. EPFR's current organization chart is shown below.



EPFR personnel respond from six stations staffed 24 hours a day, seven days a week by career firefighters. There are three rotating 24 hours shifts (A-Shift, B-Shift, and C-Shift) with forty-one people assigned per shift. Each day, the minimum staffing provides one Battalion Chief, one Ladder truck, five Engine companies, and four Medic units. Every EPFR firefighter is cross-trained in emergency medicine, with two-thirds of them certified as Emergency Medical Technicians (EMT) and the other third as Paramedics. Below is a brief overview of the fire station locations, resources, and staffing.

2.9.1 Fire Stations

EPFR primarily responds out of six fixed fire station facilities to support fire suppression, emergency medical, and special operations responses. Four additional facilities support the District: a training facility, a marine unit facility, a logistics warehouse, and an apparatus repair and maintenance facility.

Station 111 – Headquarters

18421 Veterans Memorial Dr, Bonney Lake, WA 98391

Constructed in 1994, Station 111 is in Bonney Lake and is the current Headquarters Station for East Pierce Fire and Rescue. It is staffed with six career Firefighters 24 hours a day, seven days a week. Station 111 has accommodations to support ten Firefighters per shift. Staffing can increase based on EPFR policy to support Shift staffing, Probationary Firefighter training, or special demand staffing. Station 111 is consistently one of the busiest Fire Houses in the District. A 2021 statistical response analysis shows more than 2,400 first-due responses in Station 111's area. Additionally, Engine 111 responded to nearly 2,900 emergencies, and Medic 111 responded to more than 2,300 emergencies.

East Pierce Fire and Rescue's Executive Branch, Operations Division, EMS Division, Human Resources, and Administrative Staff are assigned to Station 111. This includes the Fire Chief, the Deputy Fire Chief, the Assistant Chief of Operations, the Assistant Chief of EMS, the Medical Services Officer (MSO) Battalion Chief, the EMS Specialist, the EMS Training Assistant, two Community Resource Paramedics, and seven Administrative Staff.

Station 111's allocated apparatus and human resources are outlined below. Reserve apparatus are staffed for a response when frontline Fire Engines and Medic Units are out of service for maintenance, when special demand staffing is needed, and when additional response apparatus are required in emergency incidents, staffed by available off-duty personnel.

Resources:

Apparatus	Apparatus Type	Number of Personnel Assigned
Engine 111	Fire Engine – Type 1	3
Medic 111	Medic Unit	2
Battalion 111	Command – Battalion Chief	1
Brush 111	Fire Engine – Type 5	0
Engine 1119	Fire Engine – Type 1 (Reserve)	0
Medic 1119	Medic Unit (Reserve)	0
TOTAL STATION PERSONNEL		**6**

Response Area Target Hazards:

Building Name	Occupancy Type	Address	Hazard Note
Allen York Park Lake Tapps	Water Recreational Area and Boat Launch	7203 West Tapps HWY E, Bonney Lake, WA 98391	Life Hazard – Drowning and Injury Watercraft Incidents
Best Tire Center	Tire Store	19710 HWY 410 E, Bonney Lake, WA 98391	Fire Load
Bonney Lake High School	High School	10920 199th Ave Ct E, Bonney Lake, WA 98301	High Life Safety Evacuation Hazards
Bonney Lake Elementary School	Elementary School	18715 80th St E, Bonney Lake, WA 98391	High Life Safety Evacuation Hazards
Cedar Ridge Assisted Living Facility	Assisted Living Facility	9515 198th Ave E, Bonney Lake, WA 98391	High occupancy assisted living facility with memory care
Discount Tire Store	Tire Store	19815 South Prairie Rd E, Bonney Lake, WA 98391	Fire Load
Forest View Apartments	Apartment Building: 25 apartments total in a 2 story "L" shaped building	8313 Meyers Rd E, Bonney Lake, WA 98391	High Life Hazard Type V Construction 2 Story Non-Sprinklered
The Home Depot	Home Improvement Store	9602 214th Ave E, Bonney Lake, WA 98301	Fire Load Mixed Fuels
Lowe's Home Improvement	Home Improvement Store	19911 South Prairie Rd E, Bonney Lake, WA 98301	Fire Load Mixed Fuels
Mountain View Middle School	Middle School	10921 199th Ave Ct E, Bonney Lake, WA 98391	High Life Safety Evacuation Hazards
Renwood Apartments	Apartment Complex: 186 apartments total in (9) 3-story apartment buildings built close together.	9002 186th Ave E, Bonney Lake, WA 98391	High Life Hazard Exposure Limited Access
South Hill Family Medicine PC	Abandoned 2 Story Commercial Medical Building	19820 HWY 410 E, Bonney Lake, WA 98391	Life Hazard Abandoned Vandalized/Damaged
Target	Department Store	9400 192nd Ave E, Bonney Lake, WA 98391	Fire Load
Walmart Supercenter	Department Store	19205 HWY 410 E, Bonney Lake, WA 98391	Fire Load Mixed Fuels

Station 112 – Prairie Ridge

12006 214th Ave. E, Bonney Lake, WA 98391

Station 112 is in the Prairie Ridge area of Bonney Lake in unincorporated Pierce County. The station was constructed in 1979. Station 112 is staffed 24 hours per day, seven days per week, with three career firefighters who cross-staff an Engine, a Medic unit, and a 2,000-gallon Water Tender. The Engine and Medic unit are cross-staffed for twelve hours daily from 0800-2000. After eight PM, the assigned firefighter's staff the Engine, and the Medic unit is placed out of service. Staffing may increase to five periodically, allowing both Engine 112 and Medic 112 to be fully staffed to respond to emergencies. Data shows that station 112 is consistently the third busiest station in the District. Station 112's allocated capital and human resources are provided below:

Resources:

Apparatus	Apparatus Type	Number of Personnel Assigned
Engine 112	Engine – Type 1	3
Medic 112	Medic Unit	3*
Tender 112	2000 Gallons	0*
TOTAL STATION PERSONNEL		**3**

**Career personnel assigned to station 112 cross-staff Medic 112 and Engine 112 from 0800-2000. E112 is staffed exclusively from 2000 – 0800. T112 is staffed by available on-duty station 112 personnel when dispatched. If station 112 staff is unavailable due to other emergency calls, BC111 coordinates other staffed units to bring T112 to the emergency scene. When extra personnel is on duty, M112 is staffed for the entire 24-hour shift.*

Response Area Target Hazards:

Building Name	Occupancy Type	Address	Hazard Note
Wesley at Tehaleh	Retirement Community	17702 Cascadia Blvd	High occupancy assisted living facility with memory care
Liberty Ridge Elem.	Elementary School	12202 209th Ave Ct E	High Life Safety Evacuation Hazards
Donald Eisenman Elem.	Elementary School	18302 Canyon View Blvd.	High Life Safety Evacuation Hazards
Tehaleh Heights Elem.	Elementary School	17520 Berkley Pkwy E	High Life Safety Evacuation Hazards
Tehaleh	Development	Bonney Lake WA	Wildland/Urban Interface Hazard

Station 113 – Sumner

800 Harrison St, Sumner, WA 98390

Station 113 is a two-story firehouse located in downtown Sumner built in 1991. It has 24-hour staffing, seven days per week, with a minimum of five career firefighters. When staffing allows, Station 113 has the apparatus seating/equipment and crew quarters available to staff up to nine firefighters. Data for 2021 shows that Station 113 is the busiest in the District, with a total call volume of 2,850 dispatched responses. Ladder 113 is the busiest apparatus in the department, with total incident responses of 2,970. Medic 113 is the busiest ALS transport ambulance in the District, with 2,273 responses.

Station 113 is identified as the department's technical rescue and water rescue station. Station 113 has three major first-due freeways (SR 167, SR 410, and SR 162) that create a response to high-speed MVA's. With two rivers (the White and the Puyallup) running through 113's response area, it has potential for water rescue incidents during the summer.

Resources:

Apparatus	Apparatus Type	Number of Personnel Assigned
Ladder 113	Tractor Drawn Aerial (TDA)	3
Medic 113	ALS Transport Ambulance	2
Support 113	Water Rescue Tow Vehicle	0
Marine 113 Trailer	Water Rescue Boat Trailer	N/A
Ladder 1139	Reserve Rear-mount aerial	0
TOTAL STATION PERSONNEL		**5**

Station 113's target hazard list is ever-expanding, with hundreds of warehouses that consistently change business occupancy types. With hundreds of semi-trailers offloading materials, there is consistent potential for heavy vehicle lift and extrication incidents. Warehouse occupancies have the potential for hazardous material responses that would require a PCHIT Response.

The east and west sides of Sumner have a large area of wildland-urban interface that has shown difficult fire containment and heavy resource-dependent incidents, as discovered during the Sumner Grade Fire incident.

The following list of target hazards is only a few of the many different occupancies, business, and miscellaneous hazards that would potentially deplete resources from EPFR requiring assistance from mutual aid agencies or specialty team responses.

Response Area Target Hazards:

Building Name	Occupancy Type	Address	Hazard Note
Stafford Suites	Assisted Living	15519 62nd St Ct E	High occupancy assisted living facility
Franklin Place	Assisted Living	5713 Parker Rd E	High occupancy assisted living facility
Memory Haven	Memory Care Assisted Living	5107 Parker Rd E	High occupancy assisted living facility with memory care
Sumner High School	School	1707 Main St	High Life Safety Evacuation Hazards
Sumner Middle School	School	1508 Willow St	High Life Safety Evacuation Hazards
Maple Lawn Elementary	School	230 Wood Ave	High Life Safety Evacuation Hazards
Daffodil Elementary	School	1509 Valley Ave	High Life Safety Evacuation Hazards
Sumner Early Learning Center	School	1500 Willow St	High Life Safety Evacuation Hazards
Cascade Christian	School	96th	High Life Safety Evacuation Hazards
Costco Distribution	Warehouse	4000A 142nd Ave E	Fire Load Hazard
Amazon Distribution	Warehouse	1901 140th Ave E	Large Distribution Warehouse

REI Distribution	Warehouse	1700 45th St E	Fire Load Hazard
Dillanos Coffee Processing	Warehouse	1620 45th St E	Distribution Warehouse with large coffee roasters
Sonoco Products	Paper Mill	1802 Steele Ave	Large aging building with fire load hazard
Fleischmann's Vinegar	Vinegar Producer	1115 Zehnder St	Hazmat Hazard
Corliss Concrete	Concrete Manufacturing	16805 64th St E	Confined space, heavy machinery hazard
Train Transportation	Sounder, Burlington Northern, Union Pacific	810 Maple St	Hazmat transportation hazard with possible train derailment
Fred Meyers	Grocery Store	1201 Valley Ave E	Large Grocery Warehouse
Winco	Grocery Store	6621 166th Ave E	Large Grocery Warehouse
McLendons	Hardware Store	1111 Fryar Ave.	Large Hardware Store
Manke Lumber	Timber lumber processing	13702 Stewart Rd SE	Fire load hazard and heavy machinery
Western Wood Products	Treated lumber processing and manufacturing	1310 Zehnder St	Fire load hazard
Old Cannery Furniture	Furniture Sales	13608 Cannery Way	Fire load hazard
Freeways	SR 167, SR 410, SR 162		MVA
Rivers	White & Puyallup River		Water Rescues
Shining Ocean	Processing	1515 Puyallup St	Hazmat Hazard
Salmon Creek	Water Treatment	North end of Parker	Hazmat Hazard

Station 114 – South Lake Tapps

3206 W Tapps Dr E., Bonney Lake, WA 98391

Station 114 was built in 1960. In 1970, additional apparatus bays were added to accommodate an additional engine and an aid car. A day room was also added at this time. During the 1980s, the station was remodeled again, and the station staffed with a Chief and two captains. Staffing levels rose again, in the 1990'ss to fully staffed 24 hours a day/seven days a week. The personnel from this station cross-staff Marine 122, a fire/rescue platform watercraft, on Lake Tapps, and the station serves the north half of the Lake Tapps area.

Resources:

Apparatus	Apparatus Type	Number of Personnel Assigned
Engine 114	Engine-Type 1	3
Medic 114	Medic Unit	0
TOTAL STATION PERSONNEL		**3**

Response Area Target Hazards:

Building Name	Occupancy Type	Address	Hazard Note
Cascade Water Alliance	Hydroelectric Dam Outflow	2111 East Valley Hwy E, Sumner	Electric generation, asbestos hazard. Potential for uncontrollable large water release
Williams Pipeline Compressor Station	Natural gas pipeline compressor station	3104 166th Ave E, Lake Tapps	Large diameter, very high (800+ psi) pressure unodorized natural gas pipelines, compressor machinery
Williams Pipeline mercaptan injection/city gate with blow offs	Mercaptan injection site	15209 24 St E, Sumner	Large diameter pipelines and relief vent points, vents under high pressure.
Manke Lumber	Lumber Mill	13702 Stewart Rd E	Heavy Machinery, entrapment hazards, Heavy Fire Load

Station 115 – Training Division

1605 210 Ave E, Lake Tapps, WA 98391

Station 115 is a single-story station located on the Northeast corner of Lake Tapps. The station currently houses the personnel and apparatus assigned to the Training Division.

Currently, Station 115 is staffed with four Training Division Day staff. No emergency apparatus responds from this location.

Resources:

Apparatus	Apparatus Type	Number of Personnel Assigned
N/A	N/A	(4) Training Day Staff
TOTAL STATION PERSONNEL		

Response Area Target Hazards:

Building Name	Occupancy Type	Address	Hazard Note
N/A	N/A	N/A	N/A

Notes: Generally, Station 115 is in Good condition and is utilized as office and storage for the Training Division.

Station 116 – Foothills

10515 234th Ave. East, Buckley, WA 98321

Station 116 is located in unincorporated Pierce County on the far east end of the fire district and it is staffed with five Firefighters 24 hours a day. Station 116 has a unique first-due response area with responses that are longer than our other stations and can be 45 minutes or more. Transports to the hospital are typically much longer than in the rest of the District. In the winter, large portions of 116's first-due area have the

significant potential to be cut off from flooding. In the summer, frequent wilderness responses involve a considerable out-of-service time and often multiple resources needed. These include MVAs at the Off-Road Vehicle (ORV) park or on forest service roads to injured and ill hikers. Several large areas are at high risk for a Wildland Urban Interface (WUI) incident, so much so that DNR has developed an evacuation and response plan for the site.

Resources:

Apparatus	Apparatus Type	Number of Personnel Assigned
Engine116	Engine- Type 1	3
Medic 116	Medic Unit	2
Brush 116	Wildland Engine Type 5	0
Rescue 116	Technical Rescue	0
Brush 1169	Wildland Engine Type 6	0
Support 116	SUV	0
TOTAL STATION PERSONNEL		**5**

Response Area Target Hazards:

Building Name	Occupancy Type	Address	Hazard Note
Foothills Elementary	School	10621 234th Ave. E	High Life Safety Evacuation Hazards
White River High School	School	26928 120th St. E	High Life Safety Evacuation Hazards
Hwy 410	2-lane highway	Bonney Lake to Buckley	Significant motor vehicle traffic
Lower Carbon Ridge	Residential	See Wildfire Plan	Significant Wildland Urban Interface Hazards
Evans Creek ORV Park	ORV Park	NF-7930	Wilderness Rescue/MVA
Mount Rainier NP	National Park	Mowich/Carbon River	Wilderness Rescue/MVA
Hwy 162/165	2 lane highway		Significant motor vehicle traffic
Sunset Lake Camp	Summer Camp	30811 Quinnon Extension Rd.	High Life Safety Evacuation Hazards
SC Autokraft	Light Industrial	102 Emery Ave. N	Large/old non sprinklered building

Station 117 – Tehaleh (New-Construction)

Address TBD

Proposed Station 117 (scheduled to be complete in early 2024) will be in the Tehaleh community in unincorporated Pierce County. Tehaleh is a preplanned community with an expected population of 35,000 citizens when completed. The station will be staffed 24 hours per day, seven days a week, with three career firefighters.

Resources:

Apparatus	Apparatus Type	Number of Personnel Assigned
Engine 117	Engine Type 1	3
Brush 117	Wildland Engine Type 5	0
TOTAL STATION PERSONNEL		**3**

Response Area Target Hazards:

Building Name	Occupancy Type	Address	Hazard Note
Donald Eismann Elementary	Educational Facility	13802 Canyon View Blvd. E, Bonney Lake, WA 98391	High Life Safety Evacuation Hazards
Tehaleh Heights Elementary School	Educational Facility	17520 Berkeley Pkwy E, Bonney Lake, WA 98391	High Life Safety Evacuation Hazards
Wesley at Tehaleh	Independent, Assisted, and Memory Care Facility	17702 Cascadia Boulevard E, Bonney Lake, WA 98391	High occupancy assisted living facility with memory care

Station 118 – Edgewood

10105 24th St E, Edgewood, WA 98371

Station 118 is in Edgewood and was torn down and replaced. It is planned to be complete and occupied in early 2023. It is staffed 24 hours per day, seven days per week, with five careers firefighters. The station covers both the cities of Edgewood and Milton.

Station 118 houses one type 1 fire engine, a medic unit, and a reserve paramedic ambulance. The reserve ambulance is used when a frontline apparatus is out for repairs or maintenance or when additional medic units are needed in emergency incidents and off-duty staffing is available.

Resources:

Apparatus	Apparatus Type	Number of Personnel Assigned
E118	Engine - Type 1	3
M118	Medic Unit	2
M1189 (Reserve)	Medic Unit	0
TOTAL STATION PERSONNEL		**5**

Response Area Target Hazards:

Building Name	Occupancy Type	Address	Hazard Note
Meridian at Stone Creek	Residential R-4	1111 S 376th St, Milton	High occupancy assisted living facility with memory care
Mill Ridge Village	Residential R-4	607 28th Ave, Milton	High occupancy assisted living facility
Alder Ridge	Residential R-2	2800 Alder St, Milton	High occupancy senior housing
Cottages at Edgewood	Residential R-4	2510 Meridian Ave E, Edgewood	Assisted living memory care facility
Telecare	Residential R-4	7224 Pacific Highway E, Milton	Locked down psych facility
Edgemont Jr High	Educational	2300 110th Ave E, Edgewood	High Life Safety Evacuation Hazards
Hedden Elementary	Educational	11313 8th St E, Edgewood	High Life Safety Evacuation Hazards
Surprise Lake Middle School	Educational	2001 Milton Way, Milton	High Life Safety Evacuation Hazards

Mountain View Elementary	Educational	3411 119th Ave E, Edgewood	High Life Safety Evacuation Hazards
Northwoods Elementary	Educational	9805 24th St E, Edgewood	High Life Safety Evacuation Hazards
Discovery Primary School	Educational	1205 19th Ave, Milton	High Life Safety Evacuation Hazards
Surprise Lake	Static body of water	Milton Way/23rd Ave	Lake (3 acre surface area with avg 50' depth)
Star Ice	High Hazard	8220 Pacific Hwy E, Milton	Anhydrous Ammonia (Large storage tanks)

Notes: During the construction of Station 118, E118 and M1189 have been housed out of Station 124, 1000 Laurel St, Milton, and M118 have been housed at the former Milton Community Center, 1400 15th Ave, Milton.

Station 119 – South Prairie (Unstaffed)

305 SR 162, South Prairie, WA 98385

Station 119 is in the city of South Prairie and was built in 1986, and it has received an apparatus bay addition and remodeling. It is 5735 sq ft, with two stories. This station serves as a community center for South Prairie who owns the facility.

Currently, Station 119 is a logistic mechanic shop for apparatus out of service for repairs and maintenance.

Resources:

Apparatus	Apparatus Type	Number of Personnel Assigned
E119 (Reserve)	Engine	
TOTAL STATION PERSONNEL		

Response Area Target Hazards: No specific Target Hazards identified for this area

Notes: Generally, Station 119 is in good condition however being situated adjacent to a river, the station's site has a history of flooding.

Station 121 – Logistics Warehouse

27723 Sumner-Buckley HWY, Buckley, WA 98321

Station 121 is a single-story 2,400 sq/ft building located at the far east side of the Fire District. This station was built in 1993 and currently serves as a logistics warehouse for shipping and receiving Fire & EMS supplies.

Station 121 has three Logistic Division Day staff assigned to work out of it. No emergency apparatus respond from this location.

Resources: The logistics warehouse has day staff only and has no emergency response capabilities at that facility.

Response Area Target Hazards: No identified Target Hazards in this area.

Notes: Generally, Station 121 is in Good condition and is utilized as a Fire district warehouse / storage.

Station 122 – Boat House

2905 Sumner Tapps Hwy E, Bonney Lake, WA 98391

Station 122 is located on the northwest side of Lake Tapps and was built in 1992. It is an unstaffed station that houses Marine 122, a 2021 Munson Fireboat set up for both dive and fire operations. The boat is primarily used by personnel housed out of Station 114, located a minute away. Inside the station, Marine 122 sits on a semi-automated launch system with a dedicated launch ramp onto Lake Tapps. Station 122 also houses the boom, pads, and other spill response equipment.

Resources: No personnel are assigned to this station. The station is a storage facility and deployment site for Marine 122 only.

Response Area Target Hazards: Lake Tapps is the sole identified Target Hazard for this area. For additional Target Hazards, refer to Station 114.

Notes: Marine 122 responds to various target hazards on the lake and will operate day or night. The public swim areas are our most common areas for drownings requiring dive rescue responses, although

boat and aircraft crash into the lake can require them anywhere, as can the private parks and docks. Marine 122 responds throughout the lake into shallow areas with numerous underwater obstructions. Marine 122 responds to all of Snag Island as a water supply drafting from the lake; much of the surrounding area is hazardous to react in. Marine 122 will also be used for spill response on the lake when loaded with spill equipment and can dewater sinking vessels.

Station 124 - Milton

1000 Laurel Street, Milton, WA 98354

Station 124 is in Milton and was constructed in 1960. The building is utilized by both East Pierce Fire and Rescue and the City of Milton. Planning efforts are underway to staff the station 24 hours per day, seven days a week with three firefighters in the second half of 2023.

Station 124's allocated capital and human resources are provided below.

Resources:

Apparatus	Apparatus Type	Number of Personnel Assigned
Engine 124	Engine Type 1	3
TOTAL STATION PERSONNEL		**3**

Response Area Target Hazards:

Building Name	Occupancy Type	Address	Hazard Note
Meridian at Stone Creek	Residential R-4	1111 S 376th St, Milton	High occupancy assisted living facility with memory care
Mill Ridge Village	Residential R-4	607 28th Ave, Milton	High occupancy assisted living facility
Alder Ridge	Residential R-2	2800 Alder St, Milton	High occupancy senior housing
Surprise Lake Middle School	Educational	2001 Milton Way, Milton	High Life Safety Evacuation Hazards
Discovery Primary School	Educational	1205 19th Ave, Milton	High Life Safety Evacuation Hazards
Surprise Lake	Static body of water	Milton Way/23rd Ave	Lake (3-acre surface area with avg 50' depth)

Notes: Notes: During the construction of Station 118, E118 and M1189 have been housed out of Station 124, 1000 Laurel St, Milton, and M118 have been housed at the former Milton Community Center, 1400 15th Ave, Milton.

2.10 Comparisons to National References

There are two notable performance time references currently available to the fire service, the National Fire Protection Association (NFPA) 1710[3] and the Commission on Fire Accreditation International (CFAI).

NFPA 1710 suggests a 4-minute travel time at the 90th percentile for first due arrival of Basic Life Support (BLS) and fire incidents. CFAI recommends a 5 minute and 12 seconds travel time for first due arrival in an Urban/Suburban population density. The arrival of an Advanced Life Support (ALS) unit is recommended at 8-minutes travel time by NFPA 1710. It is important to note that the latest edition (10th edition) of the CFAI guidelines have deemphasized response times and only reference the legacy standards with a separately provided companion document[4].

The CFAI recommendations are more closely aligned with the District's historical performance as the aggregate performance is 10.48 to 19.98 minutes at the 90th percentile. However, EPFR is not currently capable of meeting the more restrictive recommendation of four minutes travel time or less at the 90th percentile under NFPA 1710. With the current configuration of stations and rural nature of the road network as well as the low population density, the District can only achieve approximately 40% coverage within 4-minutes.

[3] National Fire Protection Association. (2010). 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*. Boston, MA: National Fire Protection Association.

[4] CFAI. (2020). Fire & emergency service self-assessment manual, (10th ed.). Chantilly, Virginia: Author.

Call Category	90th Percentile Alarm (Call) Processing Time	90th Percentile Turnout Time	CFAI[5] 90th Percentile Urban Travel Time	CFAI[6] 90th Percentile Rural Travel Time	NFPA 1710[7] 90th Percentile Travel Time	USFA[8] 90th Percentile Turnout and Travel
Fire/BLS	1:30	1:30	5:12	13:00	4:00	10:59
ALS	1:30	1:30	5:12	13:00	8:00	10:59

Figure 2: Performance Standards: CFAI, NFPA, USFA

2.11 Nomenclature and Document Conventions

2.11.1 Areas of Responsibility

For the purposes of this study, we defined "areas of responsibility" (AORs) generally associated with EPFR's staffed stations. These geographic areas are shown on the map in Figure 3. The AORs are drawn from combinations of existing "Emergency Service Zones" (ESZs) currently maintained by South Sound 911, generally representing due-ordering polygons. The AORs used in this study are a convention for providing geographic breakdowns of statistics. They are aggregated as follows:

Area of Responsibility	Contents
AOR 111	ESZ for Station 111 (111 currently first due)
AOR 112	ESZ for Station 112 (112 currently first due)
AOR 113	ESZ for Station 113 (113 currently first due)
AOR 114	ESZs for Stations 114 and 122
AOR 116	ESZs for Stations 116 including rural/wilderness areas
AOR 118	ESZs for Stations 118 and 124

[5] CFAI. (2009). Fire & *emergency service self-assessment manual*, (9th ed.). Chantilly, Virginia: Author.
[6] Ibid.
[7] National Fire Protection Association. (2016). 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*. Boston, MA: National Fire Protection Association.
[8] USFA. (August 2006). Structure fire response times: Topical fire research series, 5(7). Emmitsburg, Maryland: Author.

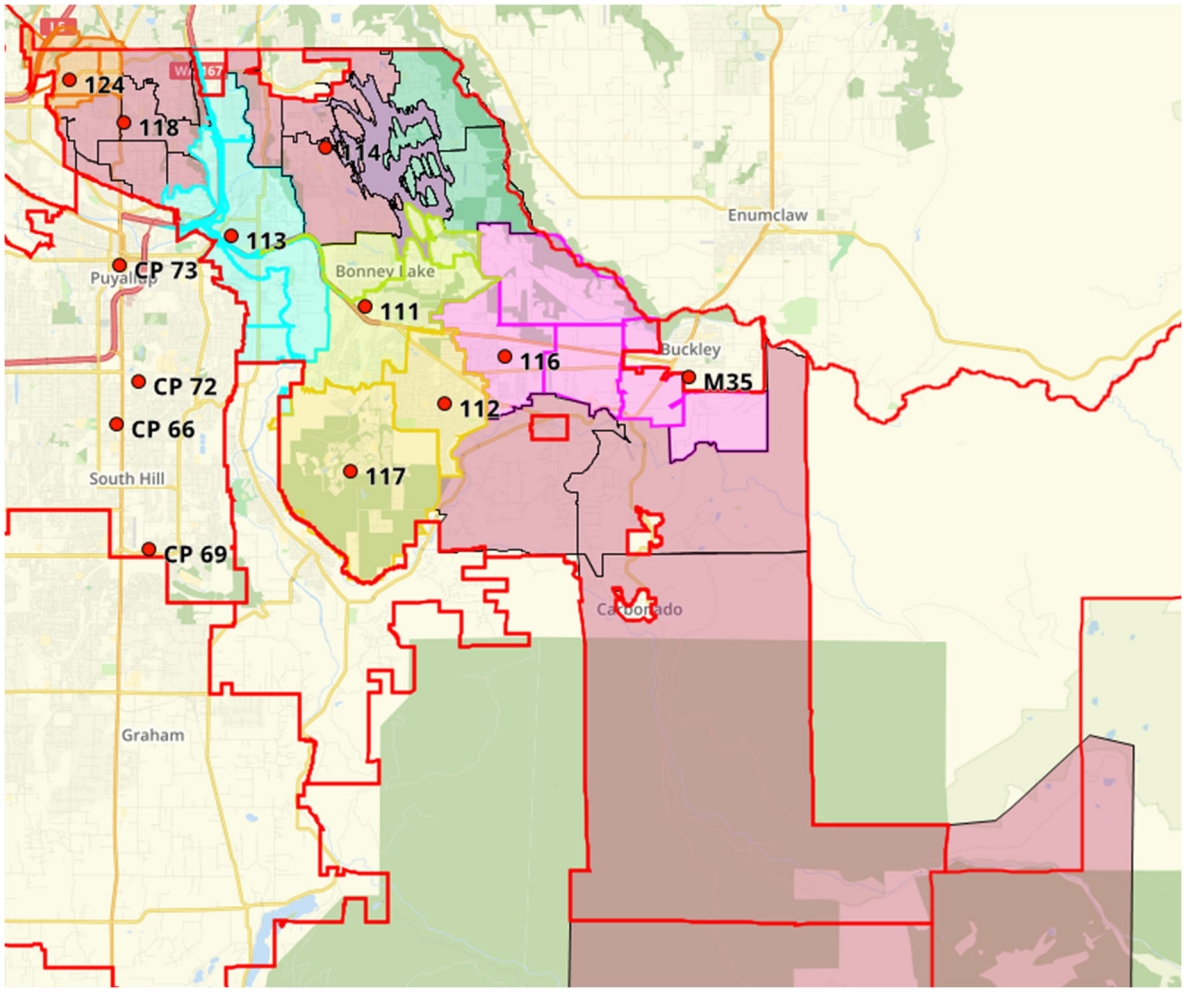


Figure 3: Areas of Responsibility

3 Historical Data Analysis

An essential element of this study is a thorough, data-centered understanding of EPFR's current and recent historical workload and performance.

3.1 Data Acquisition and Validation

For the purposes of this analysis, we studied five years of incident and response data supplied by South Sound 911, retrieved, and pre-processed by Levrum, comprising incident and response data for nearly 62,000 incidents over the five-year period. The data included (a) incidents that occurred within EPFR's primary area of responsibility, and (b) incidents outside EPFR's area of responsibility to which EPFR units responded. It did not include data regarding neighboring agencies' responses to incidents outside EPFR's area of responsibility.

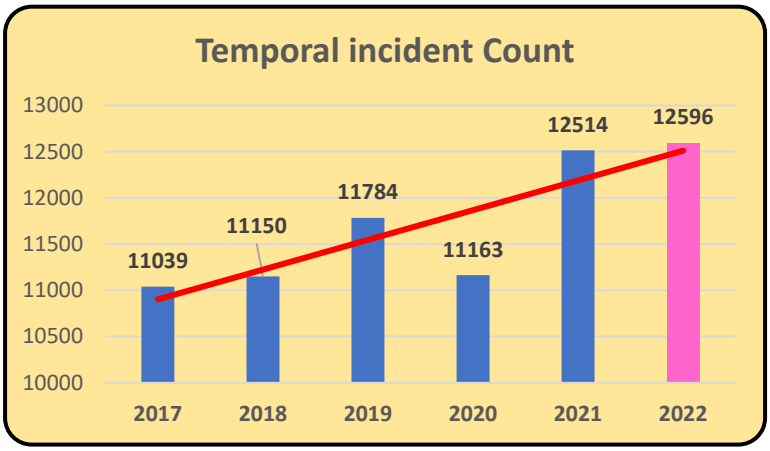
Detailed information on origin, acquisition, import and validation of the data used in this study is covered in the Technical Appendix to this report.

3.2 Incident and Workload Characteristics

In this section, we examine characteristics of the incidents relevant to EPFR's operations. These include (a) incidents within the borders of EPFR's primary area of responsibility, regardless of what units or agencies responded to them, and (b) incidents outside of EPFR's primary area of responsibility to which EPFR units responded. Section 3.3 covers metrics related to EPFR's performance on responses to these incidents.

3.2.1 Temporal Trends

Overall number of incidents by year:



The following chart illustrates the trend over time year by year since 2017 with projected estimates through 2022 based on forecast models through November 2022.

Number of incidents by calendar quarter:

Breaking down the overall incident count by quarter illustrates an overall trend toward increased call surge during Q3 (highlighted with different color for clarity) of each year. This consistent trend drives the need for appropriate staffing adjustments.

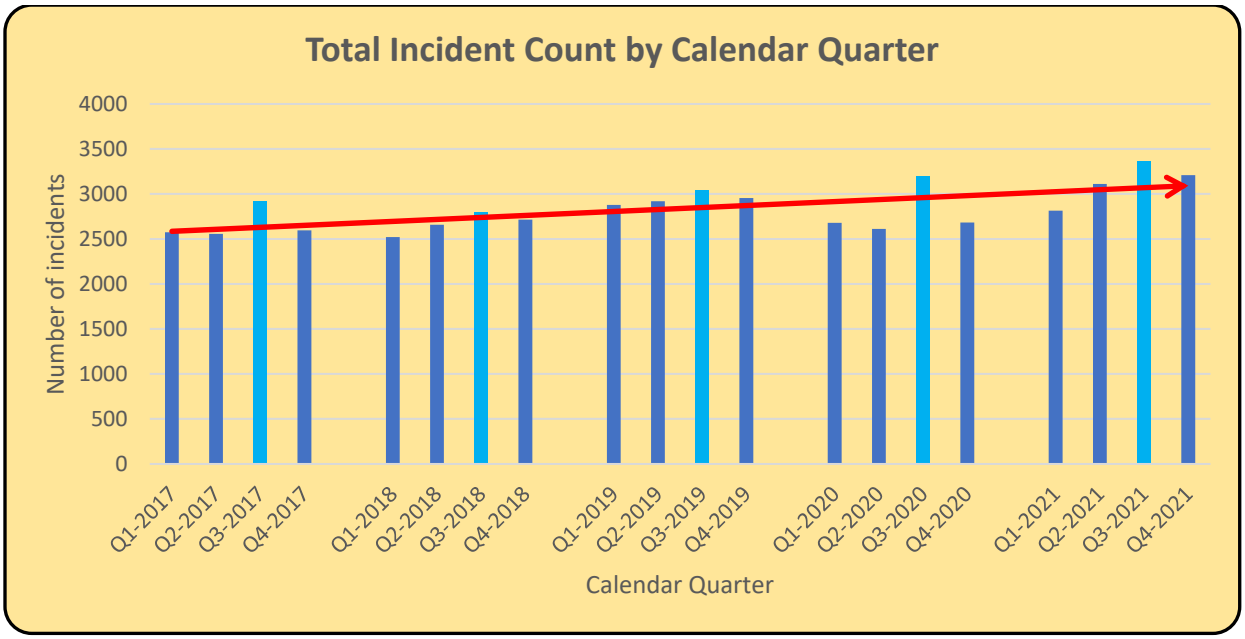


Figure 4: Priority 0 Historical Incident Volume

Counts of priority incidents. Priority "0" (zero) incidents, whose history is shown in Figure 4, are CPR calls. This may also include calls for deceased persons or calls where CPR is not necessarily warranted on arrival. However, where there is a cardiac arrest present data suggest correlation between time to treatment and overall outcome.[9]

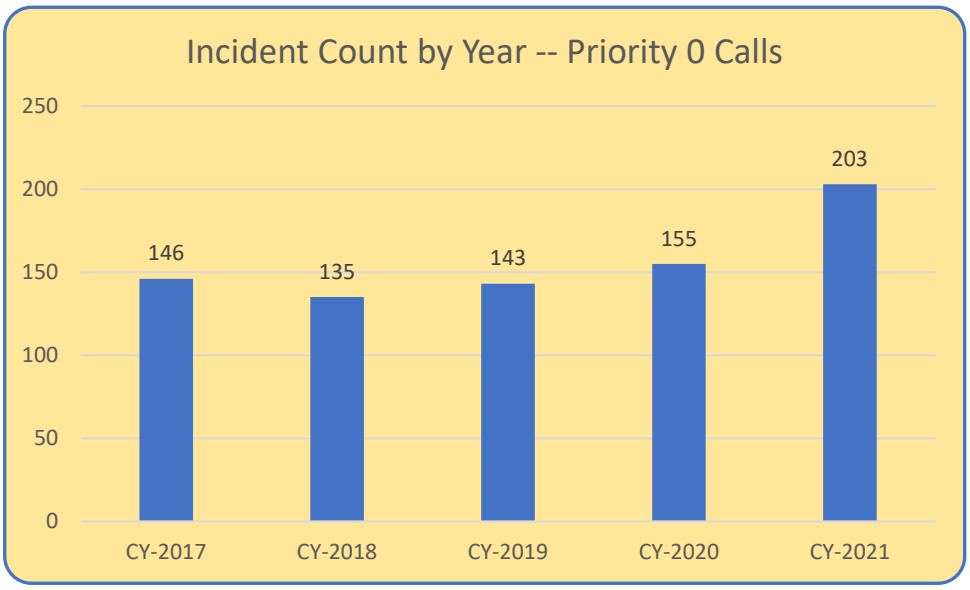


Figure 5: Priority 0 Incident History

Calls dispatched as Priority-1 include Advanced Life Support (ALS) critical calls, working fires, and other calls where an immediate threat to life or property exists. These incidents also time-critical based on information received by call takers for initial dispatch. Historical volumes of Priority-1 calls are shown in Figure 6.

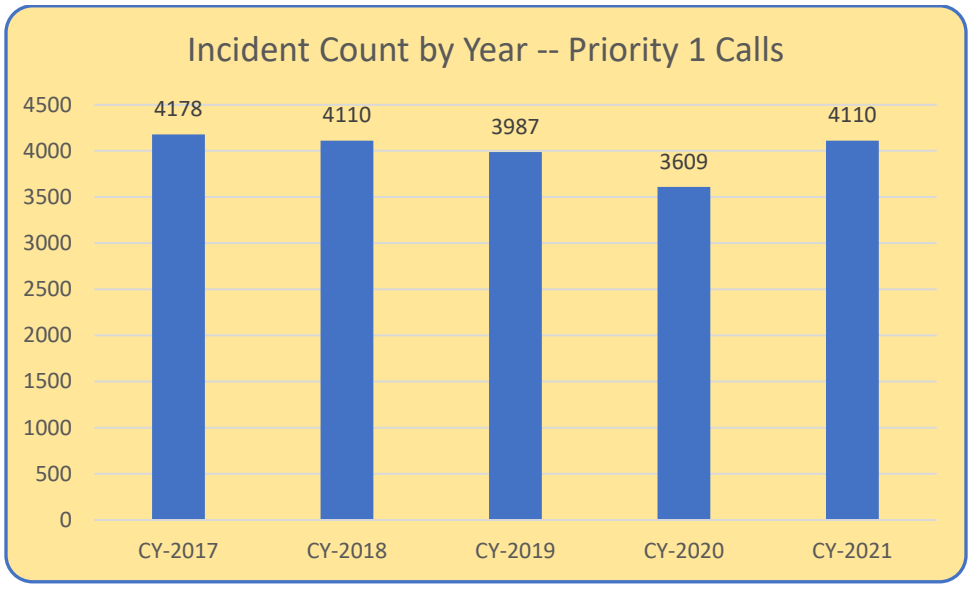


Figure 6: Priority 1 Incident History

[9] (Vukmir, 2006)

Priority 2 and 3 calls are lower acuity than Priority 0 and Priority 1 incidents. They often require 1 or 2 responding apparatus. They are urgent, but less threatening. An example of a Priority 2 call is a chimney fire. The frequency of Priority 2 and 3 calls is much lower than that of calls in other priority classes, as shown in

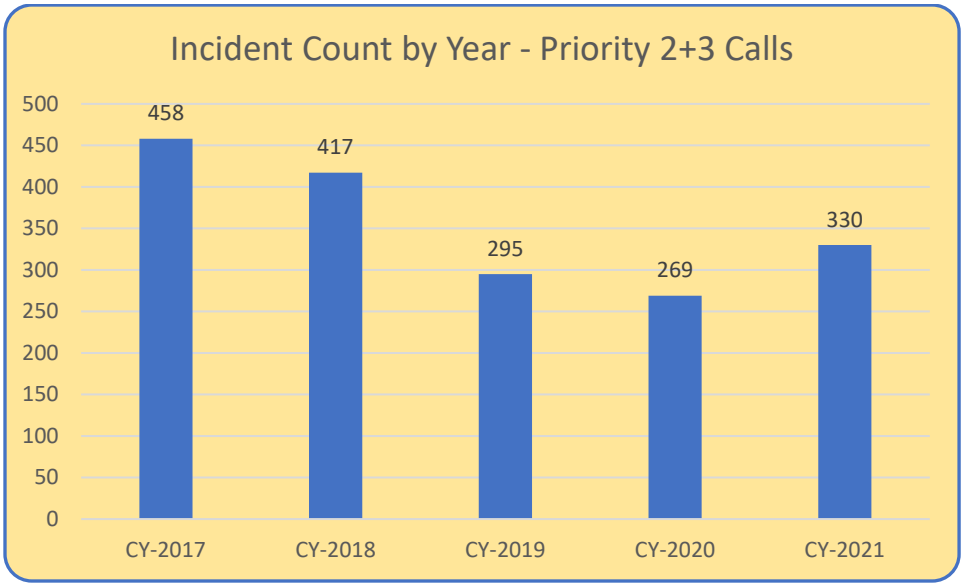


Figure 7: Priority 2+3 Incident History

Priority 4 incidents comprise a significant portion of the total call volume. These incidents represent mainly Basic Life Support (BLS) medical calls as well as Automatic Fire Alarms (AFA) both commercial and residential.

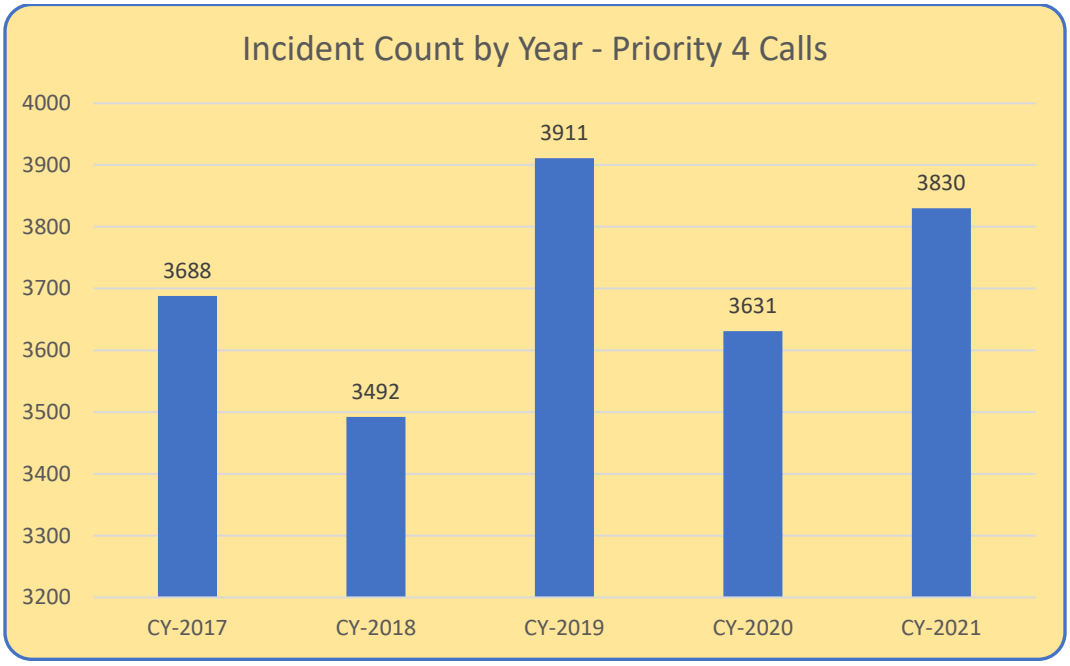


Figure 8: Priority 4 Incident History

Priority 5 through 9 incidents are largely comprised of service calls, with the majority of those patient assists. To a much lesser extent, there are odor investigations, burn complaints and wires down reports. The total numbers are combined.

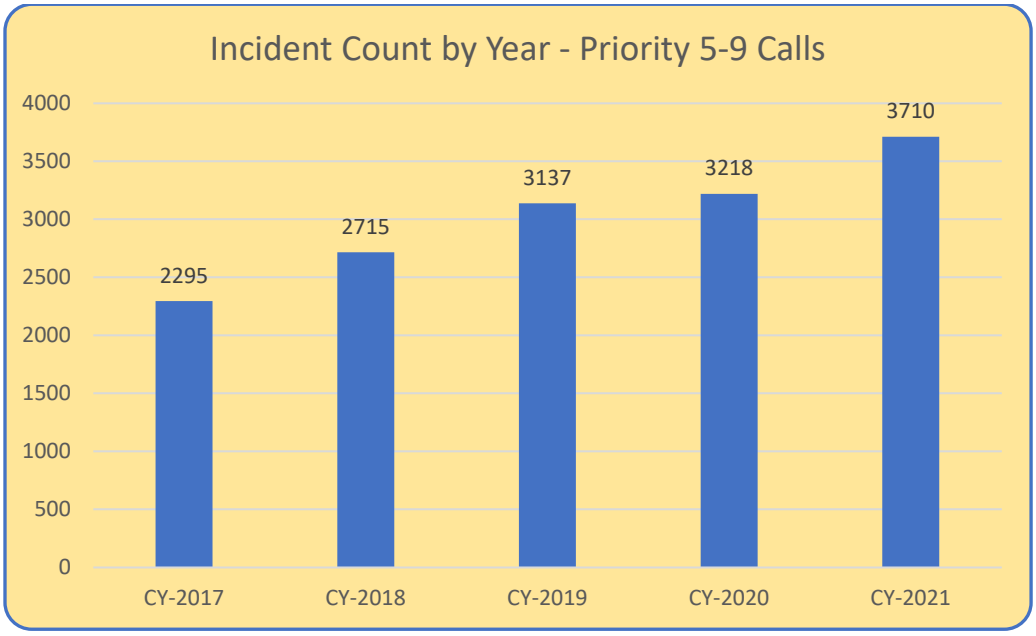
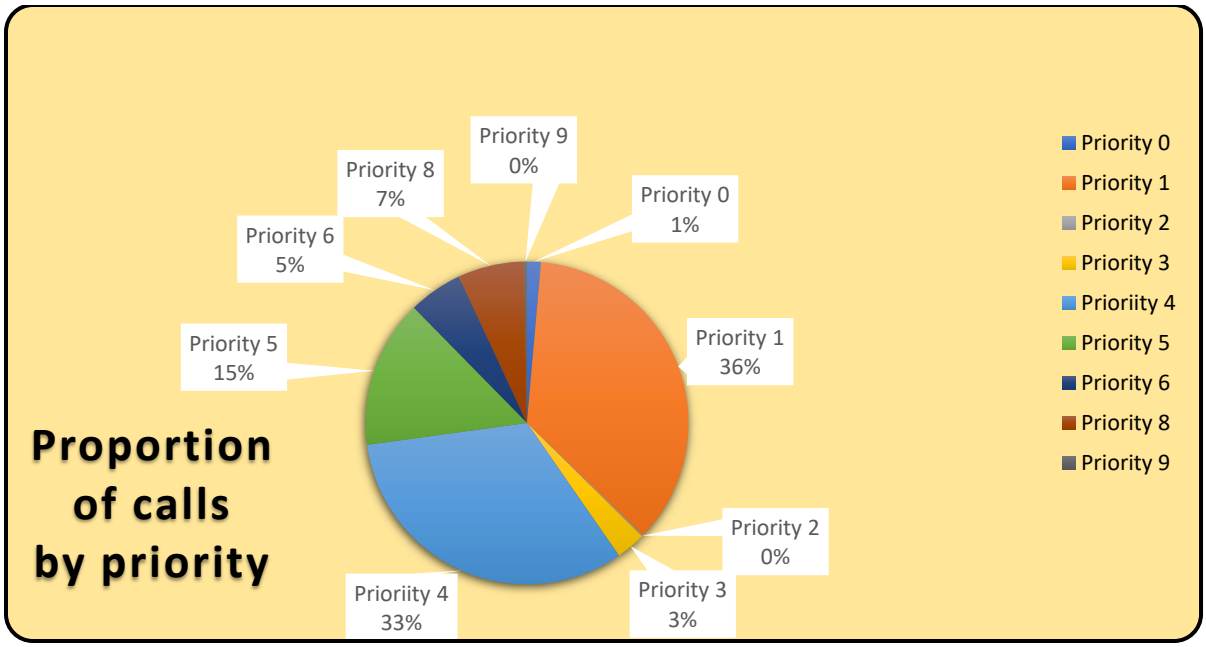
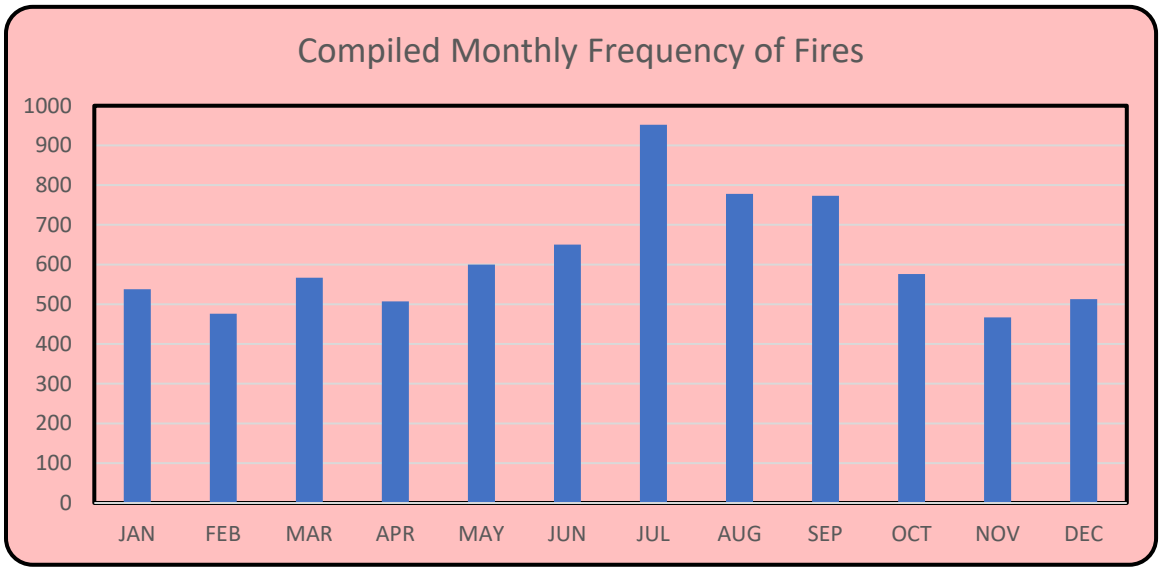


Figure 9: Priority 5-9 Incident History

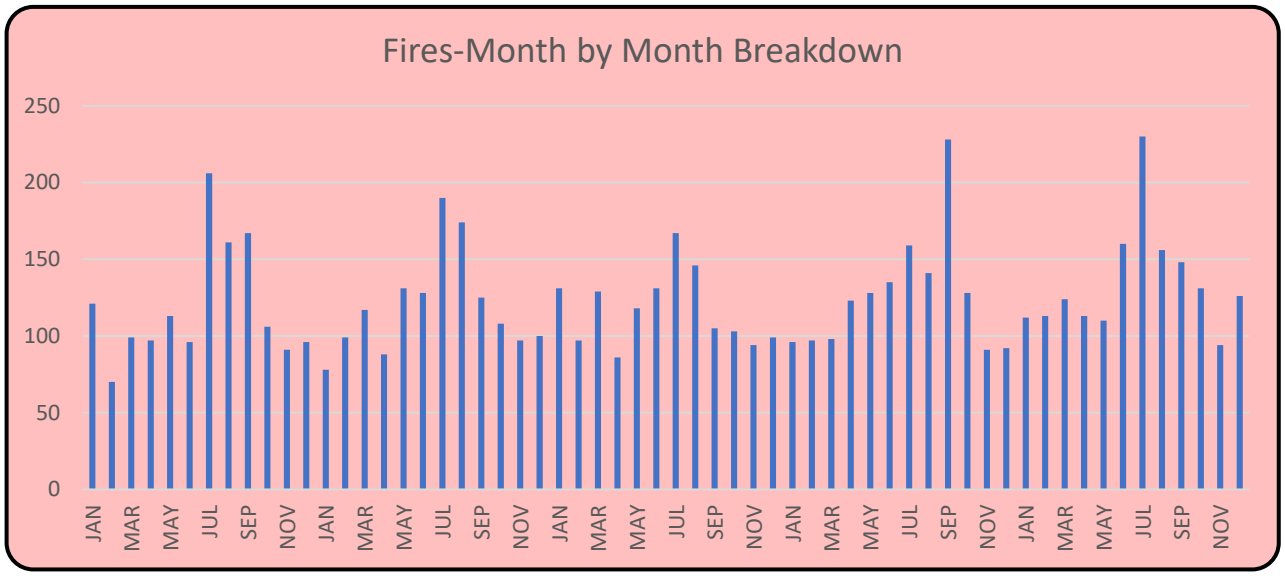
Overall, workload in the Priority 0 and Priorities 5-9 categories have been systematically increasing over the past five years; directional changes in other categories are inconclusive.

A comparison of frequency of the call priorities is as follows:





Breakdown of fire incidents and frequency—Looking at fire calls specifically, an identifiable seasonal pattern emerges. This confirms empirical data with solid data.



Number of incidents by geography and year. The most dramatic growth seems to be in the 118 area:

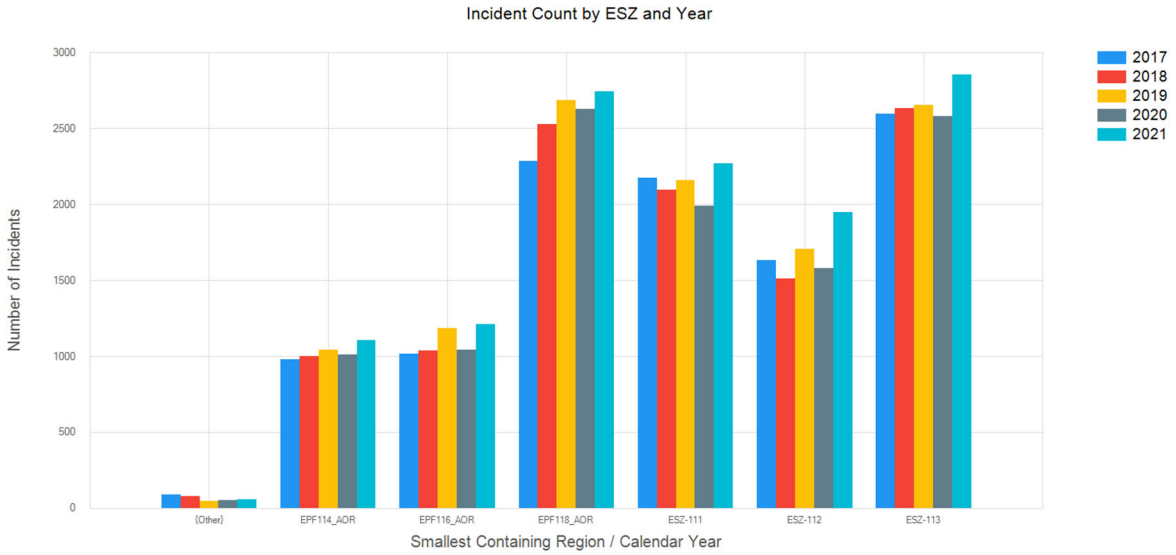


Figure 12 10 shows the number of incidents by type and quarter. EMS and mutual aid are consistently growing (except for COVID). Fire incidents show a strong seasonal pattern.

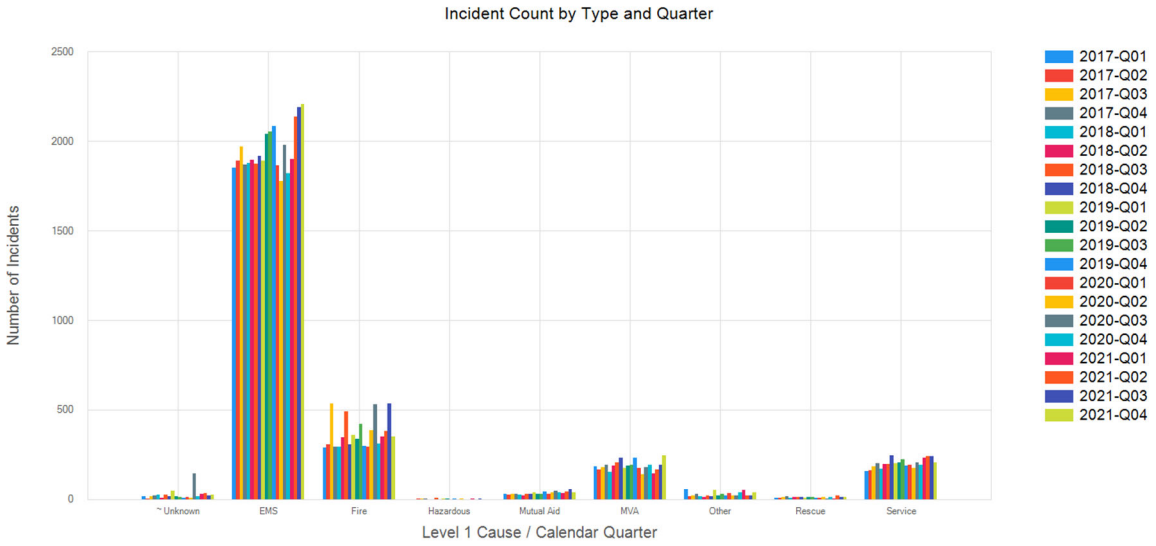


Figure 10: Incident Count by Type and Quarter

Figure 11 shows the number of fire incidents in each month of the study period, clearly illustrating the repetitive, cyclical nature of fire demand.

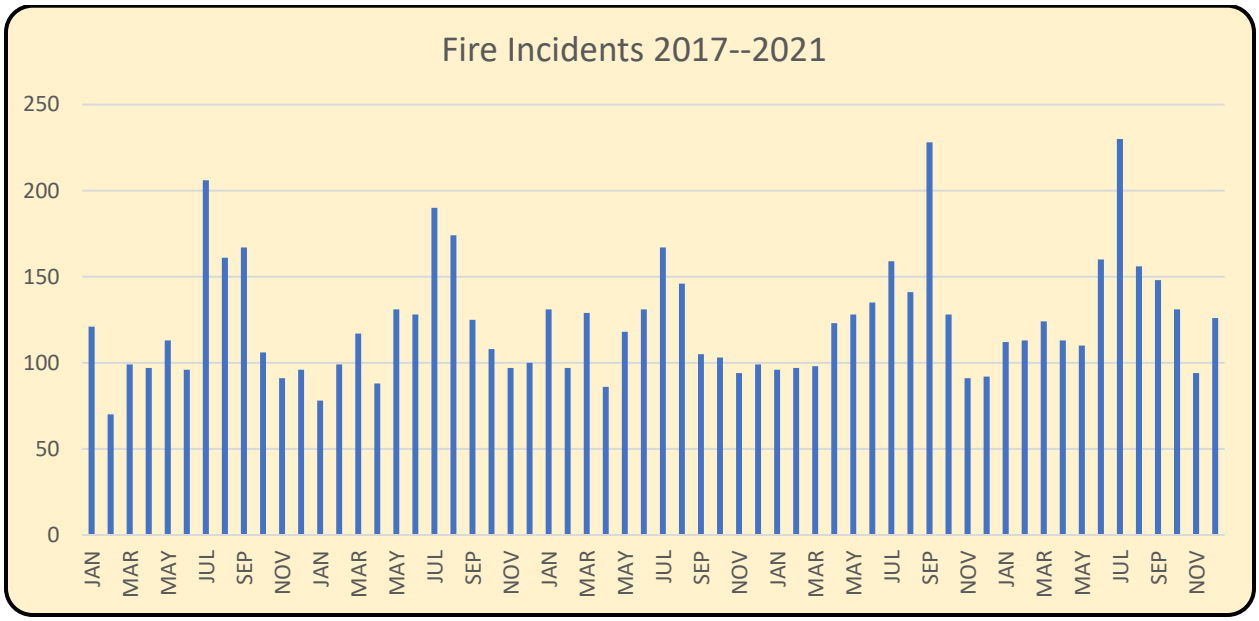


Figure 11: Incident Count by Month

Figure 12 shows key fire trends by quarter. AFAs appear to increase steadily. Outdoor fires (presumably including the INVEST category) show the seasonal pattern.

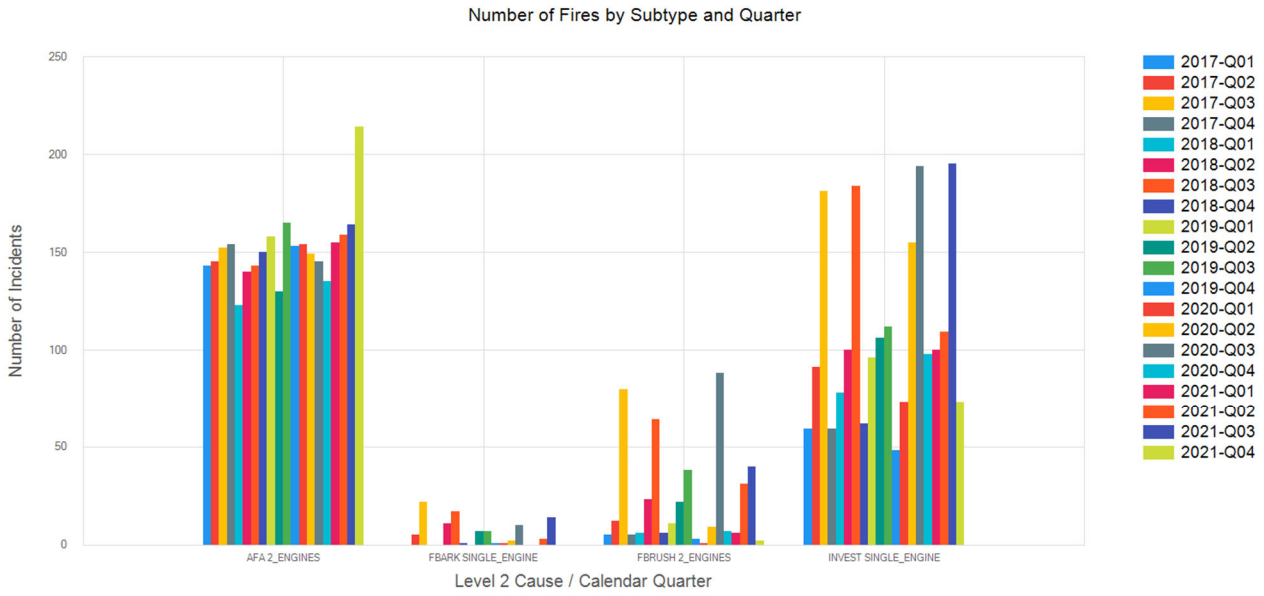


Figure 12: Incident Count by Type and Quarter

Figure 13 shows incident count by priority and year. Priority 5 calls show the most rapid increase.

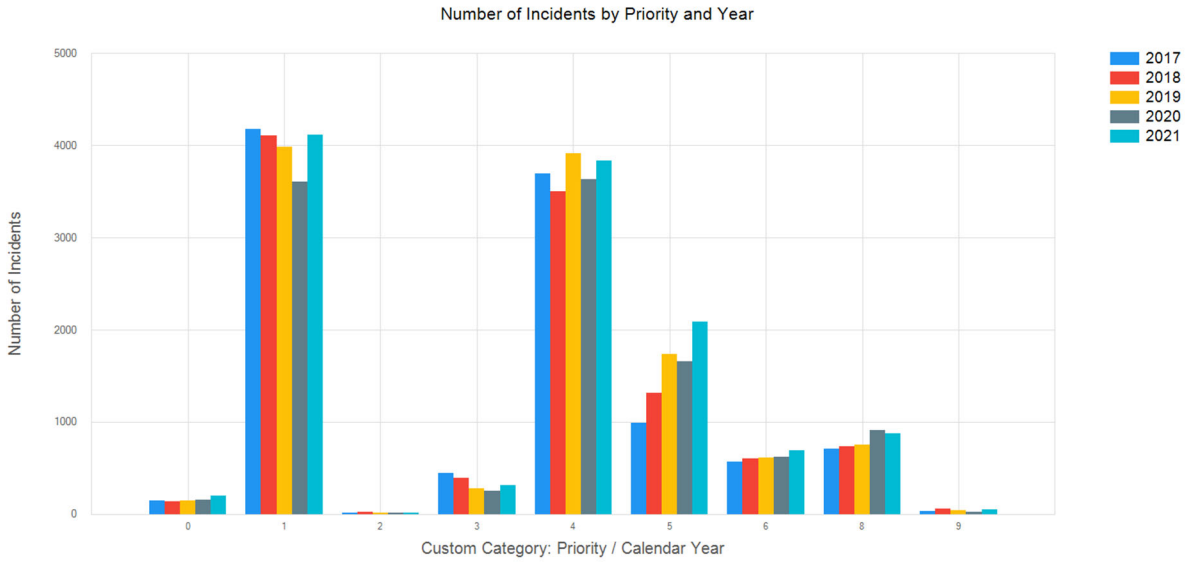


Figure 13: Incident Count by Priority and Year

Figure 14 shows incident count by detailed type and year, for Priority 5 incidents only. The increases appear to be driven by several categories of ALS response. This may indicate evolving practice in dispatch/triage, or an underlying change in utilization patterns:

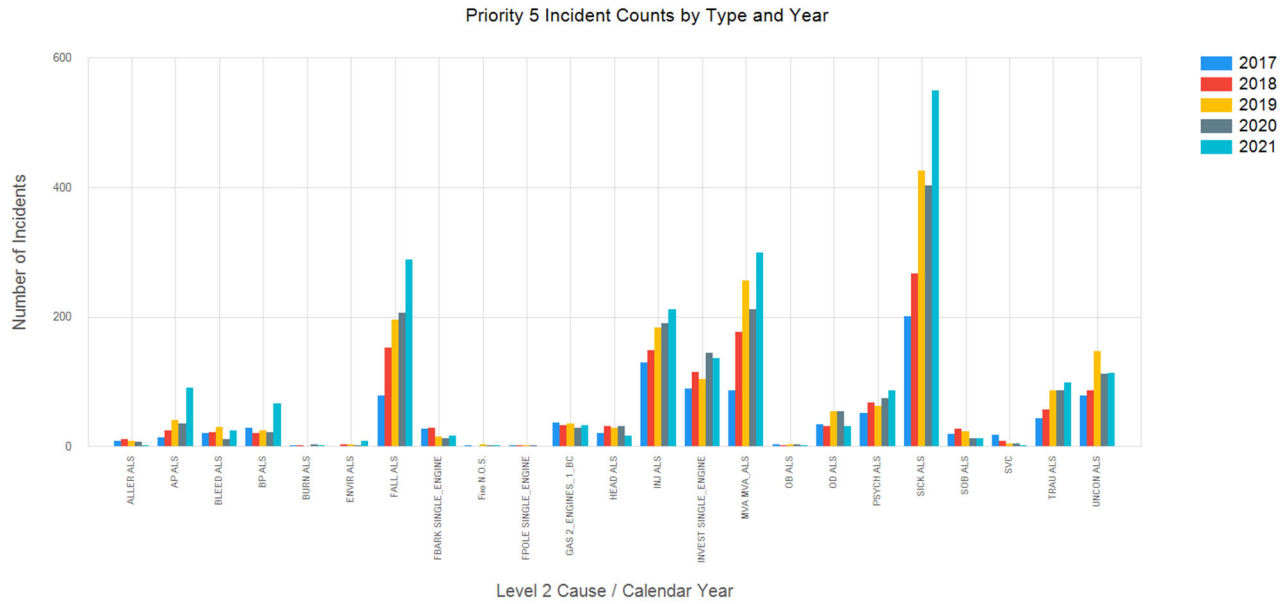


Figure 14: Detailed Counts for Priority 5 Incidents

3.2.2 Geographic Incident Distribution

Figure 15 shows the relative density of all incidents to which EPFR responded over the study period. The highest concentration of incidents is immediately northeast of Station 113's location in downtown Sumner with another "hot spot" east of Station 111.

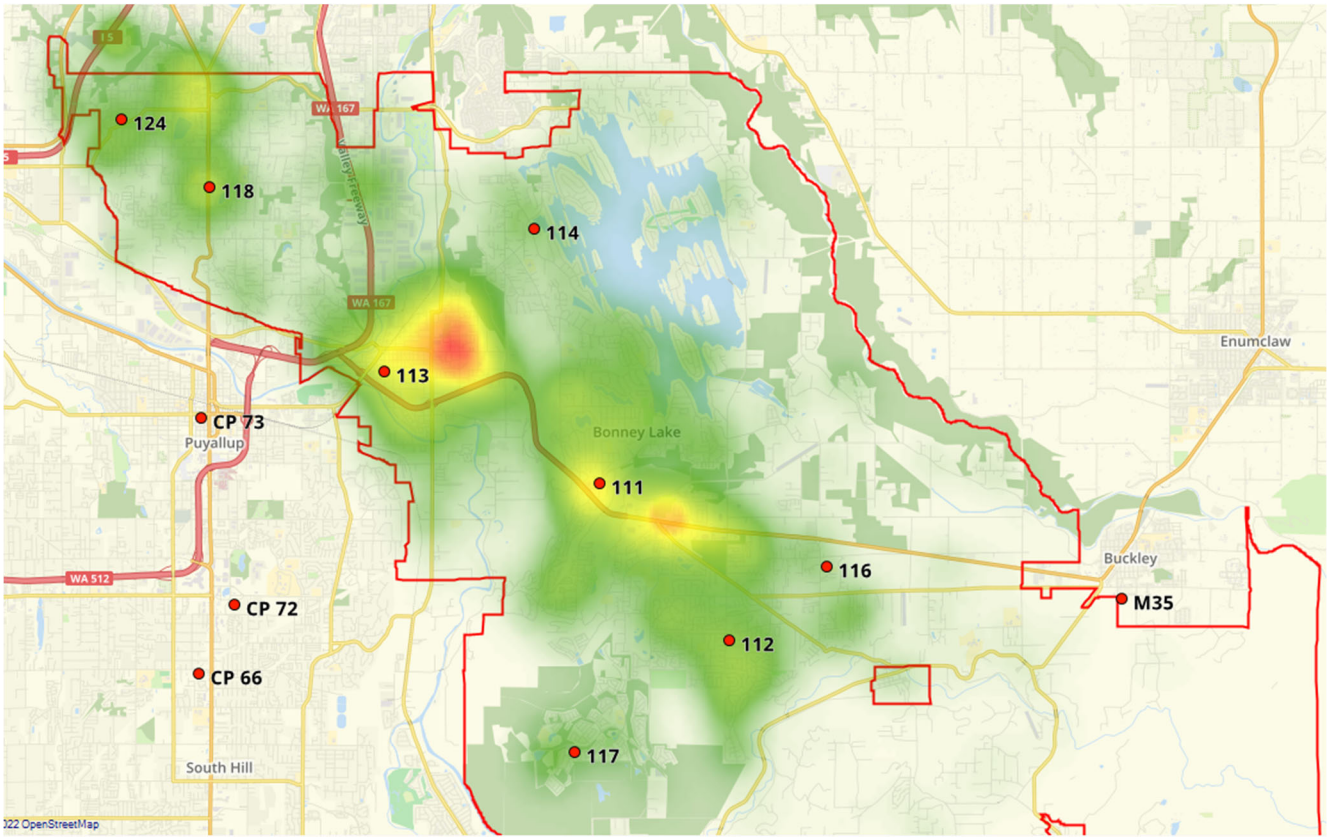


Figure 15: Overall Incident Density

The following four graphics show relative densities of priority 0, 1 and 2 incidents, as well as incidents that received responses of four or more units. The highest severity incidents are generally concentrated near Station 113, with the highest density of Priority 2 incidents southeast of Station 111. Incidents requiring high resource utilization (four or more units) were heavily concentrated in the vicinity of Station 113, with additional "hot spots" north of Station 118.

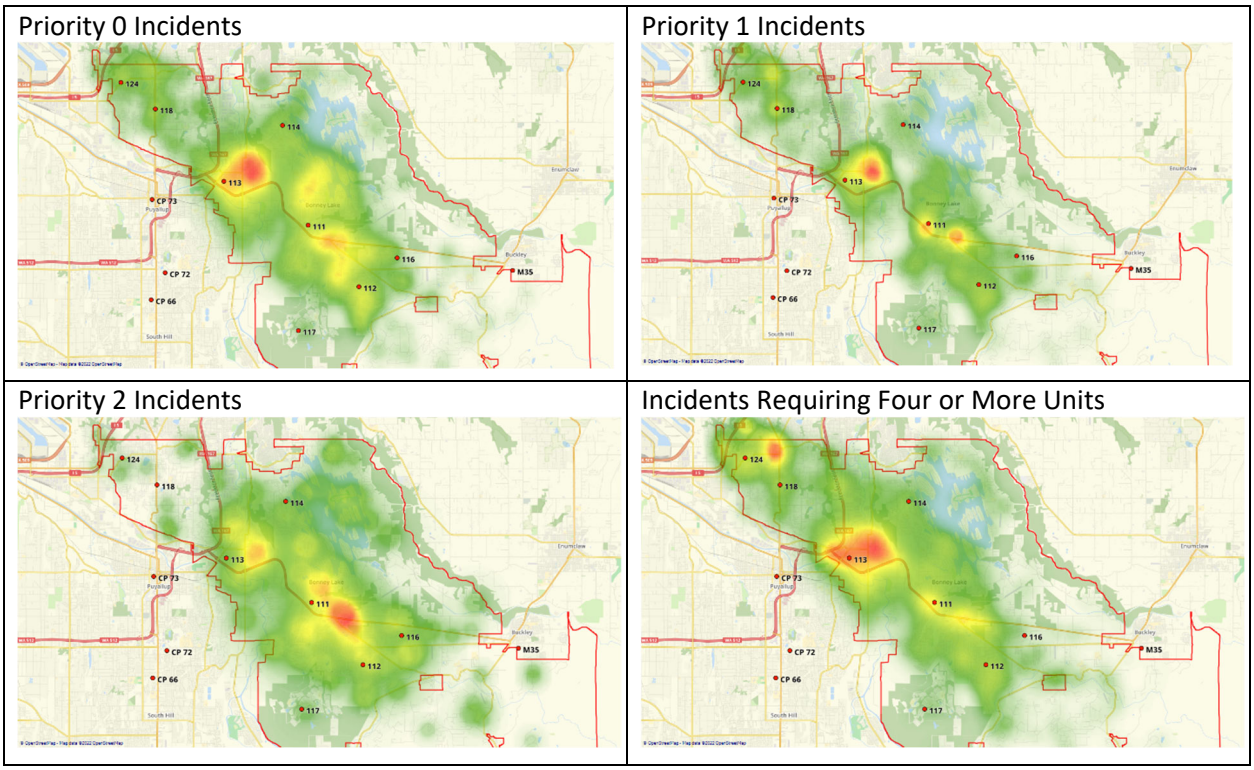


Figure 16: Priority/Consequence Density Maps

3.2.3 Road Network Coverage

The District includes approximately 693 miles of roadways. Of these, approximately 118 (17%) are within one mile of a staffed EPFR station, 479 (69%) within three miles and 609 (88%) within five miles.

Table 1 and Figure 17 summarize this information. Figure 18 through Figure 20 show the same information road coverage at 1-, 3- and 5-mile thresholds, with roads colored by closest station.

Several facts are apparent from this analysis:

- Stations 112, 113 and 118 primarily serve denser environments, with high proportions of their road networks accessible within 3 miles of the primary station
- Only Station 112 covers more than one quarter of its territory within one mile of the station
- Station 116 primarily serves a sparser, rural environment, with much lower coverage proportions at every level.

	Total Road Miles	1 Mile Coverage	3 Mile Coverage	5 Mile Coverage	1 Mile % Coverage	3 Mile % Coverage	5 Mile % Coverage
Full Jurisdiction	693.29	117.71	479.36	609.44	16.98%	69.14%	87.91%
Station 111	96.88	18.97	90.81	96.88	19.58%	93.73%	100.00%
Station 112	102.82	26.79	72.16	102.38	26.06%	70.18%	99.57%
Station 113	103.36	22.08	88.89	103.36	21.36%	86.00%	100.00%
Station 114	103.15	15.54	62.94	82.80	15.07%	61.02%	80.27%
Station 116	170.66	15.21	57.99	102.05	8.91%	33.98%	59.80%
Station 118	115.86	19.12	104.75	114.73	16.50%	90.41%	99.02%

Table 1: Road Coverage by Station AOR

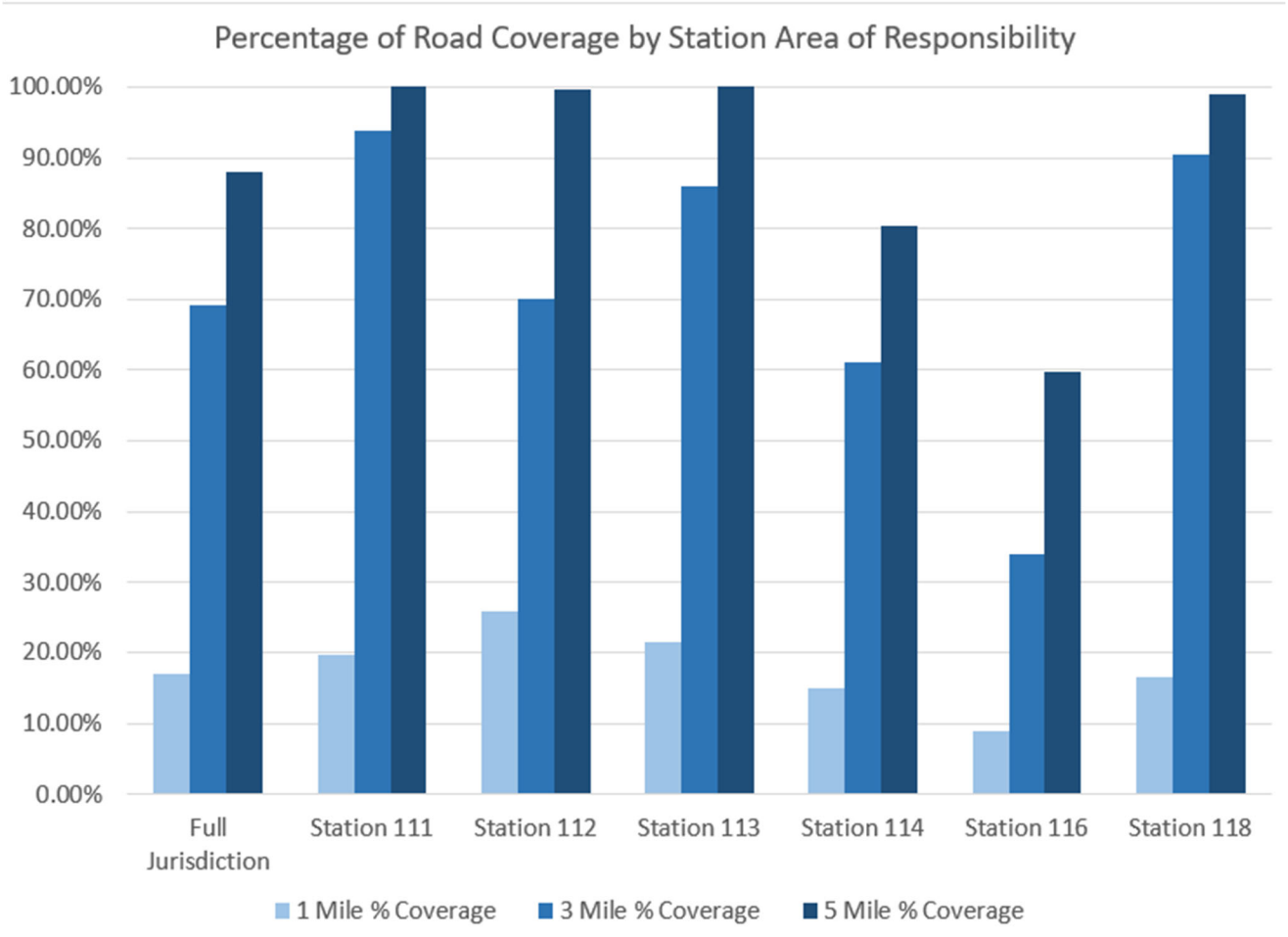


Figure 17: Road Coverage Percentage by Station AOR

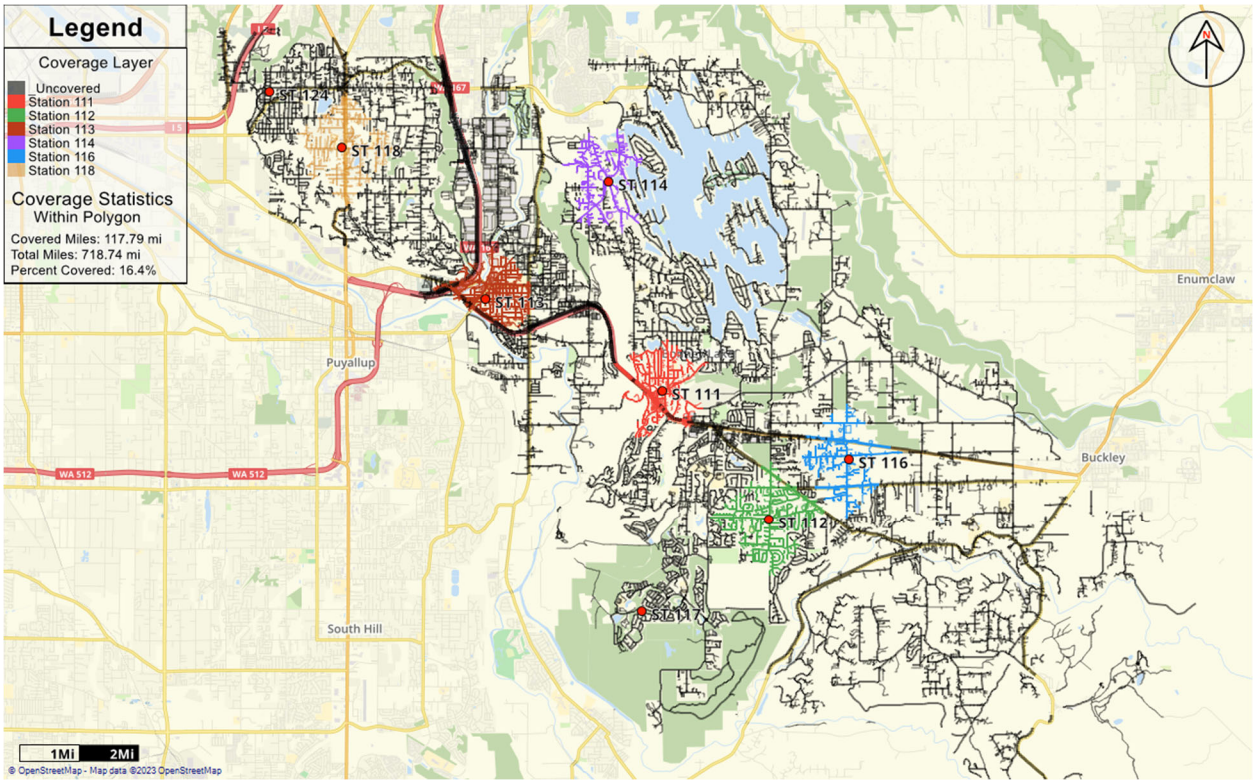


Figure 18: 1.0 - Mile Road Coverage

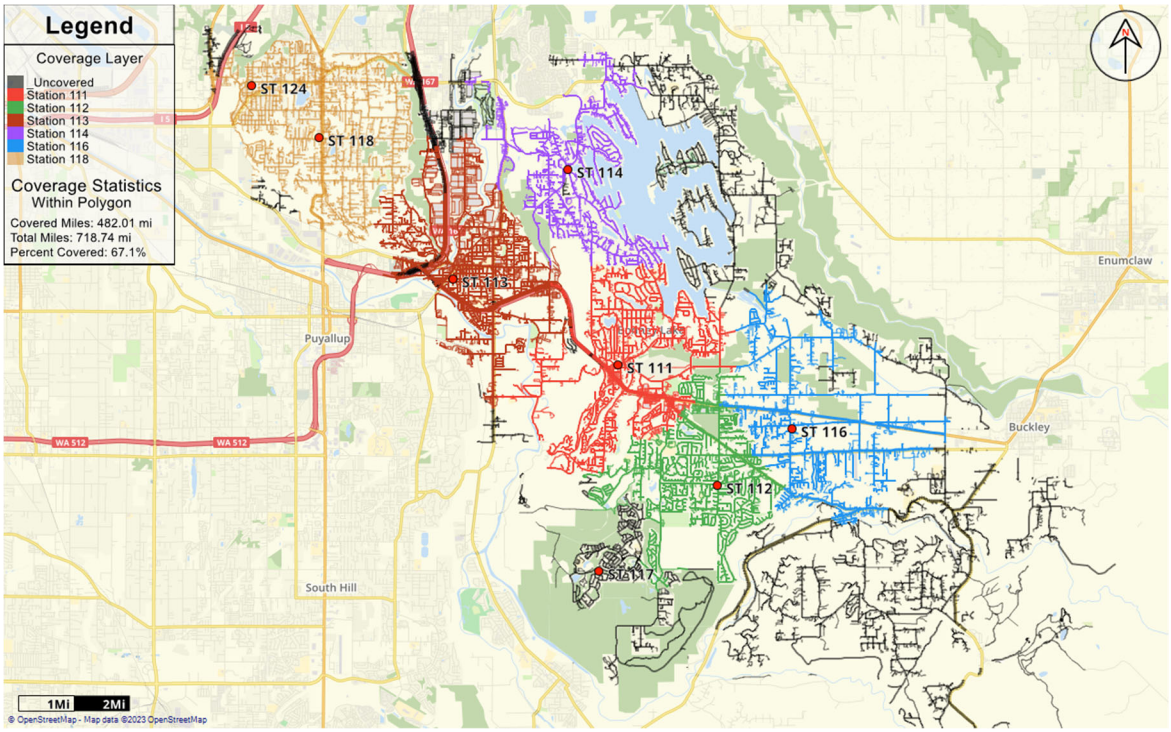


Figure 19: 3.0 Road Mile Coverage

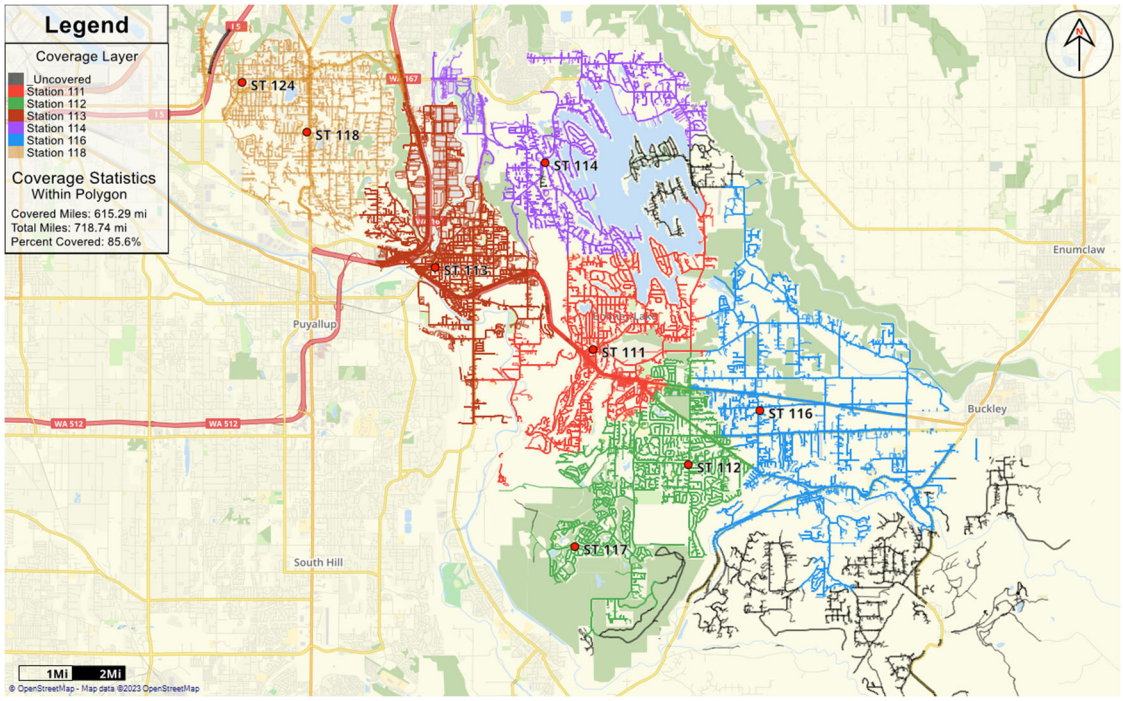


Figure 20: 5.0 road Mile Coverage

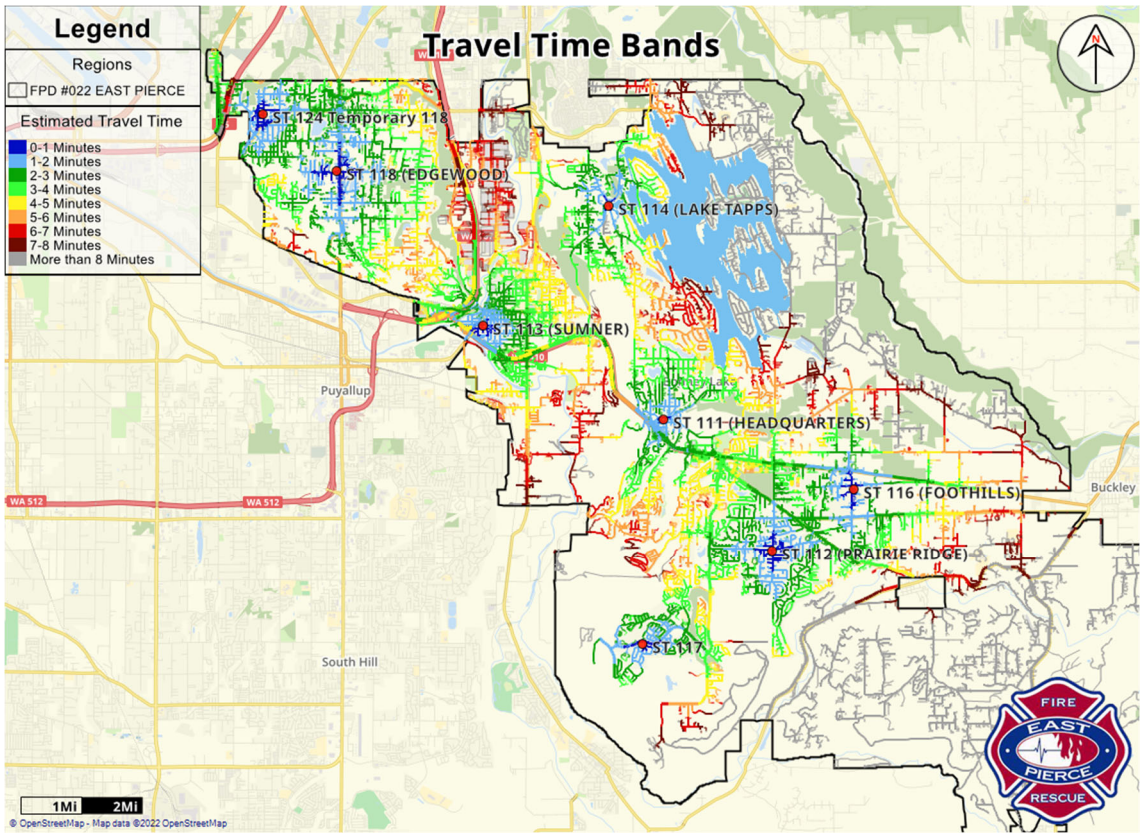


Figure 21: Overall Predicted Travel Time Coverage

3.2.4 Target Hazard Coverage

As part of the risk assessment portion of this study, EPFR staff obtained a list of target hazard occupancies from the Washington State Surveying and Rating Bureau and augmented this list via personal knowledge of EPFR company and command officers as well as internal data and documentation. This process is documented in Section 5. We analyzed the full list of 449 target hazards with respect to station proximity.

Figure 22 through *Figure 24* graphically summarize coverage information by station area of responsibility (AOR), target hazard magnitude (measured by recommended fire flow in GPM) and distance to closest staffed station. In all three figures, distance is color coded into categories: 0-1 miles (dark green), 1-3 miles (light green), 3-5 miles (yellow) and over 5 miles (red).

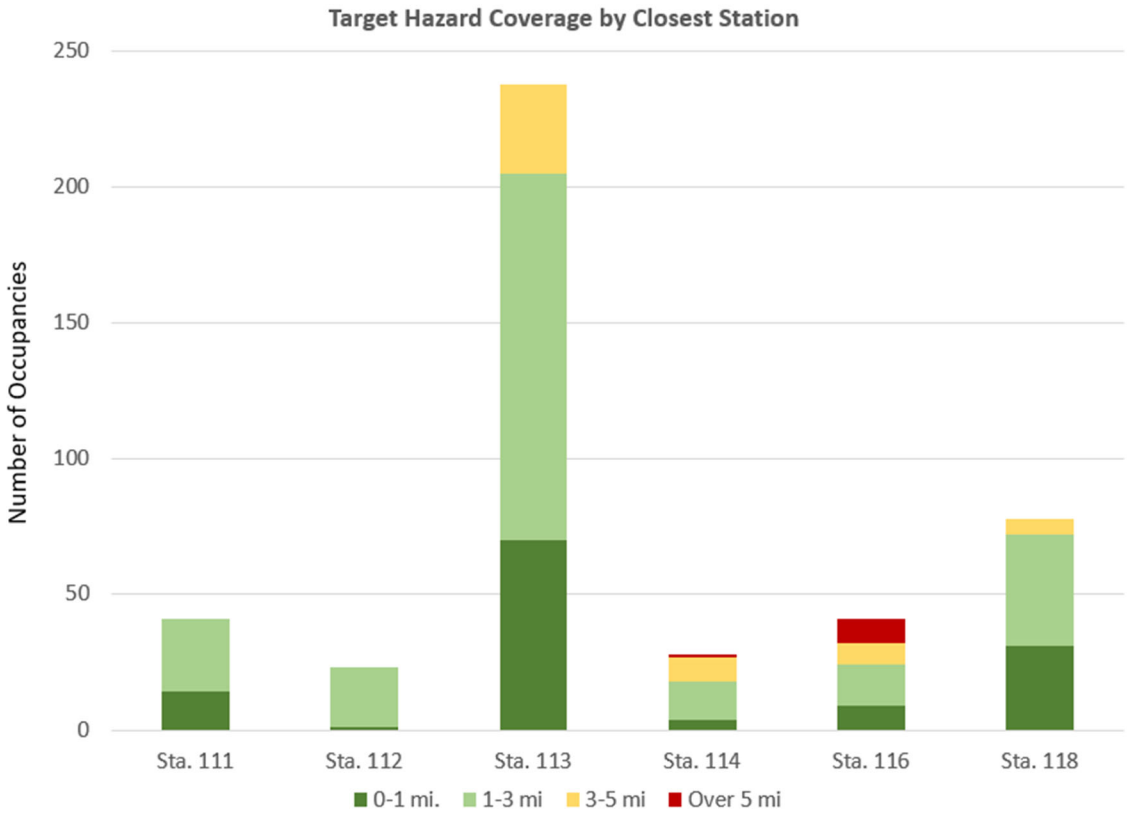


Figure 22: Target Hazard Coverage by Station AOR – This graphic illustrates the number of occupancies in each distance category by station AOR.

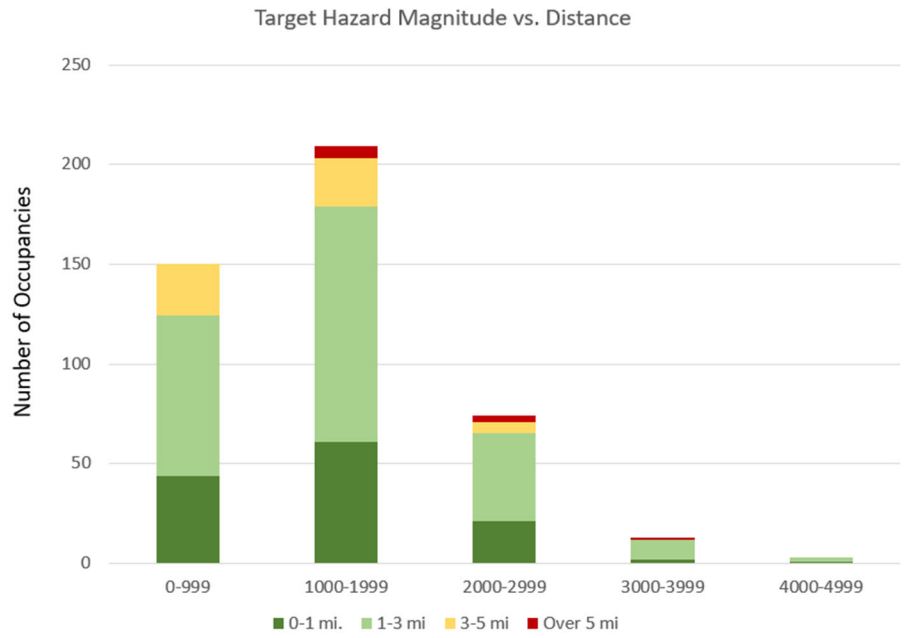


Figure 23: Target Hazard Coverage by Magnitude- This shows the number of occupancies in distance category by fire flow category.

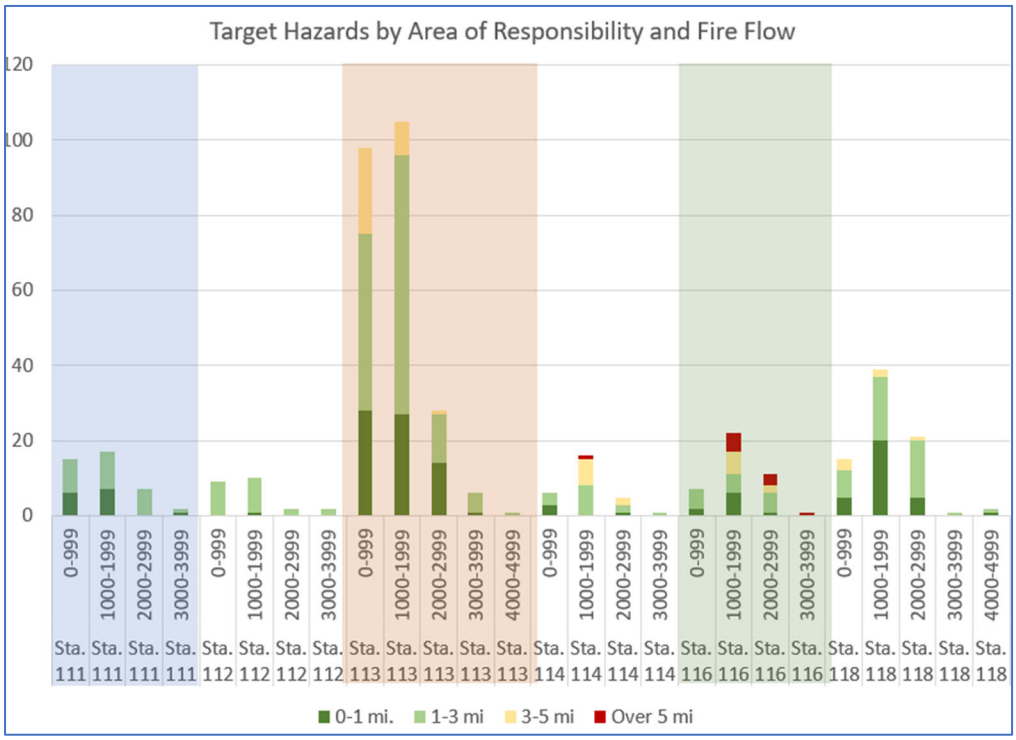


Figure 24: Target Hazard Coverage – This illustration shows target hazard coverage by station AOR, distance and magnitude. The vertical axis represents the number of target hazards in each category. The horizontal axis has station AORs as major groupings, and recommended fire flow categories as minor groupings.

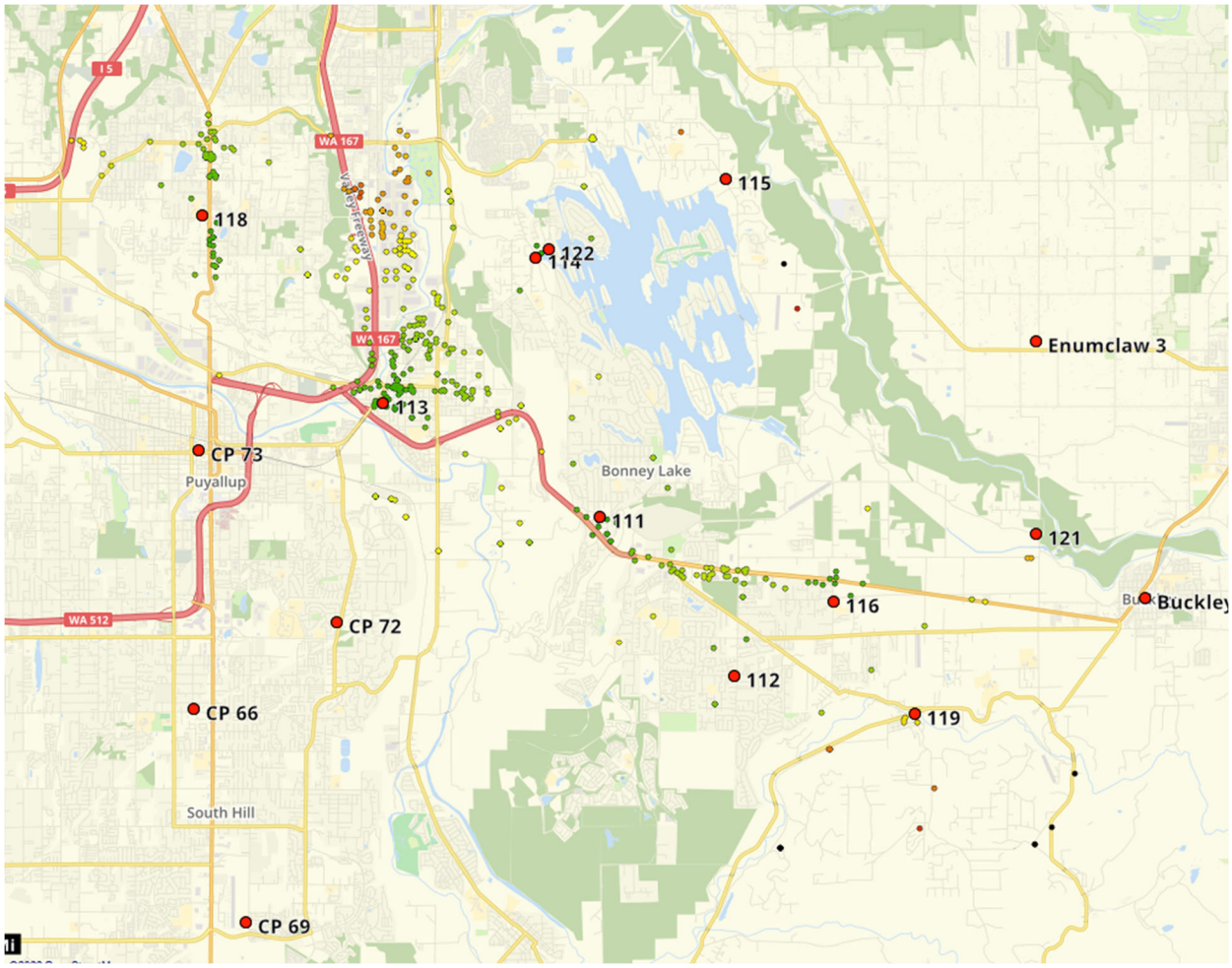


Figure 25: Target Hazard Distances - This shows the distribution of target hazards on a map of the area, with point colors shaded from green to red to indicate increasing distances to the closest staffed station.

3.2.5 Temporal Demand Patterns

The need for responses by emergency units (unit demand) fluctuates significantly throughout a typical day. Figure 26 clearly demonstrates this fact, showing momentary unit demand throughout a typical day for throughout the base year. The horizontal axis shows the time of day in hours since midnight; the vertical axis shows the average number of units committed at each minute of a typical day during the year. The lowest demand, approximately 1.4 units, occurs just after 0400; the highest demand, approximately 5.1 units, occurs just after 1600. This represents approximately a 3.6x swing between minimum and maximum demand.

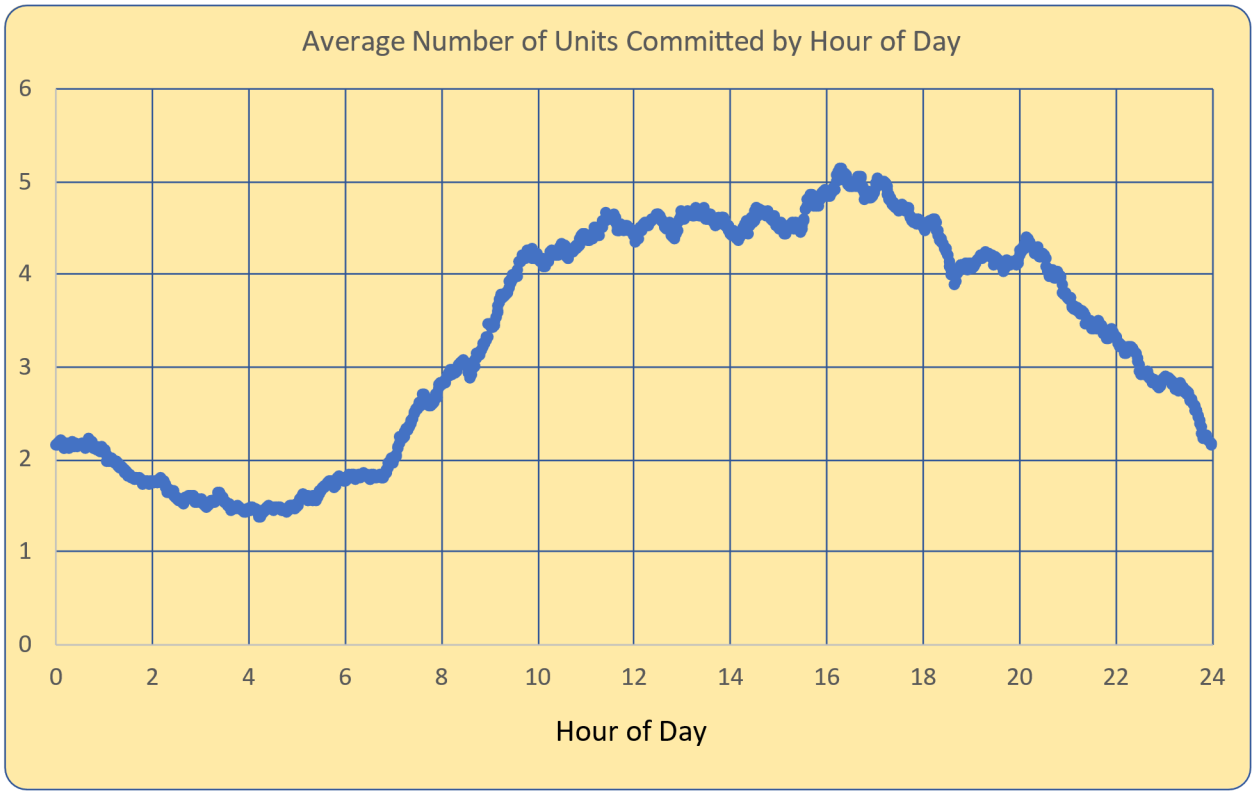


Figure 26: Unit Demand Curve

3.2.6 Balance of Trade

"Balance of trade" refers to the analysis of responses by units into their own areas of responsibility (AORs, or geographic areas in which they would ordinarily be expected to be first due) vs. other areas of responsibility. Balance of trade can be considered both externally (i.e., relative to EPFR's adjoining agencies) and internally (i.e., among EPFR's own stations and AORs).

The data obtained from SS911 contained limited information on incoming units from EPFR partner agencies, so external balance of trade analysis was similarly limited.

We analyzed the base year (6/1/2021 – 5/31/2022) data consisting of 12,429 incidents. 11,580 of these 12,429 incidents (93.2%) had identifiable responses. We analyzed these by first arriving station and area of responsibility. Table 2 summarizes internal balance of trade figures, showing the percentage of time each station arrived first in each AOR or outside FPD#22. Note that the "Outside FPD#22" category indicates which EPFR station arrived first to outside calls, of assigned EPFR units. Since partner agency unit data was inaccessible, these figures do not necessarily reflect EPFR units providing initial responses outside the jurisdiction. Also, the total number of such responses is relatively insignificant, at 0.8% of total call volume. In the table, "off-diagonal" cells indicating responses by EPFR stations into AORs other than their own are color coded by percentage. All EPFR stations except for 112 and 114 responded first to 80% or more of incidents in their own AORs. The exceptions, stations 112 and 114 are partly or largely due to partial staffing: M112 is cross-staffed by E112's crew and is only available during daytime hours, and M114 is staffed only intermittently when peak staffing allows. Accordingly, the next-due medic units in these areas (primarily M116 and M111, respectively) cover high proportions of ALS responses in AORs 112 and 114.

Table 2: Internal Balance of Trade

	Area of Responsibility						
First Arriving Station:	**Outside FPD#22**	**AOR 111**	**AOR 112**	**AOR 113**	**AOR 114**	**AOR 116**	**AOR 118**
Station 111	8.51%	80.42%	7.74%	11.83%	18.18%	8.36%	1.56%
Station 112	6.38%	8.20%	63.65%	0.54%	0.72%	5.31%	0.31%
Station 113	12.77%	1.28%	0.85%	81.51%	4.24%	0.44%	7.59%
Station 114	4.26%	3.14%	0.26%	3.36%	73.24%	0.35%	0.70%
Station 116	31.91%	6.92%	27.45%	0.54%	3.10%	85.54%	0.23%
Station 118	36.17%	0.05%	0.05%	2.21%	0.52%	0.00%	89.61%

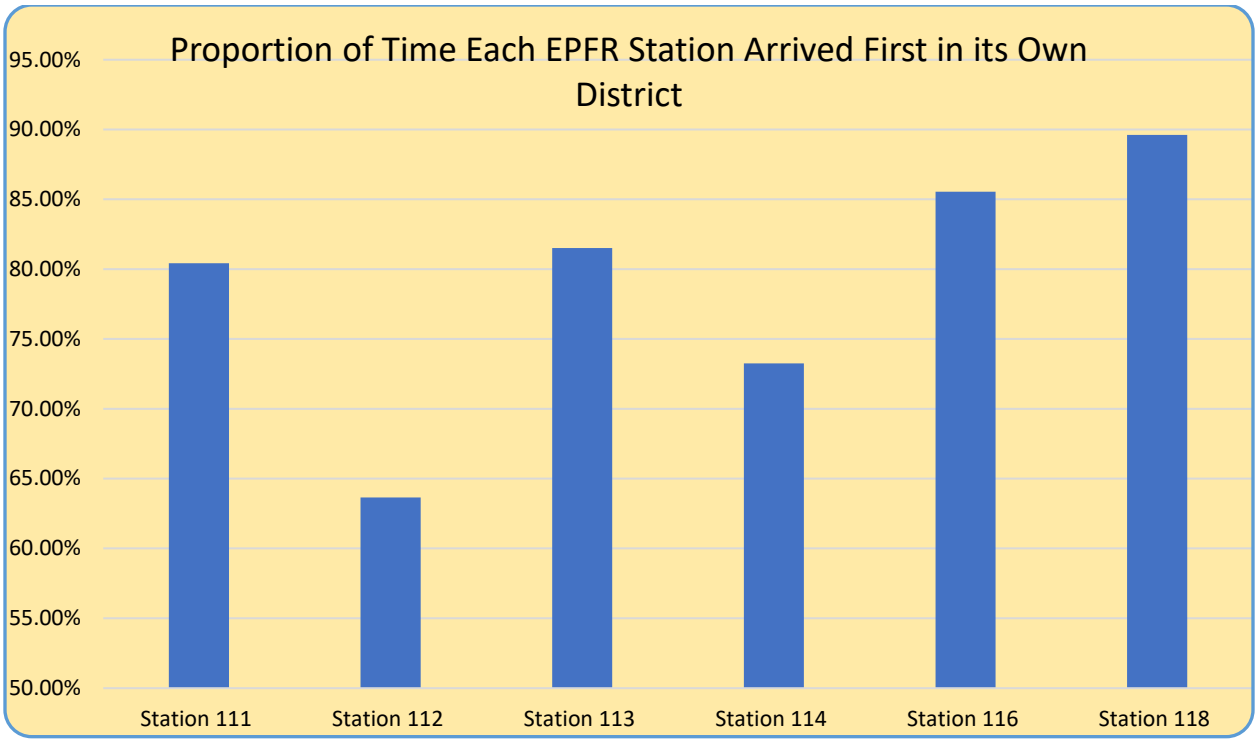
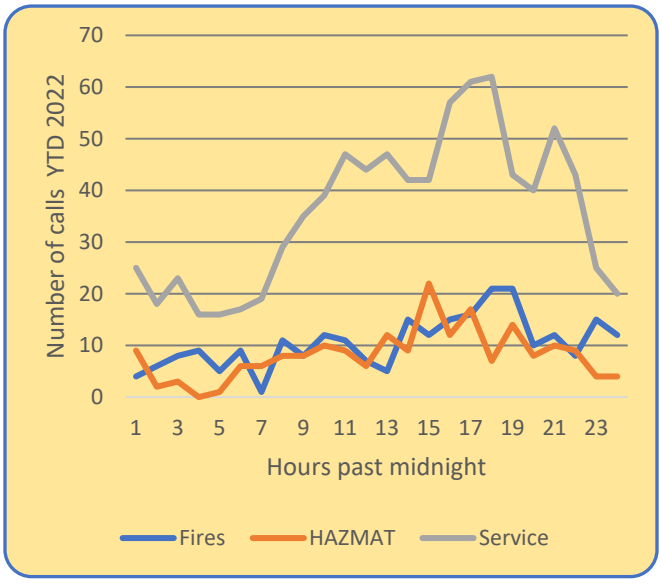
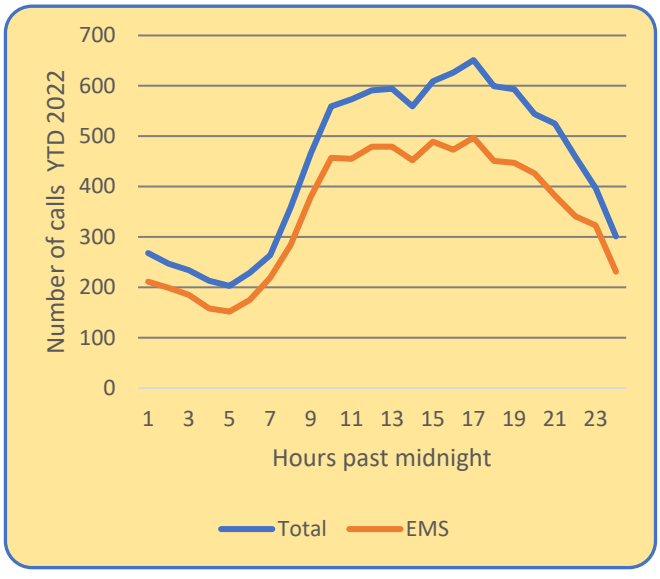


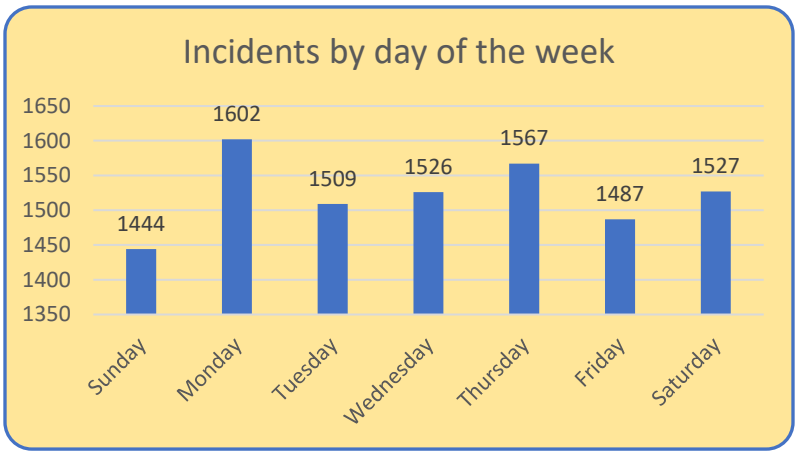
Figure 27: Internal Balance of Trade

3.2.7 Concurrency

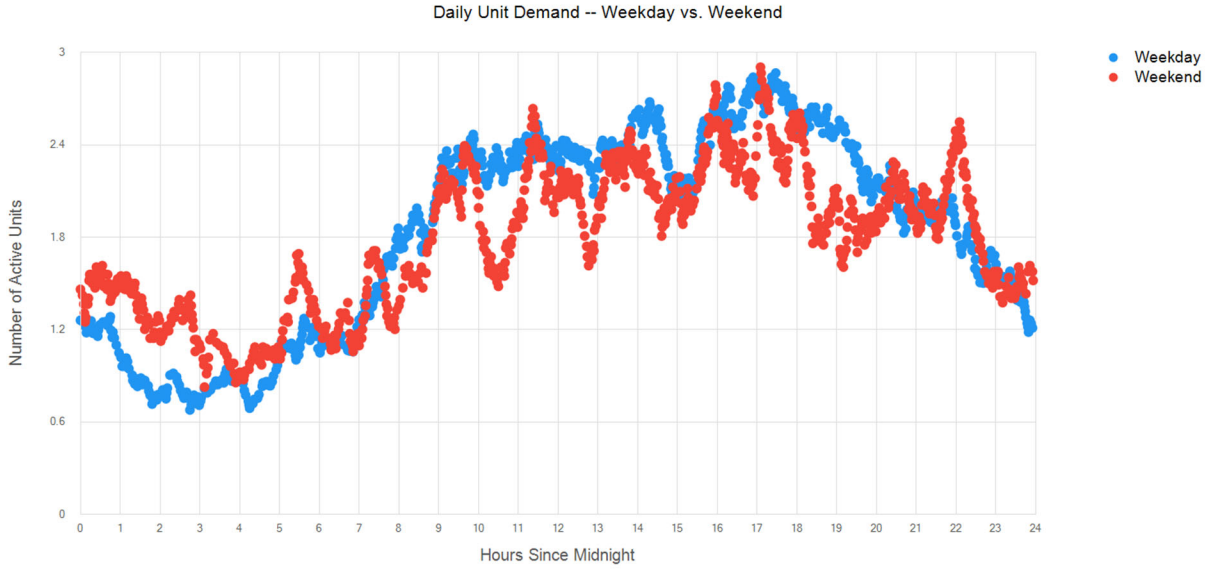
These charts show minute-by-minute demand (number of units committed, on average, to incidents), broken down by weekday vs. weekend, high-level incident types and geographical area. Note that the incident type classifications need to be slightly adjusted.







While the chart shows a large disparity between Sunday and Monday, this amounts to the difference of less than one incident every two days.



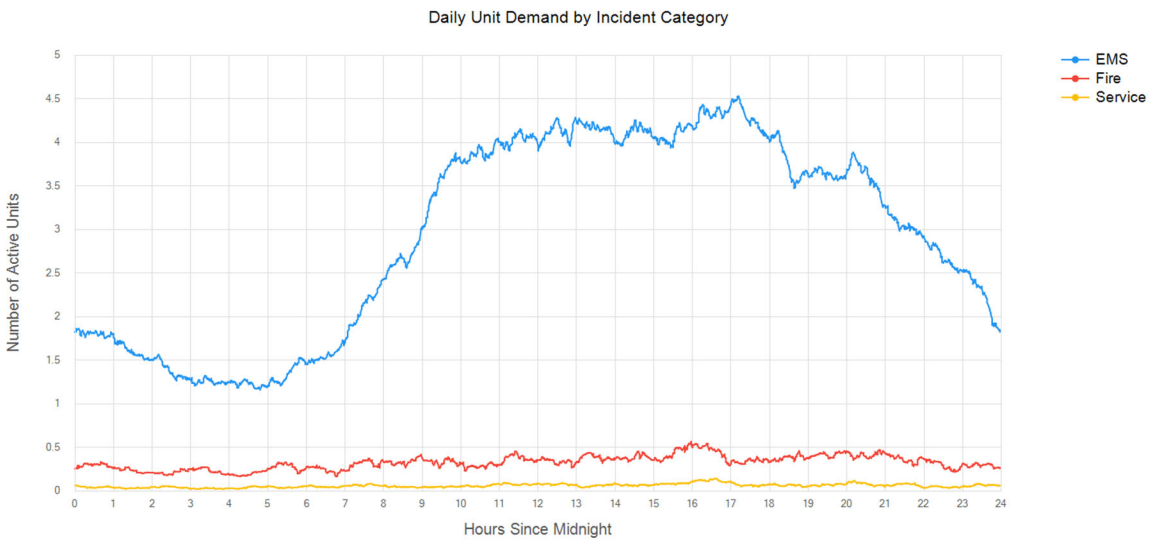


Figure 28: Daily Demand by Incident Type

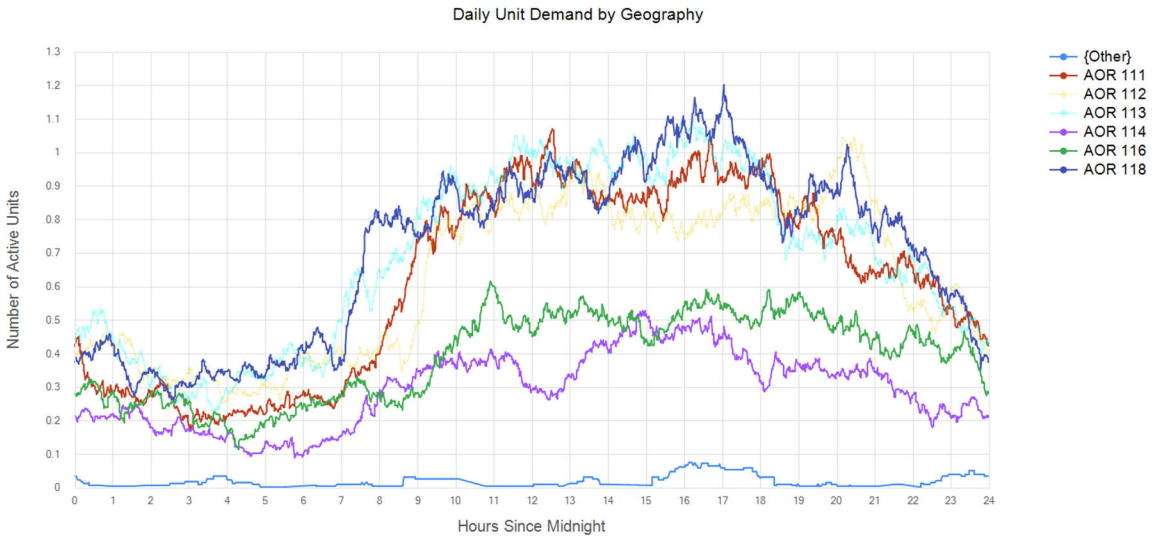


Figure 29: Daily Demand by Geography

3.2.8 Population distribution

Understanding population distribution is critical to determining ideal placement of resources to deliver our service model to maximum effect to the greatest number of people. NFPA 1710 criteria breaks down population density into four categories:

Dense Urban Population — greater than 3,000 people per square mile

Urban Population - between 1,000 and 2,999 people per square mile

Suburban Population - between 500 and 1,000 people per square mile

Rural Population - less than 500 people per square mile

Wildland —an area in which development is essentially nonexistent except for roads, railroads, powerlines, and similar transportation facilities with structures widely scattered

NFPA 1710 clearly illustrates the diverse response areas of East Pierce Fire and Rescue in a clear manner that may be lost in other population density models, such as CFAI.

Figure 30 presents a map of NFPA population density categories by US Census tract within EPFR's service area in overview form; Figure 31 shows a detailed version of the same map in larger format, focused on the northern portion of the jurisdiction where population and service demand are more concentrated.

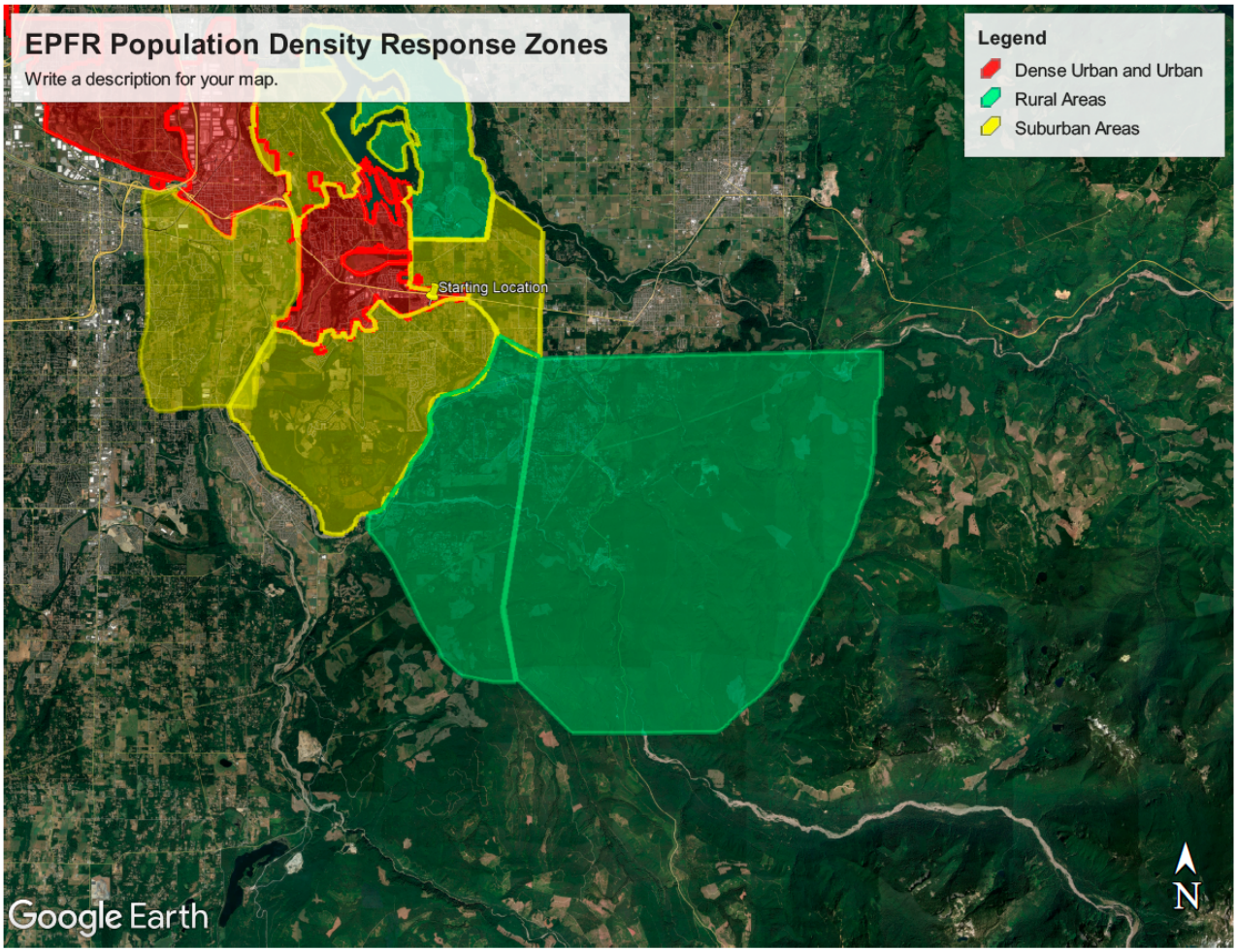


Figure 30: NFPA Population Density Categories – Overview

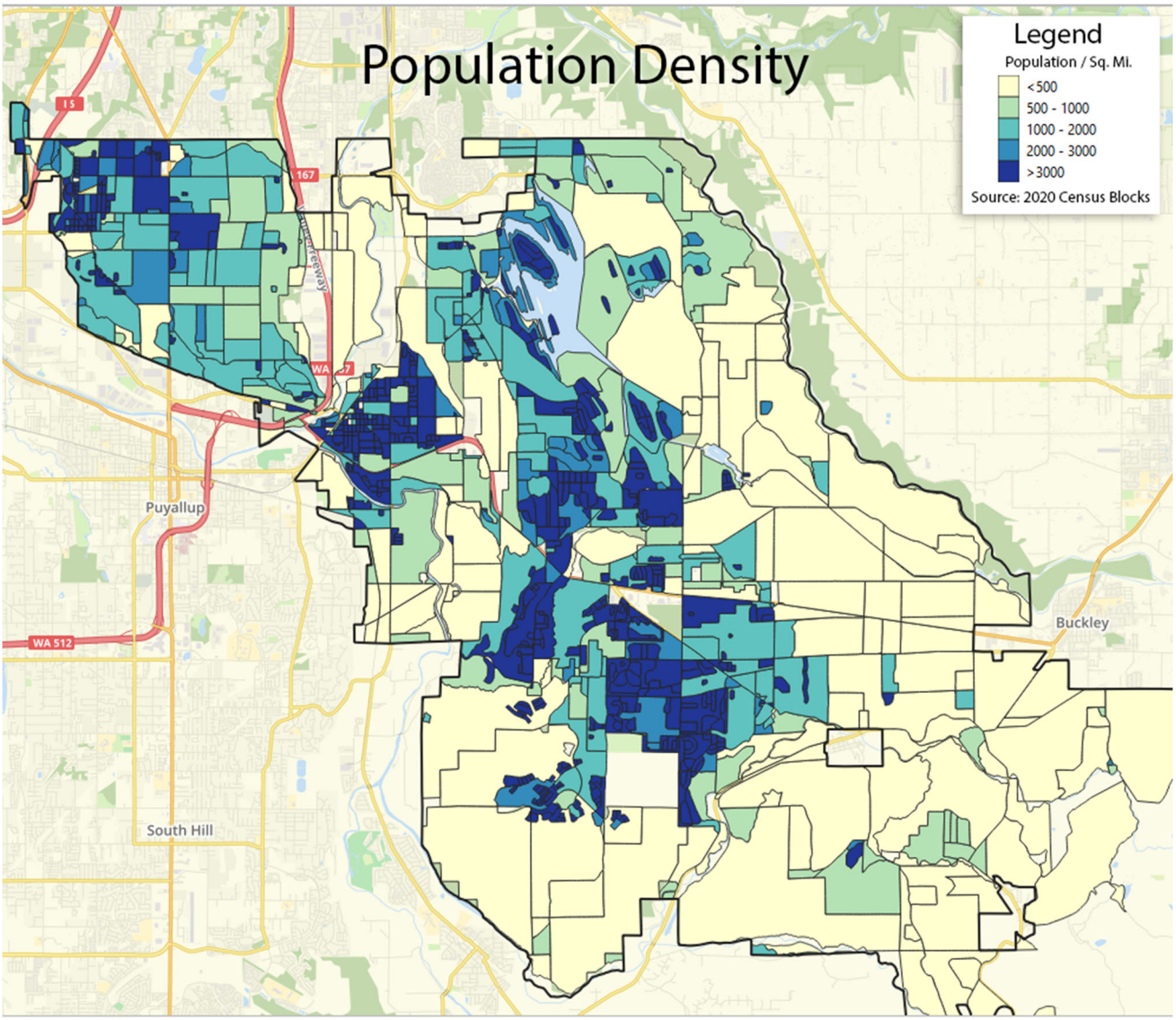


Figure 31: NFPA Population Density Categories - Detail

For purposes of managing response times into areas based on population density, EPFR uses four groupings adapted from NFPA 1710 and explained in Sections 2.8. For measuring proper resource allocation, the map above breaks down into the following:

- Dense Urban and Urban are combined and indicated in red above. These comprise the city areas of Bonney Lake, Edgewood, Milton and Sumner
- Suburban areas are indicated in yellow with much of that area located in unincorporated Pierce County
- Green indicates Rural areas with more sparsely populated regions.
- Areas beyond the color scheme, but still within EPFR jurisdiction is considered Wilderness.

- Performance measures of travel times for first arriving units on priority calls from all of 2021 and 2022. The table below shows the results:

Areas	# of Incidents	Current	Goal (90th %)
Dense Urban/Urban	7083	8:52	9:00
Suburban	3041	9:51	10:00
Rural	630	14:36	15:00

3.3 Performance Metrics

3.3.1 Call Processing Time

Figure 32 shows 90th percentile call processing times for emergent calls (defined as Priority 0-2), quarter-by-quarter over the study period. This shows a generally improving trend except for the final three quarters of the study period, roughly consistent with the implementation of Priority Dispatch™ in the South Sound 911 dispatch center. Call processing times are measured from first contact with the dispatch center to initial unit alert.

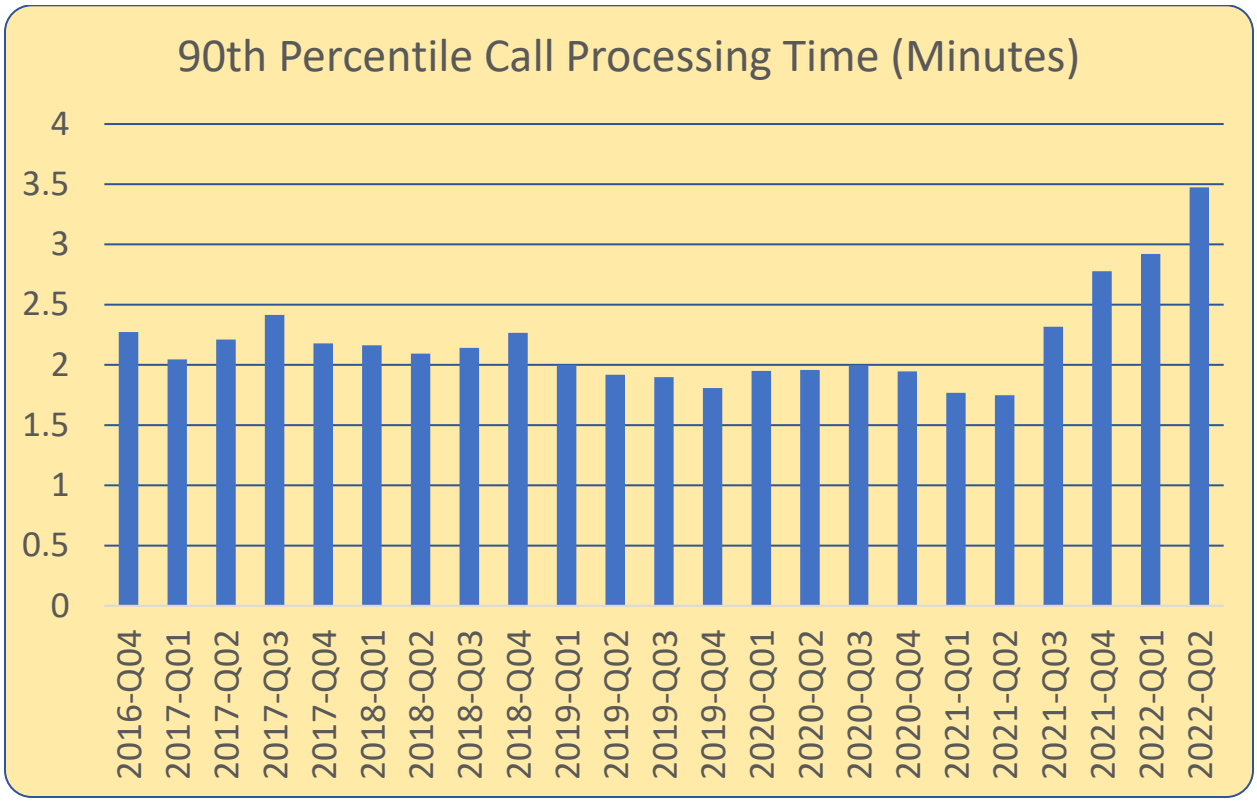


Figure 32: Call Processing Time Trend

3.3.2 Turnout Time

Figure 33 shows turnout time performance for 2020-2021

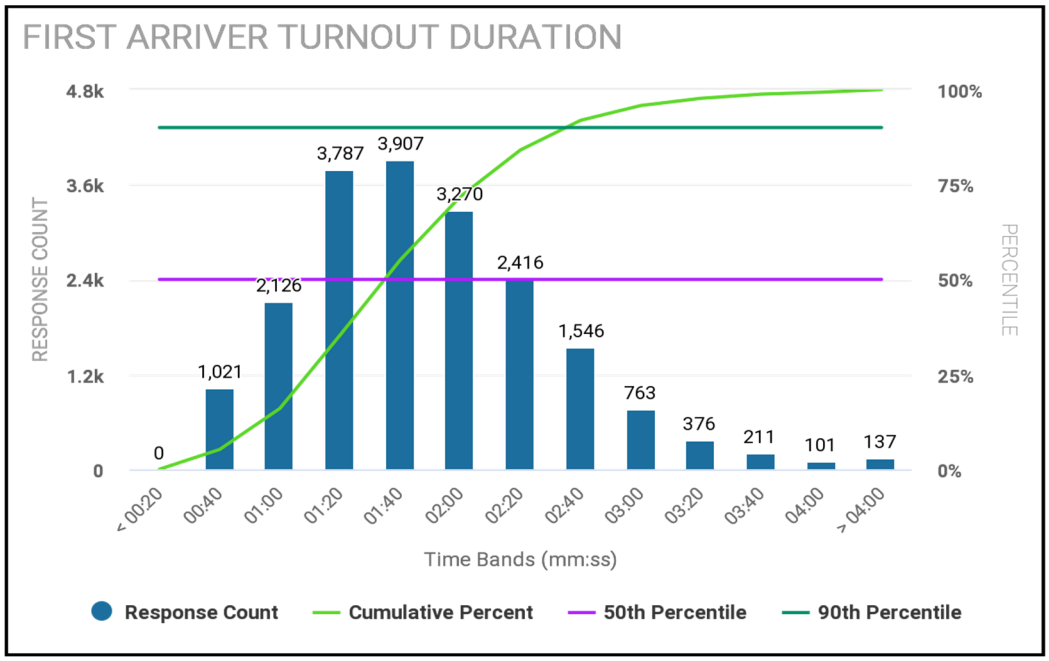


Figure 33: First Arriving Turnout Time

3.3.3 Response Time Metrics

Response time metrics appear to be trending upward in several sections of EPFR's jurisdiction, notably AORs 112, 113 and 118. This effect appears consistent across the three-standard metrics of response time:

- Figure 18 shows travel time trends.
- Figure 19 shows response time (turnout plus travel) trends.
- Figure 20 shows total response time trends (call processing, plus turnout, plus travel).
- Figure 21 shows estimated average travel speeds by AOR and quarter. These are estimated by assuming that the responding unit is in-quarters, inferring its probable travel route on the street network, and filtering out obvious outliers.

Travel times have been increasing steadily in AORs 112, 113 and 118. Since estimated travel speeds have not been systematically changing, this may indicate that the effect is due to increasing call volumes further from the stations.

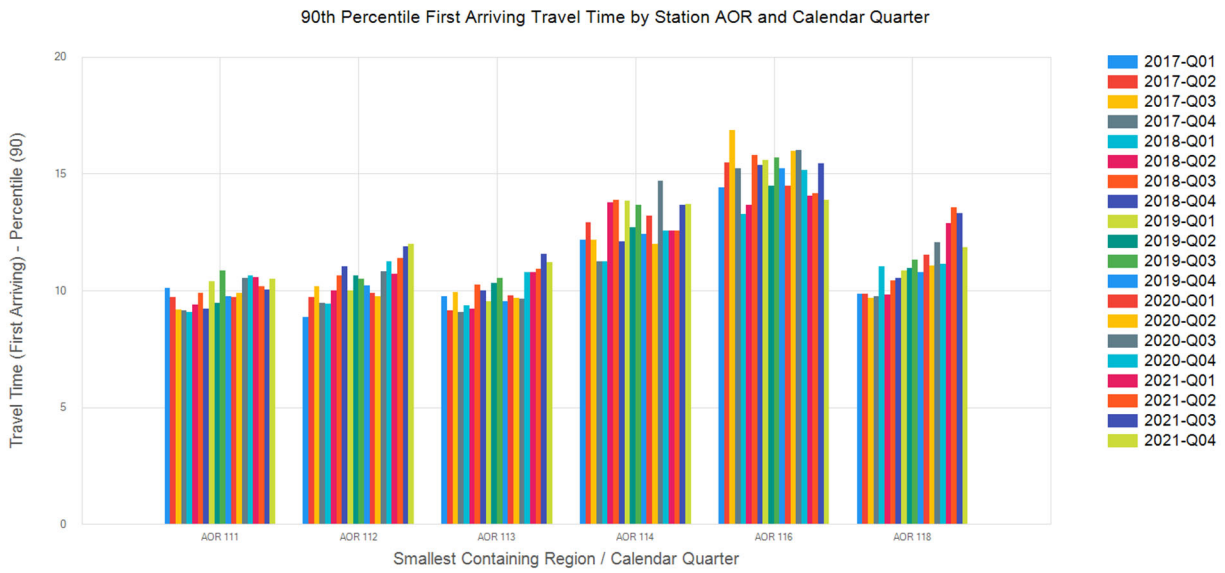


Figure 34: Travel Time Trends

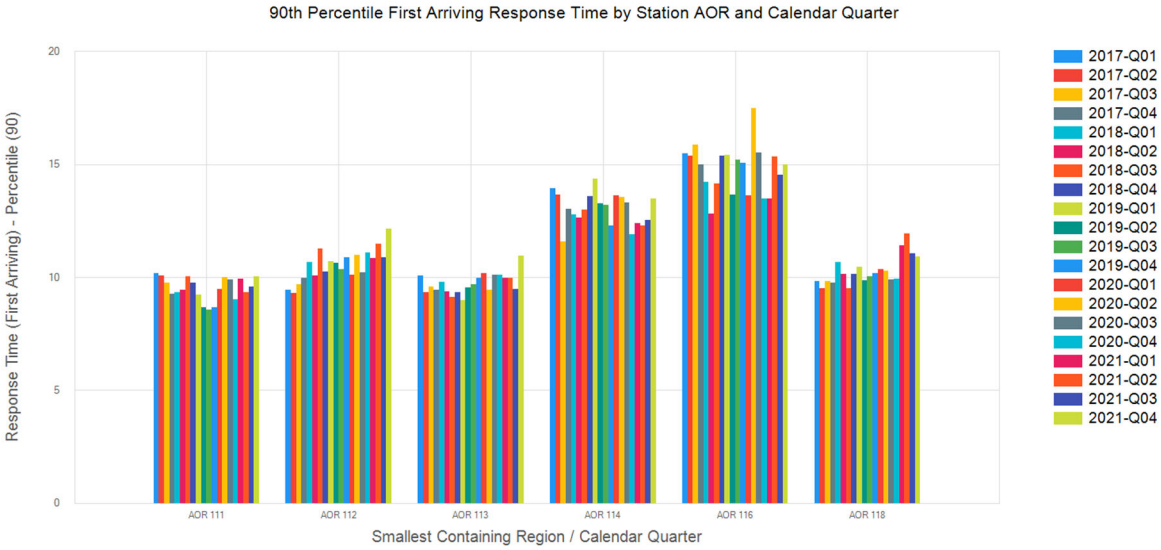


Figure 35: Response Time Trends

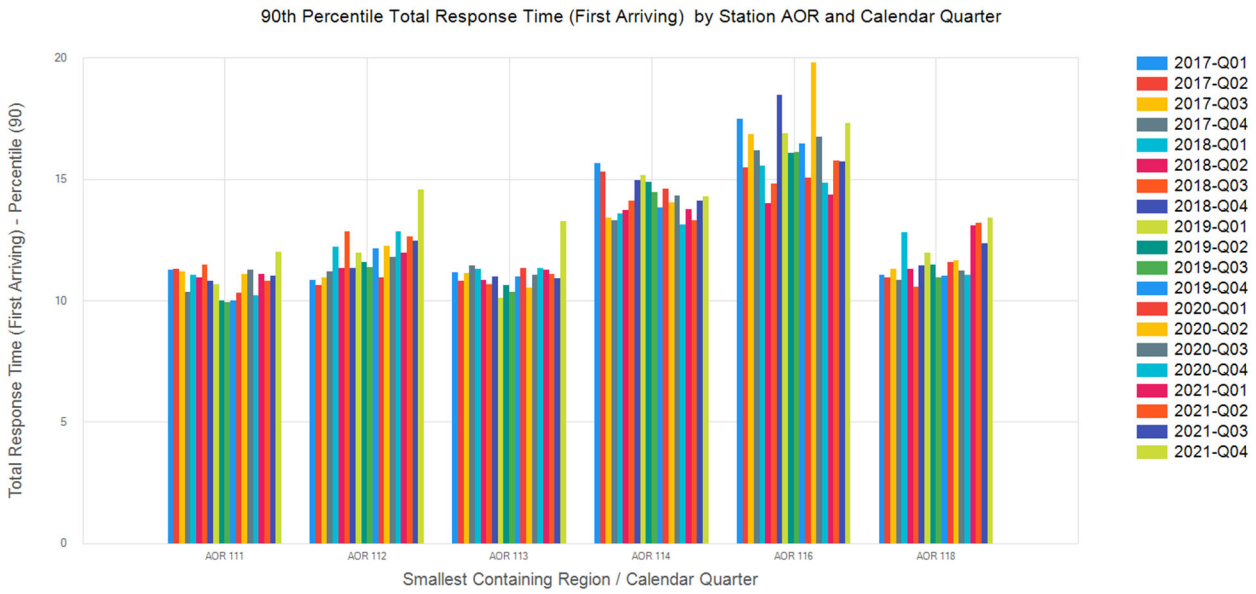


Figure 36: Total Response Time Trends

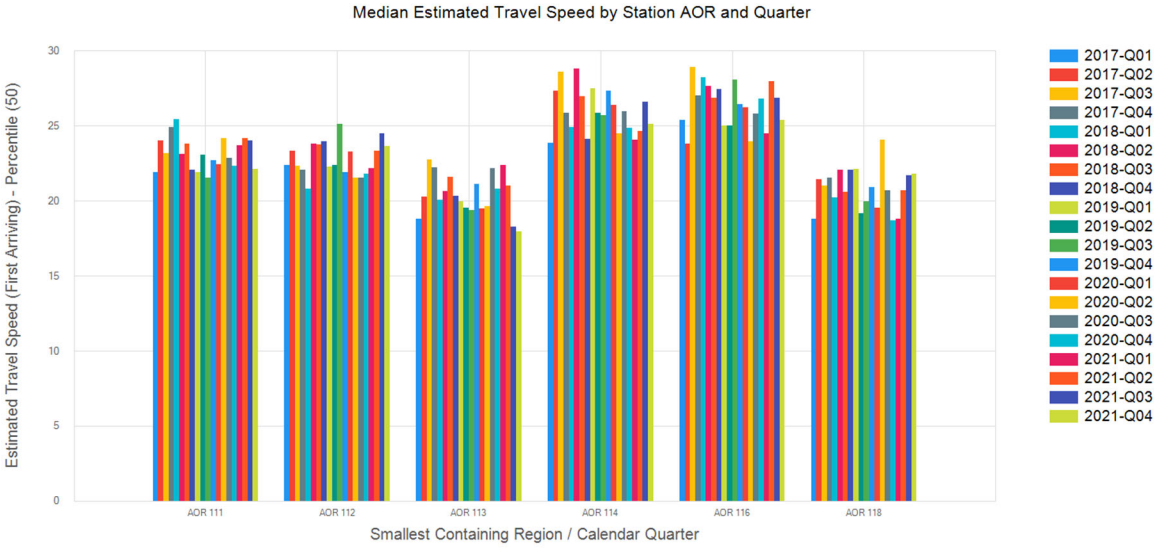


Figure 37: Estimated Travel Speeds

3.3.4 Unit Utilization

Unit utilization (UHU) measures the proportion of time that units are committed to emergency operations. The following two figures trace UHU on medic and suppression units, respectively, throughout each hour of a typical day.

Generally, unit utilization follows a pattern frequently observed in the fire service: utilization is typically 2-4x higher during the day than at night. Station 111 units are generally the busiest, with medic units considerably busier than suppression units, when measured in UHU percentage (though some suppression units run more calls). M114 shows very low utilization, due to the occasional nature of its staffing. M112 is in service only 12 hours of each shift, which is clearly reflected in Figure 38. During this time, the E112 crew cross-staffs M112. This is clearly reflected in Figure 39, where E112's utilization rate uncharacteristically decreases during the time that M112 is in service. This suggests that E112 may be unavailable for fire incidents during a significant proportion of daytime hours, due to demand on M114.

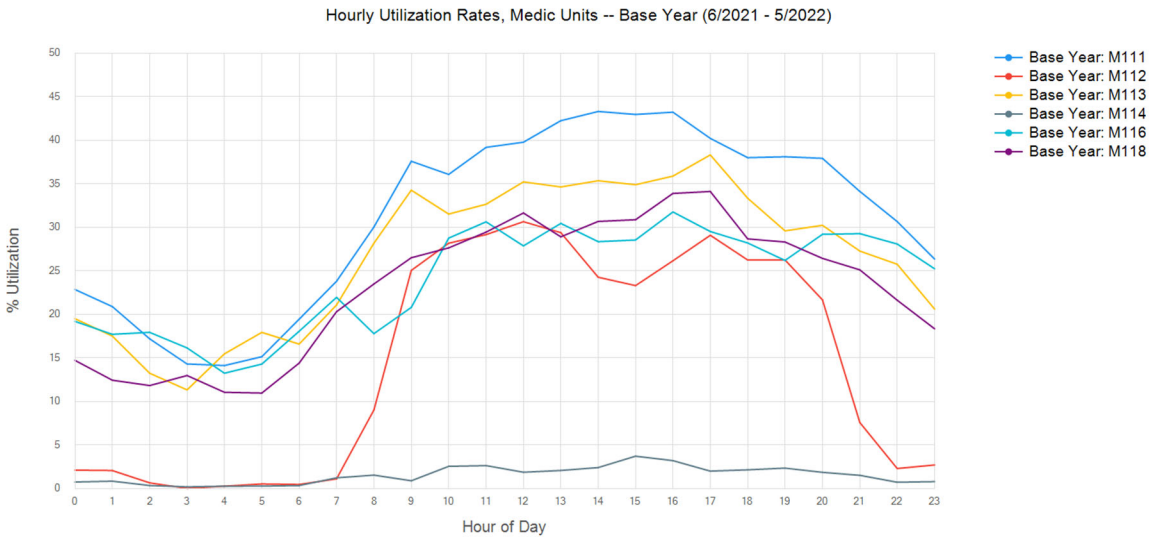


Figure 38: Temporal Demand - Medic Units

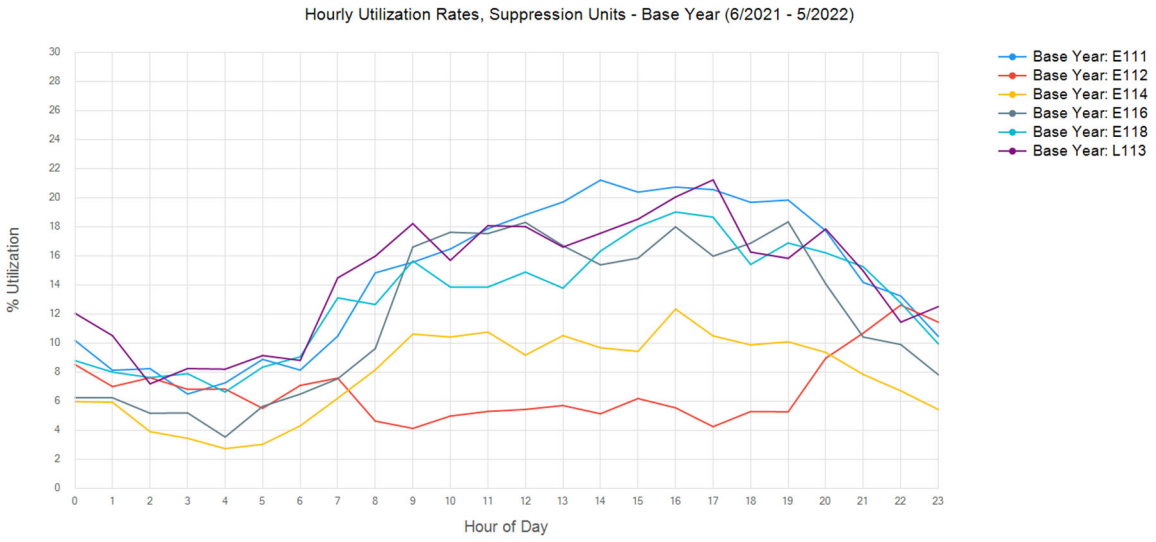


Figure 39: Temporal Demand - Suppression Units

3.3.5 Station Reliability

Station reliability refers to the proportion of time that at least one appropriate unit at a station is available to respond to incidents in that station's primary area of responsibility. We can estimate station reliability from the unit utilization data in Section 3.3.4. For cross-staffed stations, this represents the proportion of time that neither unit is committed to an incident. For fully staffed stations, this represents the proportion of time that at least one unit is not committed to an incident. Since EPFR suppression companies respond with medic units on almost all EMS calls, we took suppression company utilization as a reasonable approximation of station utilization for fully-staffed stations. Figure 40 shows approximate station reliability curves for EPFR's front-line stations. Night-time reliability rates are generally in the 90-97% range. Daytime reliability rates are mostly in the 80-90% range, except for Station 112, whose reliability dips to the 65-70% range during the day, due to the competing engine/medic demands on its crew.

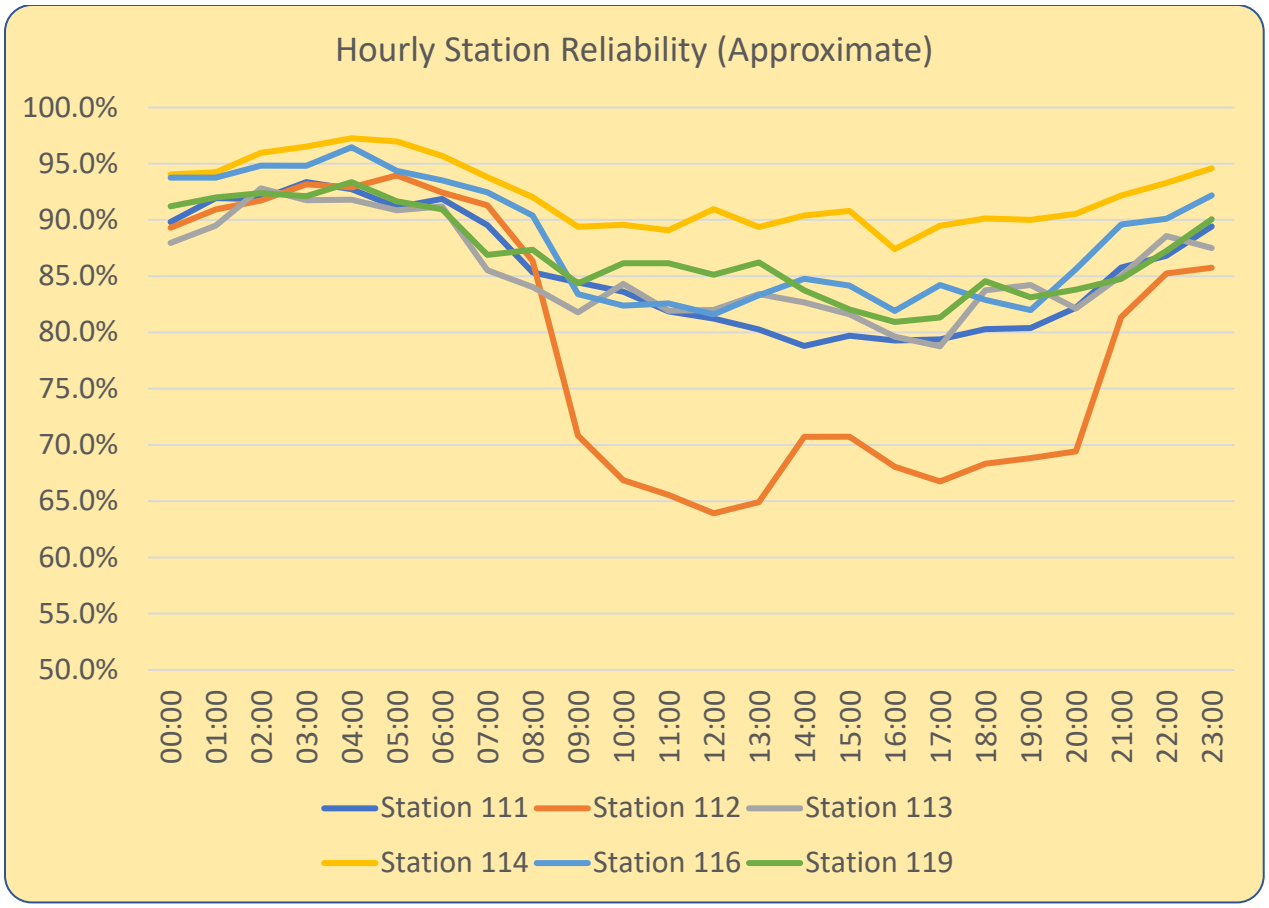


Figure 40: Approximate Station Reliability

3.3.6 Unit Substitutions and Response Delays

Unit substitutions occur when a unit that would ordinarily be first due to an incident replaced by another unit. Most frequently, this occurs because the primary unit is unavailable, and can result in a delayed response. In some cases, it can occur when a secondary unit is in transit and closer to a call than the primary unit, resulting in an improved initial response.

Figure 25 shows unit substitutions resulting in delays of more than 1:00, 3:00 and 5:00 by region.

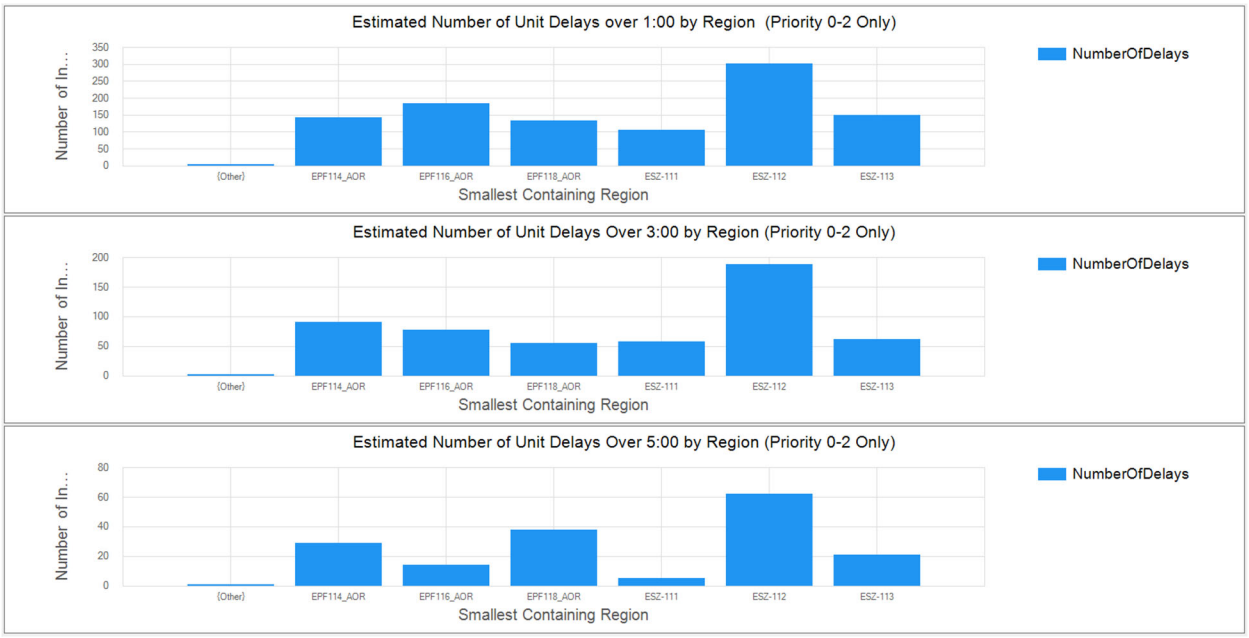


Figure 25: Unit Substitution Impact

4 Stakeholder Input

4.1 Community Expectations for Type and Level of Service

The primary goal of any emergency service delivery system is to provide sufficient resources (personnel, apparatus, and equipment) to the scene of an emergency in time to take effective action to minimize the impacts of the emergency. This need applies to fires, medical emergencies, and any other emergency situations to which EPFR responds. Obtaining and understanding the desires and expectations of community stakeholders is a crucial step. EPFR is committed to incorporating the needs and expectations of residents and policy makers in the service delivery planning process.

4.1.1 Internal Stakeholder Input and Process

On July 27th, 2022, Levrum and project team conducted a meeting with internal stakeholders of EPFR. The initial meeting was with internal operative stakeholders. This group was a carefully selected group of company officers from each of EPFR response stations, both operations and day staff, representing each of specialty teams. Each of the members of this stakeholder group was assigned to identify their response zones and identify target hazards within each of these areas.

The EPFR Commissioner's Planning committee has met with the SOC Team on two different occasions (October 24th and November 7th) to get filled in on initial plan for the document and then a follow-up more in-depth presentation. The purpose of these meeting was to continually keep the Board of Fire Commissioner's apprised of the progress of the project and to allow input to the process.

4.1.2 External Stakeholder Input and Process

It is recommended that the organization continue their strategic planning process in conjunction with the standards of coverage document. The District would benefit from using data identified within this document and needs identified within their established Strategic Plan to continue to guide the organizations decision making. By utilizing this process, the District can place additional emphasis on identified areas. This SOC helps establish general goals and specific objectives that direct the District's priorities in a manner consistent with its mission and appropriate for the community it serves.

4.2 Guiding Principles and Internal Performance Expectations and Goals

4.2.1 Mission Statement

Exceptional people providing compassionate service and rapid response to our community's diverse needs.

4.2.2 Vision Statement

East Pierce Fire & Rescue is a regional leader providing the highest level of fire, rescue, emergency medical, and prevention services to a diverse and growing community with:

- Mission-essential staffing and training.
- State-of-the-art facilities, equipment, and technology.
- A strong, diverse, and sustainable funding base, while maintaining stewardship of taxpayer resources.
- A safe environment for our citizens through effective and comprehensive prevention and public education programs.
- A safe and healthy workforce.

4.2.3 Values

Our community and our employees are our most important resource. We are committed to:

- **Do the Right Thing**. Integrity, trust, respect, and commitment.
- **Everyone Must Make a Difference**. Individual and organizational responsibility, accountability, teamwork, and collaboration.
- **Anticipating and Meeting Our Community's Needs.** Proactive planning, innovation, creativity, responsiveness, and excellent customer service.

5 Risk Assessment

East Pierce Fire and Rescue is vulnerable to the natural hazards including vegetation fires, drought, flooding, seismic activity, volcanic activity, and severe storms. EPFR is located in Pierce County, WA and comprises 8.5% of Pierce County land, and 10.5% of the population (based upon 2021 US Census data estimates).

HISTORICAL—Since 1964 there were 23 disaster declarations for Pierce County, WA. These consist of:

- 9 floods
- 8 Severe Storms
- 2 Biological (COVID)
- 2 Earthquake
- 1 Fire (Sumner Grade, 2020)
- 1 Volcano (Mt. St. Helens, 1980)

The FEMA National Risk Index, ranks Pierce County, Washington as follows:

While reviewing this report, keep in mind that low risk is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

EPFR is vulnerable to technological (human-caused) hazards associated with transportation accidents via rail and highway, urban fire, hazardous materials spills, Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) terrorism, civil disturbances, multi-casualty incidents, and some risk associated with dam failure and inundation.

The Local Hazard Mitigation Plan reviewed data from the following sources to determine the nature and degree of risk for hazards: The Federal and State Disaster Declaration History, the Pierce

County Comprehensive Emergency Management Plan (2020), and many more documents. Aside from human caused hazards (e.g., hazardous material spills and technological disasters), the following natural hazards are key issues: earthquake, fire, flood, volcano, and severe weather.

Hazard type Risk Index scores are calculated using data for only a single hazard type and reflects a community's relative risk for only that hazard type. The following chart identifies how FEMA has rated risk factors throughout Pierce County.

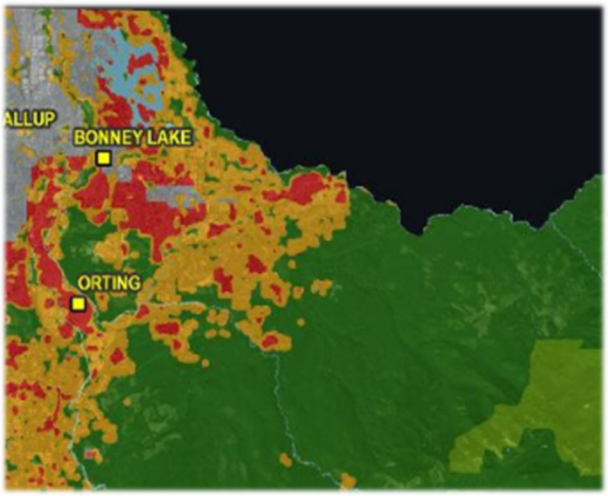
Hazard Type	Risk Index Rating	Risk Index Score		
Avalanche	Relatively High	55.59	0	100
Coastal Flooding	Not Applicable	0.00	0	100
Cold Wave	No Rating	0.00	0	100
Drought	Very Low	2.21	0	100
Earthquake	Relatively High	23.97	0	100
Hail	Very Low	3.60	0	100
Heat Wave	Relatively Low	8.85	0	100
Hurricane	Not Applicable	--		
Ice Storm	Relatively Low	13.51	0	100
Landslide	Relatively Low	9.36	0	100
Lightning	Very Low	7.94	0	100
Riverine Flooding	Relatively Low	6.07	0	100
Strong Wind	Very Low	6.23	0	100
Tornado	Relatively Low	11.39	0	100
Tsunami	Not Applicable	0.00	0	100
Volcanic Activity	Very High	100.00	0	100
Wildfire	Relatively High	60	0	100
Winter Weather	Very Low	8.30	0	100

5.1 Geologic and Meteorologic vulnerabilities

5.1.1. Volcanic—Because of its elevation (4,392 m), relief, hydrothermal alteration, icecap, glacier-fed radial valleys, and proximity to encroaching suburbs of the Seattle-Tacoma metropolis, Mount Rainier is the most threatening volcano in the Cascades. Its next eruption could produce volcanic ash, lava flows, and avalanches of intensely hot rock and volcanic gases, called pyroclastic flows. Some of these events swiftly melt snow and ice and could produce torrents of meltwater that pick up loose rock and become rapidly flowing slurries of mud and boulders known as lahars. The greatest risk at the volcano comes from its potential for generating huge lahars triggered by sector collapse or magma- water-ice interaction rather than from an eruption itself. (Mount Rainier, n.d.)

5.1.2. Fire is a concern in the entire county, not only for its destructive nature, but also because of the potential for toxic smoke that fires produce. Fires can occur because of a wide array of system failures (e.g., downed power lines, human action, lightning, or motor vehicle collisions). This is particularly true during the months of July through September. The danger is particularly high during a hot day when flames can be fanned by East winds.

Vegetation Fires, Wildland urban interface (WUI) and Wildland Urban Intermix



5.1.2.1 Interface—The interface is often found along the outskirts of urban area. The Wildland-Urban Interface is defined as those areas where human development meets areas that are covered with more than 50% wildlands. It be considered interface, development/structures must be bordered by wildlands on at least one side.

5.1.2.2. Intermix—Wildland-Urban intermix are those areas where structures intermingle with wildlands. To be considered intermix, a development or structure must be surrounded on 2 or more sides by wildlands. Intermix is often found between the interface and the wildlands. Within EPFR, intermix can also be found in undeveloped/low-density pockets of urban areas.

5.1.3. Flooding—Flooding occurs when water flow increases at a rate that exceeds the soil's ability to absorb it through percolation over a short period of time; or the capacity of natural or manmade flood control structures (e.g. levees, dams, canals, etc.) is breached or its capacity is exceeded, allowing water to escape and spread across low lying areas. Flooding can occur from locally heavy rainfall or because of heavy runoff being channeled from distant sources along established canals. Seasonal rain, coupled with a dependence on levees and creeks/canals and low-lying topography within areas of EPFR, means those areas are subject to periodic flooding. The greatest likelihood for flooding occurs between November and March, with little to no chance between June and August.

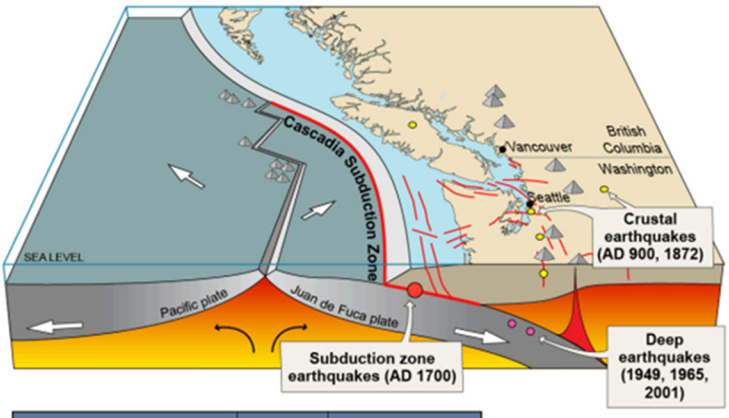
In addition, dams (White River and Mud Mountain), depending on the time of year and the amount of water contained behind each dam, if there were a breach of any of these dams, impacts to access and infrastructure impacts are not inconsequential. With a levee breach of either Lake Tapps or River Road the EPFR community and access to some of the regional hospitals could be completely shut off.

5.1.4. Storms

EPFR occasionally experiences severe winter weather that can produce heavy winds, rain, ice and/or snow. These storms are usually of short duration but can still have a significant impact on people and critical infrastructure. The most likely impact is on utility service (power and phone), safe vehicle travel, and building damage from winds and flying debris. The topography of the fire district contributes to challenges in safe travel and accessibility, with elevation changes of several thousand feet. Additionally, the mountainous regions create problems for cellular communications in some areas.

5.1.5. Seismic Activity

Washington is situated at the collisional boundary of two primary tectonic plates. The boundary where these two plates converge, the Cascadia Subduction Zone, lies approximately 50 miles offshore and extends from the middle of Vancouver Island in British Columbia to northern California. As it collides with North America, the Juan de Fuca plate slides (or subducts) beneath the continent and sinks into the earth's mantle. The collision of the Juan de Fuca and North American Plates produces the three main types of earthquakes discussed below and illustrated in Figure EQ-2. A fourth type of earthquake not covered in detail here is produced by the movement of magma inside a volcano. Such as those happening at Mt. St. Helens.



Source	Max. Size	Recurrence
Subduction zone	M 9+	200–600 years
Deep Juan de Fuca plate	M 7+	30–50 years
Crustal faults	M 7+	Hundreds of years?

Volcano
Active crustal fault
Active plate boundary fault

*figure modified from USGS Cascadia earthquake graphics at http://geomaps.wr.usgs.gov/pacnw/pacnweq/index.html

Intraplate, or Benioff Zone earthquakes in the Pacific Northwest are commonly referred to as deep earthquakes. They are capable of magnitudes 6.0 – 7.5, they typically occur between approximately 15 to 60 miles in depth and are within the subducting Juan de Fuca (oceanic) Plate.

Shallow crustal earthquakes occur primarily in western Washington, the northeastern flanks of the Cascade Range, and in the Columbia Plateau. These earthquakes are associated with movement on a fault. These earthquakes occur primarily at depths of 20 miles or less. Since 1992, there is rapidly accumulating evidence that large crustal earthquakes occur on the Seattle Fault in areas of high population. Active faults in the greater Pierce County area include Tacoma, Seattle, and the Rattlesnake Mountain Fault zone are capable of magnitudes 6.0 – 7.5.

The Cascadia Subduction Zone (CSZ) "megathrust" fault is a 1,000 km long dipping fault that stretches from Northern Vancouver Island to Cape Mendocino California. It separates the Juan de Fuca and North America plates. The Juan de Fuca plate moves toward, and eventually is shoved beneath, the continent (North American plate). Cascadia Subduction zone (interplate) earthquakes occur less frequently than intraplate (deep) events, but probably more frequently than large crustal earthquakes. Great Subduction Zone earthquakes are the largest earthquakes in the world and are the only source zones that can produce earthquakes greater than M8.5. The CSZ has produced magnitude 9.0 or greater earthquakes in the past, and undoubtedly will in the future. The last known megathrust earthquake in the northwest was in January 1700, just over 300 years ago. Geological evidence indicates that such great earthquakes have occurred at least seven times in the last 3,500 years, a return interval of 400 to 600 years.

Overall hazard risk is provided below:

Hazard	Probability	Magnitude	Priority
Wildfire	Occasional	Critical	Yes
Storms	Occasional	Critical	Yes
Earthquake	Occasional	Critical to catastrophic	Yes
Volcano	Occasional	Catastrophic	No
Flood	Likely	Critical	Yes
Dam/Levee Failure	Unlikely	Critical	No

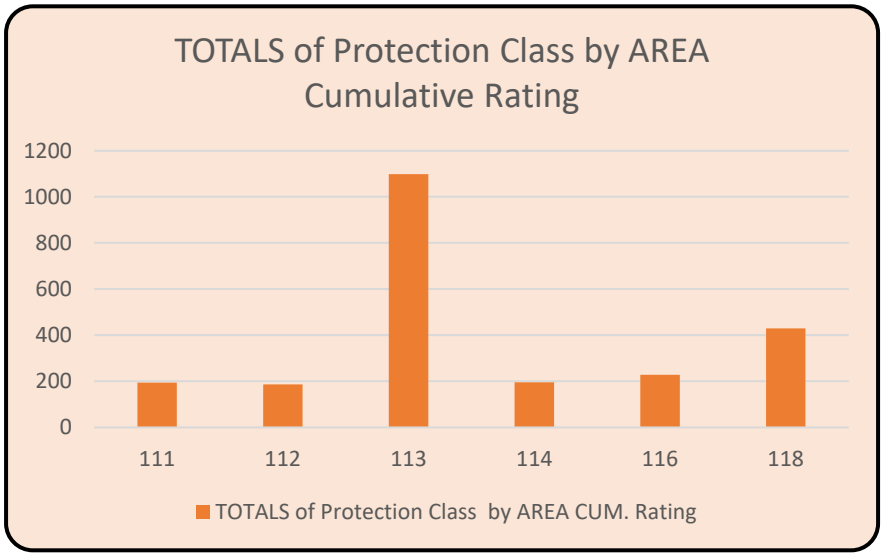
5.2. Target Hazards

Target hazards were identified in each of the station areas based on building types, fire flow needs (amount of water needed to extinguish a fire) and life risks associated with those structures. Based on that data, an overall score or Protection Class is assigned. Numbers were generated from data supplied by Washington Surveying and Rating Bureau (WSRB).

This information was shared with line officers who work in the respective areas identified. The line officers verified the data for relevancy about changes that may have occurred with the property in question. Additionally, those officers provided updated information and provided new information where appropriate. A compiled score was totaled for all the identified target hazards for each of the station geographic areas.

Some of the data appears in section 2.9.1 above. A consolidation of this information is as follows:

TOTALS of Protection Class by AREA	
AREA	CUM. Rating
111	194
112	186
113	1098
114	195
116	228
118	429



6 Critical Task Analysis

This section considers the community's identified risks and illustrates the number of personnel that are necessary to accomplish the critical tasks at an emergency. EPFR should have the resources needed to effectively mitigate incidents with the highest potential to negatively impact the community. In the cases where a multi-agency response is needed due to the risk, or specialized personnel are needed to mitigate certain types of incidents, mutual aid is included in the critical tasking counts to achieve the effective response force (ERF).

Critical tasks are those activities that must be conducted by firefighters at emergency incidents to stop loss, treat EMS patients, and control the situation. Critical tasks must be performed in a timely manner, and with sufficient staff, or the loss will continue to increase, become worse, and likely require additional resources.

Critical tasking plays a key role in determining and assigning the appropriate resources to specific types of incidents based on risk. As the actual or potential risk increases, the need for higher numbers of personnel and apparatus also increases. With each type of incident and corresponding risk, specific critical tasks need to be accomplished and certain numbers and types of apparatus should be dispatched. For example, there are many more critical tasks to be performed on a large, high-risk commercial structure fire than on a separate low-risk EMS incident with one patient.

As part of this SOC, an evaluation of EPFR resources was conducted to calculate the ERF to establish their capabilities to respond to and mitigate incidents based on risk. EPFR understands its own capabilities and what type of incidents the District can mitigate on their own. The evaluation also includes the assets available to a District as well as automatic and mutual aid available to assist at an incident. The evaluation includes:

- Staffing
- Availability and reliability to respond
- Travel distances and road network
- Pre-fire incident planning
- Population density; urban, suburban, and rural coverage areas
- Community demographics including residential, commercial, industrial, agricultural, and historic areas
- Critical infrastructure; electrical distribution, natural gas, water delivery, and transportation

Tasks that must be performed at a fire can be broken down into two key components: life safety and fire flow. Life safety tasks are based on the number of building occupants, and their location, status, and ability to take self-preservation action. Life safety related tasks involve the search, rescue, and

evacuation of victims. The fire flow component involves delivering sufficient water to extinguish the fire and create an environment within the building that allows entry by firefighters.

The number and types of tasks needing simultaneous action will dictate the minimum number of firefighters required to combat different types of fires. In the absence of adequate personnel to perform concurrent action, the command officer must prioritize the tasks and complete some in chronological order, rather than concurrently.

These tasks include:

- Command
- Scene safety
- Search and rescue
- Fire attack
- Water supply
- Pump operation
- Ventilation
- Backup/rapid intervention

Critical task analysis also applies to non-fire type emergencies including medical, technical rescue, and hazardous materials emergencies. Numerous simultaneous tasks must be completed to effectively control an emergency. The District's ability to muster needed numbers of trained personnel quickly enough to make a difference is critical to successful incident outcomes.

This combined assessment serves as the foundation for determining and assigning the District's resources to complete the critical tasks and achieve the ERF. Critical tasking serves as the justification for sending appropriate resources to all types of calls. More resources respond to higher risk calls with more critical tasks to accomplish, and fewer resources respond to lower risk calls with fewer tasks to accomplish.

Figure 41 illustrates the minimum emergency incident staffing recommendations of the Commission on Fire Accreditation International (CFAI).

The following definitions apply to the figure:

Low Risk—Minor incidents involving small fires (fire flow less than 250 gallons per minute), single patient non-life-threatening medical incidents, minor rescues, small fuel spills, and small wildland fires without unusual weather or fire behavior.

Medium Risk—Medium risk incidents involving fires in single-family dwellings and equivalently sized commercial office properties (fire flow between 250 gallons per minute to 1,000 gallons per minute), life threatening medical emergencies, hazardous materials emergencies requiring specialized skills and equipment, rescues involving specialized skills and equipment, and larger wildland fires.

High Risk—High risk incidents involving fires in larger commercial properties with sustained attack (fire flows more than 1,000 gallons per minute), multiple patient medical incidents, major releases of hazardous materials, high risk rescues, and wildland fires with extreme weather or fire behavior.

Figure 42: Staffing Recommendations Based on Risk

Incident Type	High Risk	Medium Risk	Low Risk
Structure Fire	27-28	21	16
Emergency Medical Service	8-10	5	2-5
Rescue	17-20	10-15	4
Hazardous Materials	15		3
Wildland Fire	24		6

EPFR developed the following Critical Task analyses using the risk matrices included in the Critical Task section for various incident types. Further it has defined, based on current unit staffing levels, the number and type of apparatus needed to deliver sufficient f personnel to meet the critical tasking identified. Our review of the Critical Task analysis concludes that all are generally in keeping with industry standards and provide the minimum number of personnel needed for safe and effective incident operations.

Establishing resource levels needed for various types of emergencies is a uniquely local decision. Factors influencing local decisions for incident staffing include the type of equipment operated, training levels of responders, operating procedures, geography, traffic, and the nature of building and other risks being protected.

Finally, it is also important to note that certain incidents require specially trained and certified personnel. These special operations incidents include Hazardous Materials High Risk and all Technical Rescues. EPFR participates in regional response teams for these

types of specialized, and infrequently occurring incidents. It would not be fiscally practical, and operationally difficult to maintain currency of skills for EPFR to maintain all of the technical specialist staffing in-house. EPFR, like other agencies in Pierce County, fills their critical taking with a multi-agency regional response. Those incidents are noted with an asterisk and comment.

6.1 Critical Tasking Tables

Critical tasks for all-risk incidents are defined below. These are based upon the tasks to be accomplished and not the staffing of engine, ladder, and medic companies. Those comparisons will be evaluated in the following section.

6.1.1 Structure Fire Low Risk

Task	Number of Personnel
Command	1
Pump Operations	1
Fire Attack	3
Back Up Line	3
Search	2
Ventilation	2
Water Supply	2
Medical/Rehab	2
Total	16

6.1.2 Structure Fire Medium Risk

Task	Number of Personnel
Command	1
Safety	1
Pump Operations	1
Fire Attack	6
Back Up Line	3
Search	3
Ventilation	2
Water Supply	2
Medical/Rehab	2
Total	**21**

6.1.3 Structure Fire High Risk

Task	Number of Personnel
Command	1
Safety	1
Pump Operations	1
Fire Attack	6
Back Up Line	3
Search	4
Ventilation	4
Water Supply	1
Medical/Rehab	2
On Deck	4
Aerial Operator	1*
Total	**27-28**

**Use of aerial apparatus adds an additional FF*

6.1.4 Non-Structure Fire Low Risk

Task	Number of Personnel
Command/Safety	1
Pump Operations	1
Attack Line	1
Total	**3**

**Unknown type fire, burn complaint, smoke investigation, beauty bark fire.*

6.1.5 Non-Structure Fire Low Risk

Task	Number of Personnel
Command/Safety	1
Pump Operations	1
Attack Line	1
Total	**3**

**Unknown type fire, burn complaint, smoke investigation, beauty bark fire.*

6.2 Emergency Medical Services

6.2.1 Emergency Medical Services Low Risk

Task	Number of Personnel
Scene Management/Safety	0-1
Patient Care	1
Transport	1
Documentation	0-1
Total	2-4

In the lowest level of these incidents, one provider may be able to perform two or more critical tasks. For example, the patient care provider may complete the tasks of patient, documentation, and scene management, but not patient care and transport.

6.2.2 Emergency Medical Services Medium Risk

Task	Number of Personnel
Scene Management/Safety	1
Patient Care	2
Transport	1
Documentation	1
Total	5

Moderate Risk (Non Cardiac Arrest) – Moderate risk, life threatening, or potential permanent morbidity medical emergencies

Task	Number of Personnel
Scene Management/Safety	1
Patient Care	5
Transport	1
Documentation	1
Clinical Oversight	0-1
Family Liaison	0-1
Total	8-10

Moderate Risk-Cardiac Arrest - Clinical oversight and family liaison tasks may be performed by personnel performing other critical tasks but account for both needs and best practice.

6.2.3 Emergency Medical Services High Risk

Task	Number of Personnel
Incident Command/Safety	1
Medical Group Supervisor	1
Triage	2
Treatment at Scene	4
Transport Manager	1
Transportation/Patient Care to Hospital	10
Total	19 +

High Risk (Ten or more patients) - Other critical tasks such as litter bearers, staging officers, etc. are required as the incident size/total patients grow. Provide approximately two response personnel for every patient beyond ten.

6.3 Rescue: Technical and Water

6.3.1 Rope Rescue

Task	Number of Personnel
Incident Command	1
Rescue Group Leader	1*
Technical Safety Officer	1*
Rigging	1*
Main Line	1*
Belay Line	1*
Rescue Team	1-3*
Haulers	5
Edge/Controller	1
Treatment/Transport	2
Total	**17**
*Numbers of personnel are dynamic depending on size and scope of the incident as well as numbers of potential victims.	

6.3.2 Trench Rescue

Task	Number of Personnel
Incident Command	1
Rescue Group Leader	1
Technical Safety Officer	1
Ground pads/Lip Bridges	2
Shoring Team	4
Panel Team	4
Rescue Team	2
Air monitoring	1
Extrication Team/Rigging	2
Treatment/Transport	2
Total	**20**
*Numbers of personnel are dynamic depending on size and scope of the incident as well as numbers of potential victims.	

6.3.3 Swift Water

Task	Number of Personnel
Command	1
Rescue Group Supervisor/Safety	1
Rescue Team	2
Backup Team	2
Patient Care / Transport	2
Upstream Spotter	1
Downstream Safety	1
Total	**10**
*This is the minimum number of personnel to affect a basic swift water rescue and would need to expand with multiple patients, large search area or putting multiple boats in the river.	

6.3.4 Dive Rescue

Task	Personnel
IC/RGS	1
Witness interview	1
Mar122 pilot/shore support	1
Dive Supervisor	1
Tender	1
Divers	2
Pt. care/transport	4
Total	**10**

6.4 Hazardous Materials

6.4.1 Hazardous Materials: Low Risk

Task	Number of Personnel
Incident Command	1
Research/Support/Backup	2
Entry team	3
Total	**6**

6.4.2 Hazardous Materials: High Risk

Task	Number of Personnel
Incident Command	1
HM Incident Safety Officer (HM Tech/HM ISO)	1
HM Group Supervisor (HM Tech)	1
HM Safety Officer (HM Tech)	1
Research (HM Tech)	1
Entry Team Leader (HM Tech)	1
Entry Team and Backup Team (HM Techs)	4
Site Access Control (HM Tech)	1
Decontamination Officer (HM Tech)	1
Decontamination Crew (HM Techs)	2
Medical Officer (HM Tech)	1
Total	**15**
Hazardous Materials – High Risk PCHIT Level Response (EPFR has 16 HM Technicians)	

6.5 Wildland Fire

6.5.1 Wildland Fire: Low Risk

Wildland Interface--Low Risk (<50' diameter)	
Task	**Number of Personnel**
Command/Safety	1
Pump Operations/Lookout	1
Attack Line	2
Exposure Lines	1
Water Supply	1
Total	**6**

6.5.2 Wildland Fire: High Risk

Task	Number of Personnel
Command/Safety	1
Pump Operations/Lookout	1
Division Supervisors	2
Attack Lines	8
Structure Protection/Exposure line	3
Ground Support (cutting line)	6
Rehab	2
Tender Operator/Water Supply	1
Other (Mop-up, Overhaul, Aircraft, Support)*	As needed*
Total	**24**

*Additional mutual aid resources from Washington Department of Natural Resources (DNR) available upon request.

**Staffing numbers assume an initial attack first alarm assignment on an emerging WUI fire <1 acre.

7 Deployment Analysis

7.1 Current Alarm Assignments

To ensure sufficient personnel and apparatus are dispatched to an emergency event the following first alarm response assignments have been established. Total Staffing Needed is the number identified in the Critical Tasking analysis above. The number of personnel and apparatus required to mitigate an active and complex working incident will require additional resources above and beyond the numbers listed below.

It is also important to note that certain incidents require specially trained and certified personnel. These special operations incidents include Hazardous Materials High Risk and all Technical Rescues. EPFR participates in regional response teams for these types of specialized, and infrequently occurring incidents. EPFR, like other agencies in Pierce County, fills their critical taking with a multi-agency regional response. Those incidents are noted with an asterisk and comment.

7.1.1 Structure Fire Low Risk

Unit Type	Number of Units	Total Personnel
Engine	4 or 5	12 or 15
Ladder	0 or 1	3
Medic	2	4
Battalion Chief	1	1
Total Staffing Provided		**20 or 23**
Total Staffing Needed		**16**

7.1.2 Structure Fire Moderate Risk

Unit Type	Number of Units	Total Personnel
Engine	4 or 5	12 or 15
Ladder	0 or 1	3
Medic	2	4
Battalion Chief	1	1
Total Staffing Provided		**20 or 23**
Total Staffing Needed		**21**

7.1.3 Structure Fire High Risk

Unit Type	Number of Units	Total Personnel
Engine	5 or 6	15 or 18
Ladder	1	3
Battalion Chief	1	1
Medic	2	4
Total Staffing Provided		**23 or 26**
Total Staffing Needed		**27 or 28**

7.1.4 Brush Fire Low Risk

Unit Type	Number of Units	Total Personnel
Engine	1	3
Total Staffing Provided		3
Total Staffing Needed		**6**

7.1.5 Brush Fire High Risk

Unit Type	Number of Units	Total Personnel
Engine Type 1	2 or 3	6 or 9
Engine Type 6	2	6
Water Tender	2	6
Battalion Chief	1	1
Medics	0	0
Total Staffing Provided*		**19 or 22**
Total Staffing Needed		**24**

*Additional mutual aid resources from Washington Department of Natural Resources (DNR) available upon request.

7.1.6 Non-Structure Fire Low Risk

Unit Type	Number of Units	Total Personnel
Engine or Ladder	1	3
Total Staffing Provided		**3**
Total Staffing Needed		**3**

7.1.7 Non-Structure Fire Moderate Risk

Unit Type	Number of Units	Total Personnel
Engine or Ladder	2	6
Total Staffing Provided		**6**
Total Staffing Needed		**9**

7.1.8 Non-Structure Fire High Risk

Unit Type	Number of Units	Total Personnel
Engine	1 or 2	3 or 6
Truck	0 or 1	3
Battalion Chief	1	1
Medic	0	0
Total Staffing Provided		**10**
Total Staffing Needed		**9**

7.1.9 Aircraft Emergency

Unit Type	Number of Units	Total Personnel
Engine	4 or 5	12 or 15
Ladder	1	3
Battalion Chief	1	1
Medic	2	4
Total Staffing Provided		**20 or 23**
Total Staffing Needed		**15**

7.1.10 Hazardous Materials – High Risk

Unit Type	Number of Units	Total Personnel
Engine	1 or 2	3 or 6
Ladder	1	3
Battalion Chief	1	1
Medic	0	0
Total Staffing Provided		**7 or 10**
Total Staffing Needed		**15**

*EPF&R does not maintain all technical specialist personnel on duty each day. EPF&R would utilize technical specialist resources with a regional response from Pierce County Hazardous Incident Team (PCHIT).

7.1.11 Hazardous Materials – Low Risk

Unit Type	Number of Units	Total Personnel
Engine or Ladder	1	3
Total Staffing Provided		3
Total Staffing Needed		**3**

7.1.12 Emergency Medical Service - Low

Unit Type	Number of Units	Total Personnel
Medic	1	2
Engine	1	3
Total Staffing Provided		**5**
Total Staffing Needed		**2 or 5**

7.1.13 Emergency Medical Service (Non-Cardiac Arrest)

Unit Type	Number of Units	Total Personnel
Engine or Ladder	1	3
Medic	1	2
Total Staffing Provided		**5**
Total Staffing Needed		**5**

7.1.14 Emergency Medical Service (Cardiac Arrest)

Unit Type	Number of Units	Total Personnel
Engine or Ladder	2	6
Medic	1	2
Battalion Chief	1	1
Total Staffing Provided		**9**
Total Staffing Needed		**7 or 10**

7.1.15 Major Medical (10+ Patients)

Unit Type	Number of Units	Total Personnel
Engine	2 or 3	6 to 9
Ladder	0 or 1	3
Medic	3	6
Battalion Chief	1	1
Total Staffing Provided		**16 or 19**
Total Staffing Needed		**19**

7.1.16 Motor Vehicle Accident (Non-Trapped)

Unit Type	Number of Units	Total Personnel
Engine or Ladder	1	3
Medic	1	2
Total Staffing Provided		5
Total Staffing Needed		**5**

7.1.17 Motor Vehicle Accident (With Entrapment)

Unit Type	Number of Units	Total Personnel
Engines or Ladder	1 or 2	3 or 6
Battalion Chief	1	1
Medic	1	2
Total Staffing Provided		**6 or 9**
Total Staffing Needed		**10**

7.1.18 Motor Vehicle Accident (Freeway Response)

Unit Type	Number of Units	Total Personnel
Engine or Ladder	2	6
Medic	1	2
Total Staffing Provided		8
Total Staffing Needed		**8**

7.2.1. Swift Water Rescue

Unit Type	Number of Units	Total Personnel
Engine	1 or 2	3 or 6
Ladder	0 or 1	0 or 3
Battalion Chief	1	1
Medic	1	2
Marine 113	1	3
Mutual Aid Marine Units	2	6
Total Staffing Provided*		**15 or 18**
Total Staffing Needed		**10**

*EPF&R does not maintain a water rescue specialist on duty each day. EPF&R would utilize mutual aid resources from Orting Valley Fire and Rescue (OVFR), Central Pierce Fire and Rescue (CPFR), King County Zone 3, or Pierce County Sheriff's Department for any significant water rescue related incidents.

7.2.2. Dive Rescue

Unit Type	Number of Units	Total Personnel
Engine	1 or 2	3 or 6
Ladder	0 or 1	0 or 3
Battalion Chief	1	1
Medic	1	2
Marine 113	1	3
Marine 122	1	3
Total Staffing Provided*		**12 or 15**
Total Staffing Needed		**10**

*EPF&R does not maintain a water rescue specialist on duty each day. EPF&R would utilize mutual aid resources from OVFR, CPFR, King County Zone 3, or Pierce County Sheriff's Department for any significant water rescue related incidents.

7.2.3. Fire Boat Service Call

Unit Type	Number of Units	Total Personnel
Marine 122	1	3
Total Staffing Provided		**3**
Total Staffing Needed		**3**

7.3.1. Technical Rescue – Rope

Unit Type	Number of Units	Total Personnel
Engine or Ladder	5 or 6	15 or 18
Battalion Chief	1	1
Medic	1	2
Total Staffing Provided		**18 or 21**
Total Staffing Needed		**17**

*EPF&R does maintain a technical rescue specialist on duty each day. EPF&R would utilize mutual aid resources from Pierce County Special Operations Rescue Team (PCSORT) for any significant technical rescues including high angle rope, trench, structural collapse, and confined space.

7.3.2. Technical Rescue – Confined Space

Unit Type	Number of Units	Total Personnel
Engine or Ladder	5 or 6	15 or 18
Battalion Chief	1	1
Medic	1	2
Total Staffing Provided		**18 or 21**
Total Staffing Needed		**18**

*EPF&R does maintain a technical rescue specialist on duty each day. EPF&R would utilize mutual aid resources from PCSORT for any significant technical rescues including high angle rope, trench, structural collapse, and confined space.

7.3.3. Technical Rescue – Trench

Unit Type	Number of Units	Total Personnel
Engine or Ladder	5 or 6	15 or 18
Battalion Chief	1	1
Medic	1	2
Total Staffing Provided		**18 or 21**
Total Staffing Needed		**20**

*EPF&R does maintain a technical rescue specialist on duty each day. EPF&R would utilize mutual aid resources from PCSORT for any significant technical rescues including high angle rope, trench, structural collapse, and confined space.

7.3.4. Technical Rescue – Structural Collapse

Unit Type	Number of Units	Total Personnel
Engine or Ladder	5 or 6	15 or 18
Battalion Chief	1	1
Medic	1	2
Total Staffing Provided		**18 or 21**
Total Staffing Needed		**18 or 21**

*EPF&R does maintain a technical rescue specialist on duty each day. EPF&R would utilize mutual aid resources from PCSORT for any significant technical rescues including high angle rope, trench, structural collapse, and confined space.

8 Future Demand Modeling

8.1 Overview

Planning for EPFR's future is a critical component of the Standard of Cover process. Realistic assessment of future service demand is, in turn, a critical component of planning for the organization's future. The current Strategic Plan [9] identifies its second major strategic goal as "Prepare for a growing population and increasing demand for service."

EPFR is faced with unique challenges in this regard. Population and employment have been growing rapidly over the organization's recent history, with attendant increases in service demand. Over the five-year study period, the organization sustained demand growth of 13.1%, an average Compound Annual Growth Rate (CAGR) of 3.14%. Planning data [1][2] indicate that this trend is likely to continue, with large numbers of buildable land parcels available and public policy aimed toward sustainably rapid growth. Further complicating these planning challenges, current plans of record [8] call for the development of a major Employment-Based Planned Community (EBPC), the Tehaleh development, which is forecast to comprise between 7000 and 9000 new dwelling units (16,000-23,000 new residents), to be completed by 2032.

Though EPFR's future planning challenges are significant, so too are the planning resources and expertise available to it. We were extremely fortunate during this study to have the expert cooperation of the Pierce County Department of Public Works and Planning (PCPWP), whose staff provided us with detailed, geographically tagged information concerning individual parcels capable of additional development, along with information on historical growth rates by use class. They provided extremely detailed development plans for the Tehaleh development. We used the Code3 Strategist software to incorporate this input and build incident datasets representing alternate future demand scenarios, and to simulate these datasets against the current deployment model to assess their impact on service delivery.

8.1.1 Approach

Predicting the future is fraught with uncertainty: planners never know how, when, where or to what extent the next major economic downturn or boom, pandemic, earthquake, policy change, social trend or other factor will drastically affect service demand. Accordingly, we used a scenario-based approach to assess the organization's capability to meet future demand. Instead of predicting a certain character and level of demand at a specific future time, this approach generates a range of alternate scenarios based on assumptions drawn from recent historical data and uses these scenarios to evaluate (a) the organization's resilience to the range of scenarios given its current configuration, and (b) trigger points for corrective intervention in scenarios where the organization's current configuration is predicted to fail to meet policy goals.

We modeled growth in service demand according to three paradigms:

- **Intrinsic growth** – growth or change in service demand that occurs naturally in areas that already generate emergency incidents. This can arise from increasing population, aging population, demographic change, environmental and economic factors, and other causes.
- **General development growth** – growth or change in service demand that occurs due to the development of land previously not used for habitation or employment, in broad categories that

cannot be specifically predicted. We divided this growth into category by aggregated zoning classification as shown in Figure 43. Each category included county and municipal zoning designations that we classified according to their formal definitions or other indicators from published documentation [7]- [10]:

- ***High Density / Mixed***: high-density, multifamily dwelling uses, or mixed commercial/apartment occupancies ("taxpayers" or "five-over-twos")
- ***Town Center:*** dense commercial centers specifically designated in zoning codes
- ***Municipal Single Family Residential (SFR):*** SFR units, within existing municipal boundaries and subject to municipal zoning. NOTE: due to complications in conforming County GIS-based zoning with municipal zoning information provided as PDF maps, municipally zoned SFR areas are shown as "Other" on some charts.
- ***Urban County SFR***: SFR units, outside of municipal boundaries, but explicitly zoned for urban density single family residences under County zoning ordinances.
- ***Rural:*** County-designated, low-density rural residential uses
- ***Commercial:*** commercially zoned properties
- ***Industrial:*** industrially zoned properties, including light and heavy industry, vehicular operations, etc.

- **Specific development growth** – growth or change in service demand that occurs due to specific, large-scale developments for which specific plans exist. This applies primarily to the Tehaleh development in EPFR's case, as it is by a vast margin the most significant development currently planned.

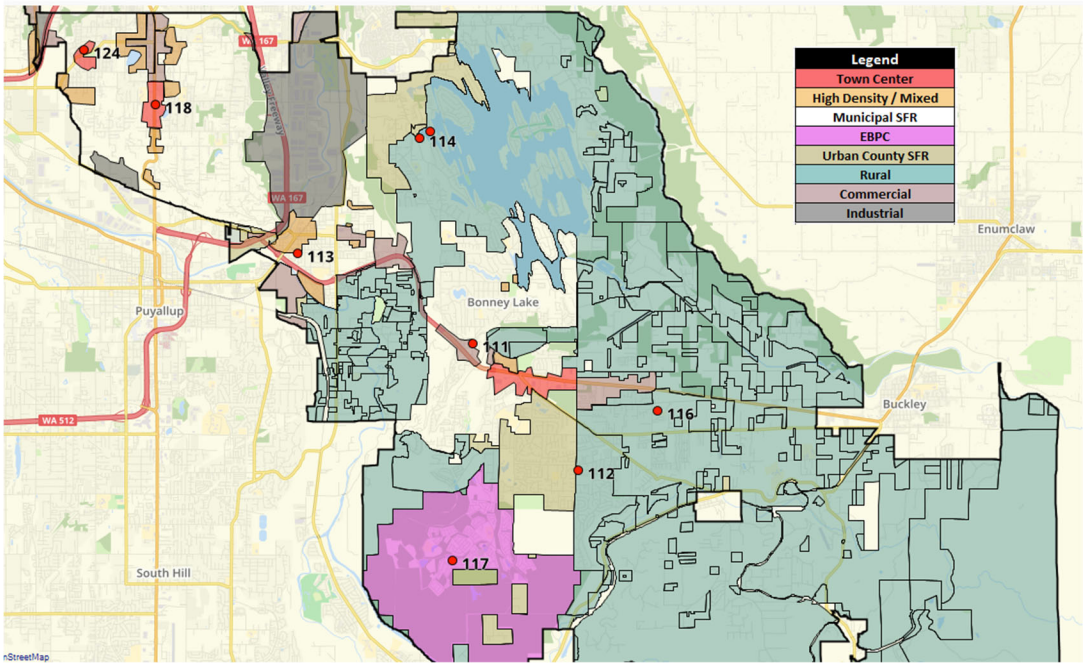


Figure 43: Aggregated Zoning

8.2 Historical Growth Analysis

In this section, we examine data on historical growth in service demand and attempt to correlate it with data on civic development.

8.2.1 Historical Demand Growth

Figure 44 shows annual call volume by zoning category and year, excluding the Tehaleh area. The Municipal SFR category has shown dramatic growth, and the High Density / Mixed and Industrial categories have shown moderate but consistent growth.

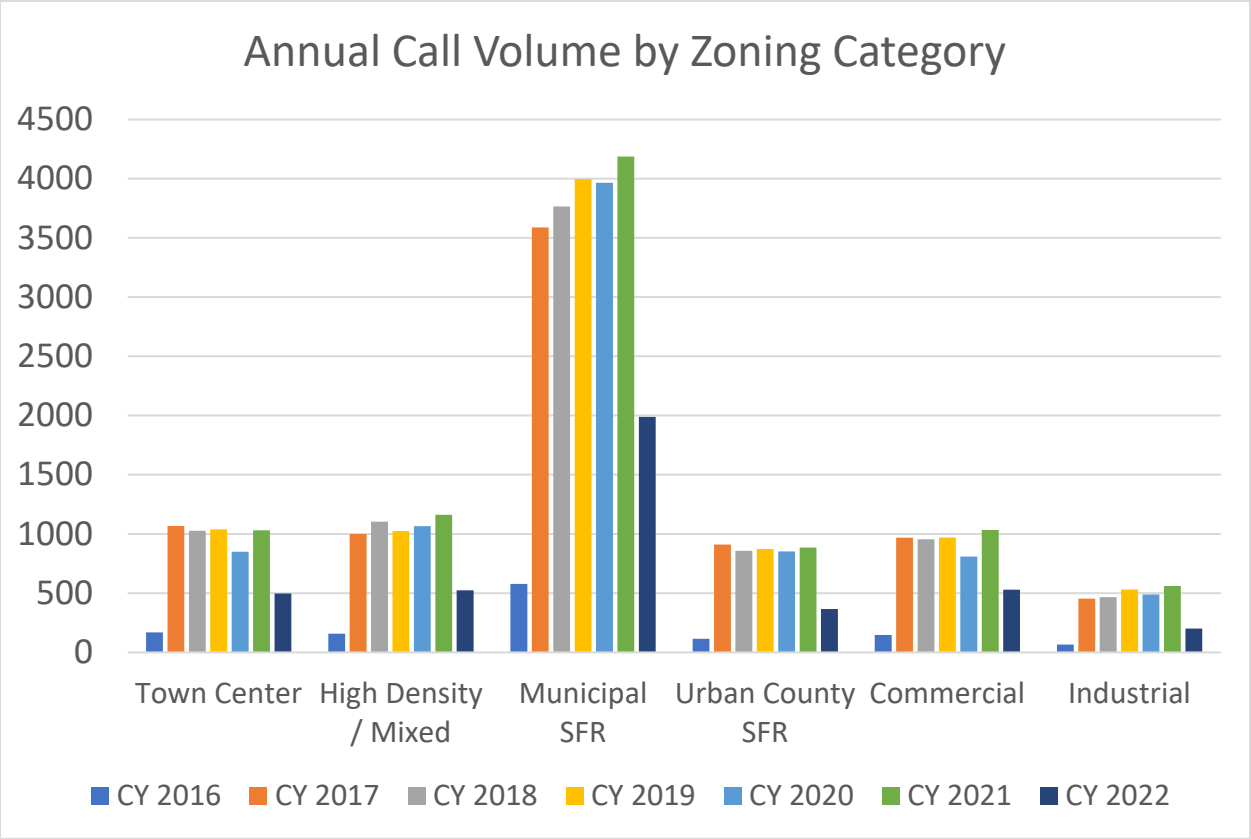


Figure 44: Call Volume Growth by Zoning Category

Figure 45 shows statistics for annual growth rates derived from this data: minimum and maximum annual percentage change; the simple average of the growth rates for each year between 2017 and 2021, inclusive; and the compound annual growth rate (CAGR) over the same period. Figure 45 shows the same data graphically. Several points are evident from these statistics. As might reasonably be expected, variability in growth rates is highest for smaller datasets with low or no overall growth. The simple average and CAGR statistics smooth out the variability of the minimum and maximum. For modeling purposes, we generally assumed that total growth rates (including both intrinsic and general development) in each zoning category would fall between the extrema of the CAGR and simple average growth rates.

Table 3: Growth Rate Summary Statistics

	Municipal SFR	Urban County SFR	Commercial	High Density / Mixed	Rural	Town Center	Industrial	**TOTAL**
Maximum annual % change	6.37%	30.44%	21.52%	11.31%	11.35%	39.52%	14.96%	**11.93%**
Minimum annual % change	-0.59%	-5.67%	-9.69%	-5.78%	-6.38%	-33.51%	-8.10%	**-5.13%**
Average annual % change	3.34%	3.35%	2.38%	2.93%	1.42%	6.93%	2.26%	**3.02%**
2017-2021 CAGR	1.85%	-0.01%	0.24%	1.53%	1.23%	-0.98%	2.32%	**1.35%**

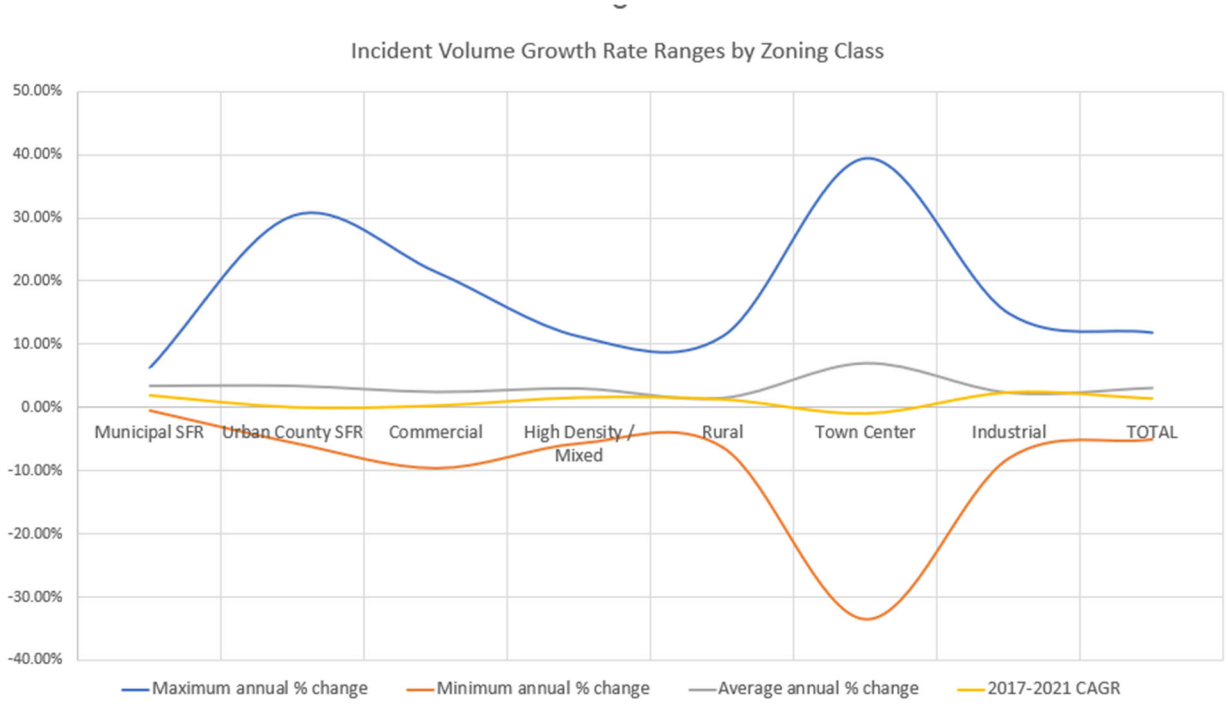


Figure 45: Growth Rate Statistics by Zoning Category

8.2.2 Intrinsic Growth

The population of all US Census blocks within EPFR's jurisdiction grew from 90,356 to 111,548 between 2010 and 2020 [1][2], a CAGR of 2.13%. Referencing a different Census source, the EPFR Strategic Plan indicates that the EPFR service population grew 21% (1.92% CAGR). During the period 2017-2022, EPFR's call volume grew from 10,765 to 12,183, a CAGR of 3.14%. We can crudely estimate from these numbers that the intrinsic rate of call volume growth is in the 0.8-1.2% range annually. This growth can be expected to take place in areas where there is already significant call volume, even without significant new building in these areas. These rates would result in intrinsic call volume growth between 8.3% and 12.6% by 2032.

8.2.3 General Development

Subtracting the baseline estimated intrinsic call volume growth rates (assumed above to be 0.8% to 1.2% annually) from the observed call volume growth rates in each zoning category provides bracketing growth rates for new development in each zoning category. We arbitrarily limited results to growth rates in the range between 0% and 25% annually.

	Observed Growth Rate		Less Intrinsic Growth Rate:	Estimated General Development Growth Rate	
Zoning Category	**Low:**	**High:**		**Low:**	**High:**
Town Center	-0.98%	6.93%	0.8-1.2%	0%	6.13%
High Density / Mixed	1.53%	2.93%	0.8-1.2%	0.33%	2.13%
Municipal SFR	1.85%	3.34%	0.8-1.2%	0.65%	2.54%
Urban County SFR	-0.01%	3.35%	0.8-1.2%	0%	2.55%
Rural	1.23%	1.42%	0.8-1.2%	0.03%	0.82%
Commercial	0.24%	2.38%	0.8-1.2%	0%	1.58%
Industrial	2.26%	2.32%	0.8-1.2%	1.06%	1.52%

8.2.4 Specific Development: Tehaleh

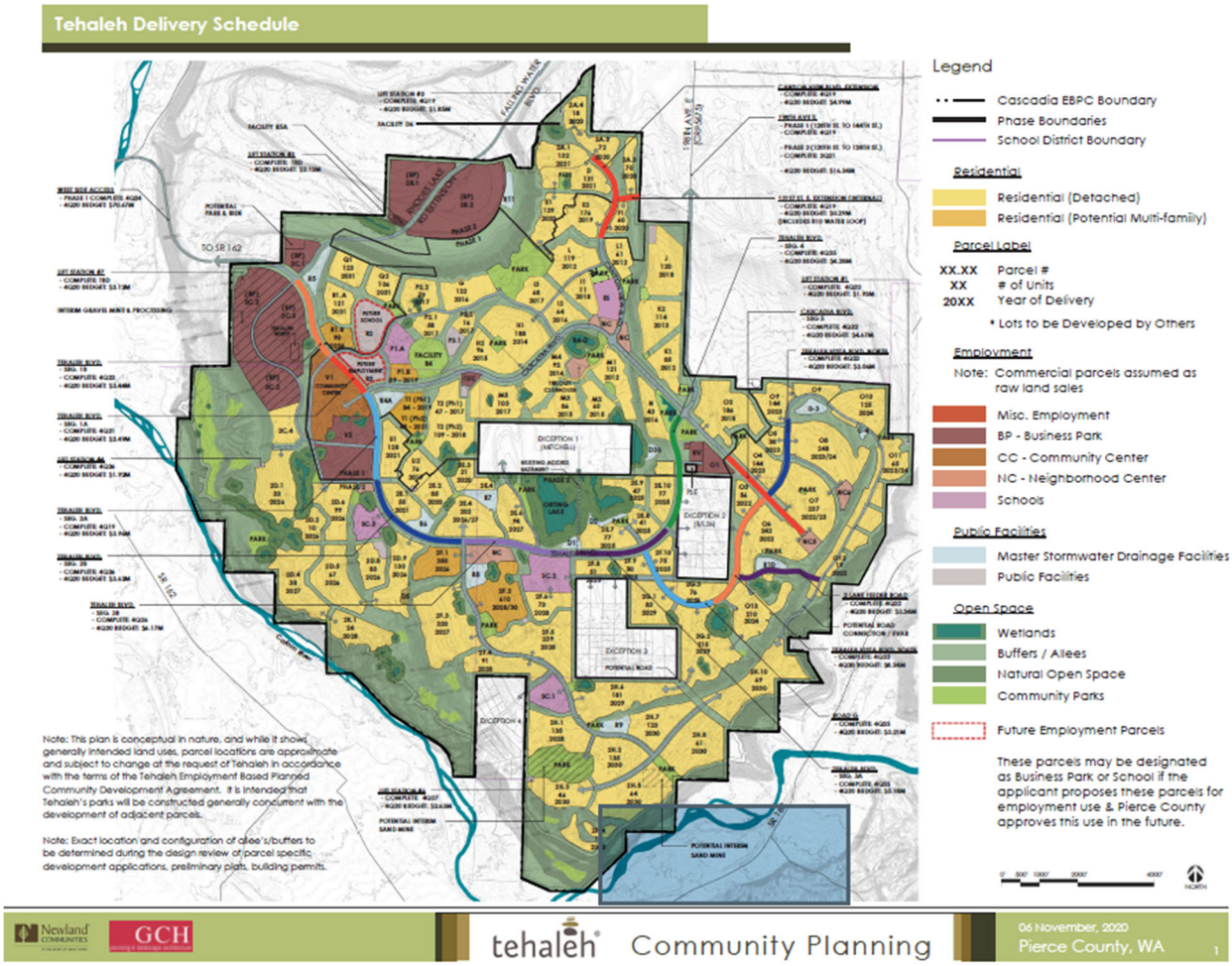


Figure 46: Tehaleh Implementation Plan

The Tehaleh development will undoubtedly change the character of EPFR's more significantly than any other single factor within the planning horizon, due both to its scale and to its location relative to the rest of EPFR's jurisdiction and service population. Figure 46 provides visual perspective on this effect, comparing the annual number of certificates of occupancy (CO's) granted within the Tehaleh project boundaries vs. those granted in the rest of the EPFR jurisdiction.

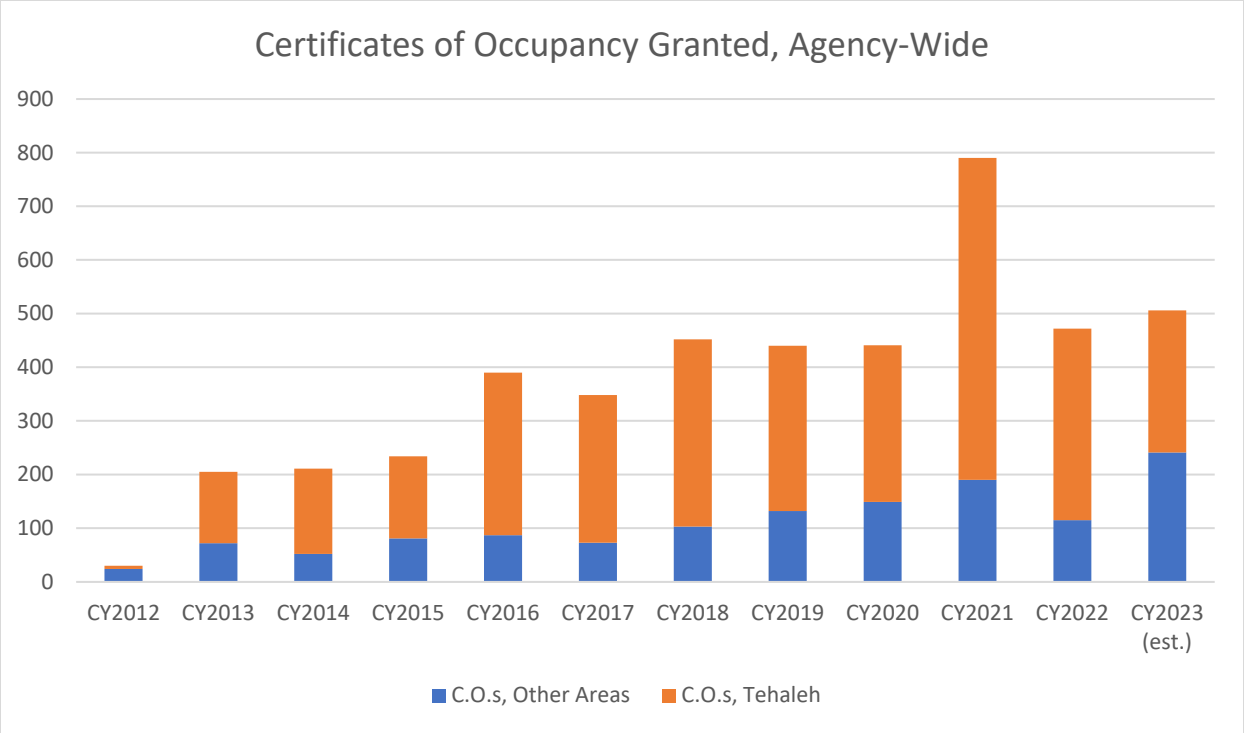


Figure 47: Completed Construction - Tehaleh vs. Rest of EPFR Jurisdiction

Fortunately, Tehaleh development plans provided by PCPWP [11], shown in Figure 46: Tehaleh Implementation Plan, provide excellent detail as to the location, character and timing of specific portions of the development. Equally fortunately, a considerable amount of development has already taken place within the project boundaries, with finalized building permits documenting project completion, and allowing correlation with observed increases in call volume in the areas identified. Allowing a three-year lag between permit finalization, we found extremely strong correlation (R^2 = 91%) between the rate of new construction in Tehaleh and the rate of increase in call volume attributable to the area, as shown in Figure 48. The figure shows cumulative numbers of units constructed, subject to a three-year lag, on the X axis. On the Y axis, it shows the total number of calls dispatched to points within the Tehaleh boundary during the corresponding years. It shows the linear least squares regression line equation and R^2 value for that line (the R^2 value, or "coefficient of determination," measures the amount of variation in the subject data that is explained by the regression line. A perfectly linear dataset will have an R^2 value of 1.0 or 100%, while less linear or more random datasets will have R^2 values tending toward 0 [13]). From this linear relationship we observe that new dwelling units generate an average of roughly 17 incidents annually per 100 units, for occupancies of the type that have been constructed in the Tehaleh area since 2012.

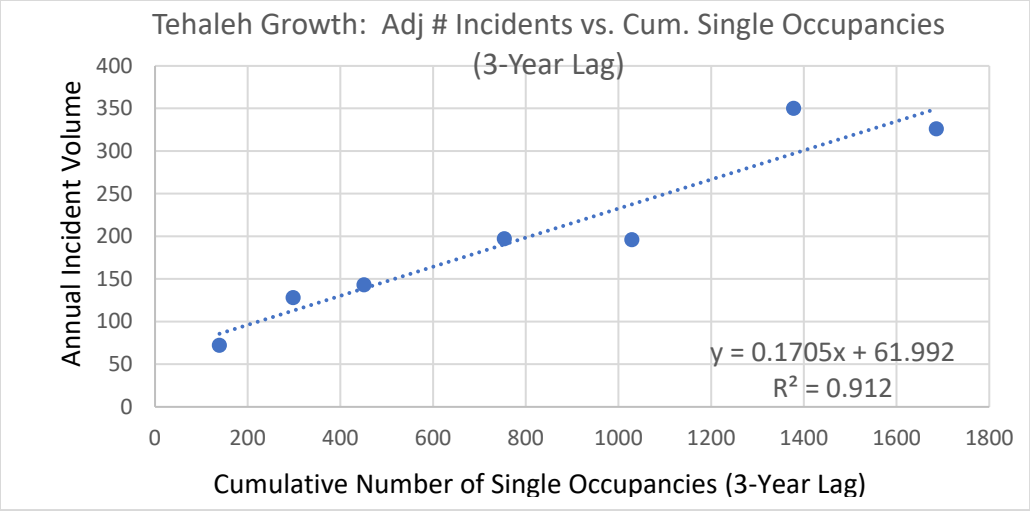


Figure 48: Tehaleh Construction vs. Associated Call Volume

8.3 Development Models

Using the data in the preceding subsections, we created demand models using Code3 Strategist and used these models to generate sample future event datasets for evaluating the resilience of EPFR's current deployment against plausible future conditions. Our baseline assumption was that the Tehaleh project will be built essentially as planned, which appears to be the case according to data through 2021. The timeline of this project is uncertain due to economic and other factors beyond the control of the developers or planning authorities. The pace of Tehaleh development vs. intrinsic and general development growth may vary relative to each other. Our baseline assumption was that Tehaleh will be built and occupied according to plan, including the planned schedule, and that "background" (intrinsic and general development) rates will remain within historical limits during Tehaleh's construction. We generated ten alternate scenarios on this baseline assumption, representing different levels of buildout on all three dimensions – Tehaleh, intrinsic growth and general development growth. These scenarios contained one sub-scenario for Tehaleh, and an additional fourteen: seven for intrinsic growth in each zoning category, and seven for general development in each zoning category. The derivation of sub-scenarios is detailed in the following subsections. Each scenario included up to 10% random variation in intensity the individual components (e.g, if the sub-scenario base rate for intrinsic growth in the Municipal SFR category was 1.85%, the rate of incident generation could be between 1.67% and 2.04%). The incident generation process replicated the characteristics (time of day, day of week, season of year and incident type) of the historical incident dataset for the appropriate area. For intrinsic growth, incident locations sampled from prior incident locations, so that "frequent flyer addresses" would continue to generate significant incident volumes. For new development, incident locations were sampled uniformly from buildable parcels identified by PCPWP [3][4]. The following subsections describe the process of building the sub-scenarios identified above in more detail.

8.3.1 Tehaleh Analogy Model

The detailed nature of Tehaleh plans, along with the incident history available for areas of Tehaleh where construction has been completed, enabled us to build a comprehensive analogy model to guide estimating the impact of future development. The aim of this process was to build future workload models that replicate the frequency, type, time of day, day of week and season of year characteristics of historical incidents in similar usages. Four main use types were found to be important: single family residential, multi-family/high-density residential, assisted living and business park. We were able to build analogies from prior experience within Tehaleh for single family residential and assisted living uses, as there was sufficient incident history to build these models. We identified business park analogy sources from similar zoning provided by PCPWP (primarily in Milton), and high-density residential analogs through addresses provided by EPFR [5]. We manually replicated the information from the Tehaleh plan of record [11] (see also Figure 46), because a digital version this information was not easily available. This graphic shows our classification of Tehaleh plan parcels: existing single family uses in blue, proposed single family uses in teal, high-density uses in orange, schools in red and un-designated uses outlined in bright red.

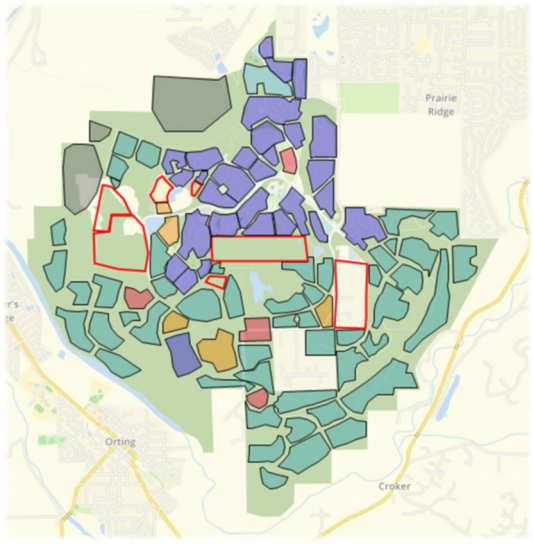


Figure 49: Manual Classification of Tehaleh Parcels

Our model scaled the frequency, type and time characteristics of the analogy sources according to the magnitude of each proposed parcel. E.g., a single family residential parcel planned for 50 homes would receive similar types of incidents at similar times, but at half the frequency of a similar parcel planned for 100 homes.

Our analogy source classification yielded reasonable results. We classified the incident generation properties of each source parcel according to six dimensions: incident generation frequency per unit area, proportions of most and second-most frequent incident type, and proportions of incidents occurring on weekdays, weekend days and nights. Figure 50 shows classification of Tehaleh SFR, and outside MFR and business park (shown as "Industrial" on the figure) uses on two of these dimensions. The classes are not linearly separable in two dimensions, but do form compact, convex-bordered groups as shown by the manually interpolated curves, so we considered the classification to be adequate.

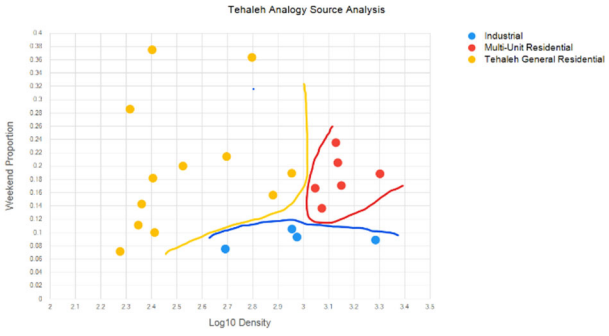


Figure 50: Tehaleh Analogy Source Classification (2-D)

We sampled incident characteristics from the full range of input sources for each use type. This recreated the inherent variability of each use class across multiple scenarios.

8.3.2 General and Intrinsic Growth

Our model identified annual rates for generalized new development and intrinsic growth for each zoning category, using CAGR and average growth rates from Figure 45 above as rough bounding guidelines, and used historical incidents for each zoning category as sampling sources.

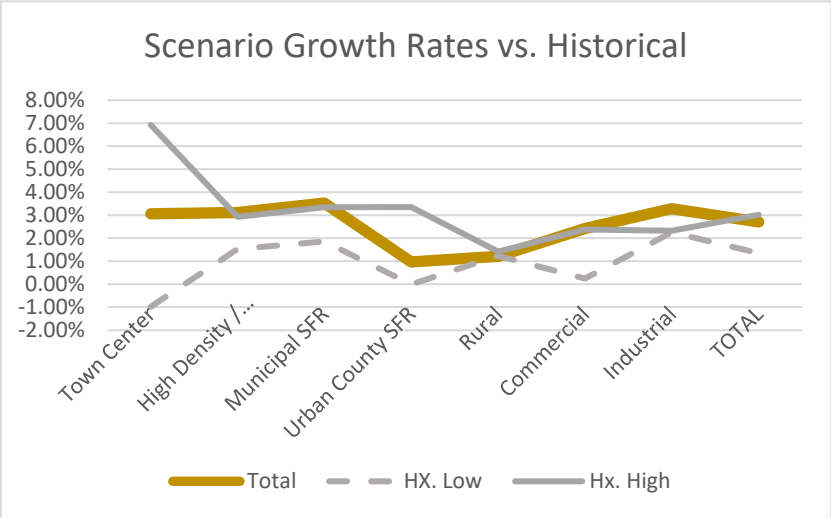


Figure 37 shows the overall annual call volume growth rates for each zoning category generated by the end-state scenario (tan line) compared to lower and upper bounds of the average and CAGR figures for each zoning class from Figure 45. The scenario growth rates are generally on the aggressive side, but within or adjacent to the bounding values except for the Industrial class, which over-estimates by about 1% (3.28% vs. 2.32%).

The overall growth rate generated by the end-state scenario was 2.70%, between the historical bounds of 1.35% and 3.02%.

8.4 Projected Demand

The ten scenarios generated varying numbers of incidents in the predictive datasets.

Table 4 summarizes the number of incidents in each dataset generated by the scenarios, broken down by zoning class.

Table 4: Scenario Generation Characteristics

Scenario	Municipal SFR	Commercial	EBPC	High Density / Mixed	Rural	Town Center	Urban County SFR	Industrial	TOTAL
00 Base Year Actual	4310	1132	393	1145	3005	1023	880	535	**12,423**
01 - Current Activity	4327	1135	402	1149	3009	1027	883	538	**12,470**
02 - 11% Completion	4591	1186	535	1207	3018	1080	901	567	**13,085**
03 - 21% Completion	4811	1233	662	1257	3030	1130	914	592	**13,629**
04 - 34% Completion	5089	1287	876	1327	3035	1191	927	621	**14,353**
05 - 45% Completion	5418	1332	949	1371	3051	1262	941	652	**14,976**
06 - 56% Completion	5631	1377	1141	1420	3061	1309	962	677	**15,578**
07 - 66% Completion	5784	1391	1308	1526	3072	1360	990	715	**16,146**
08 - 80% Completion	6138	1485	1448	1555	3077	1443	1006	732	**16,884**
09 - 91% Completion	6472	1521	1573	1640	3094	1450	1010	793	**17,553**
10 - 100% Completion	6619	1565	1682	1682	3100	1517	1029	806	**18,000**

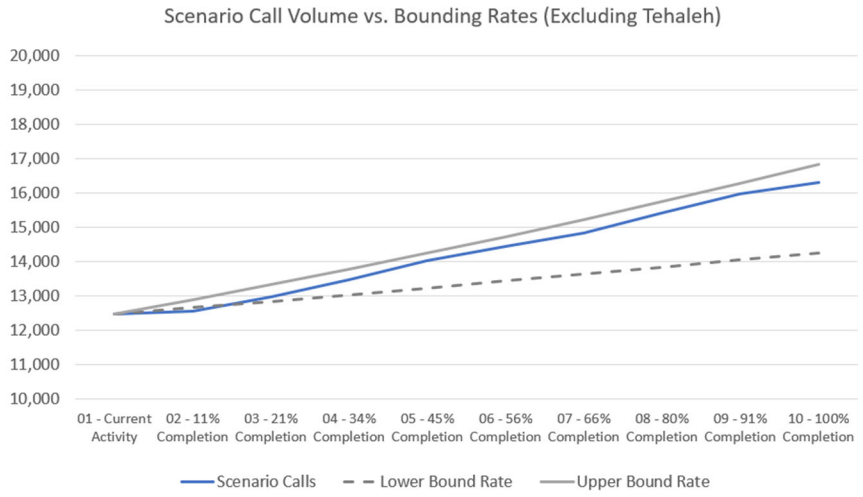


Figure 51: Scenario Call Volume Growth Comparison

Figure 51 compares call volume growth in the generated scenarios against the upper and lower bounds derived from Figure 45, excluding the Tehaleh region, to reflect change attributable to intrinsic growth and general new development. As noted previously, the scenario-generated call volumes track within the upper and lower bounds, but closer to the upper bound.

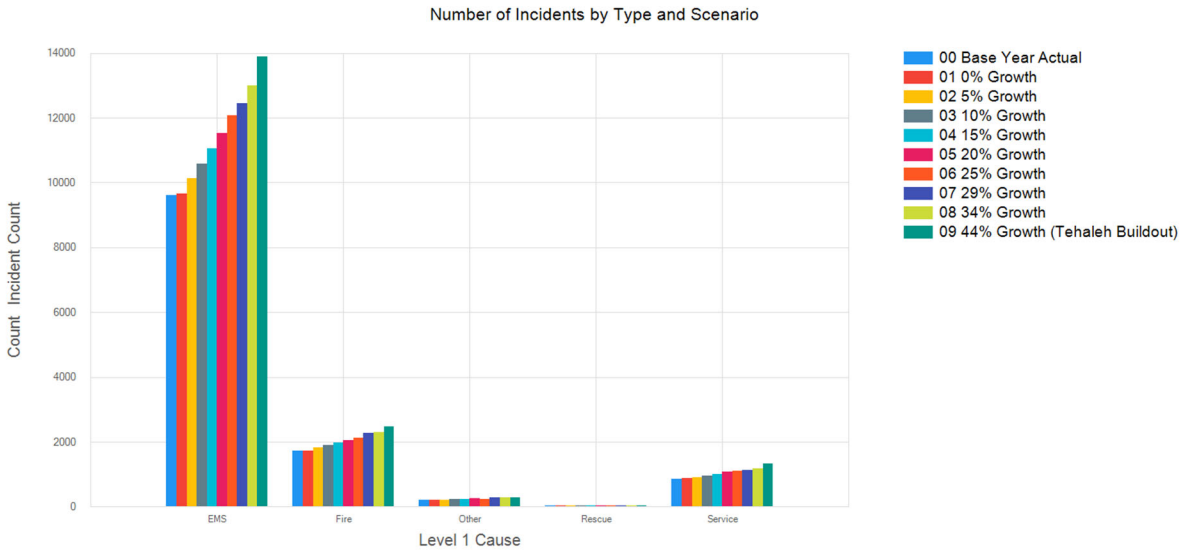


Figure 52: Scenario Call Volume Breakdown by Incident Type

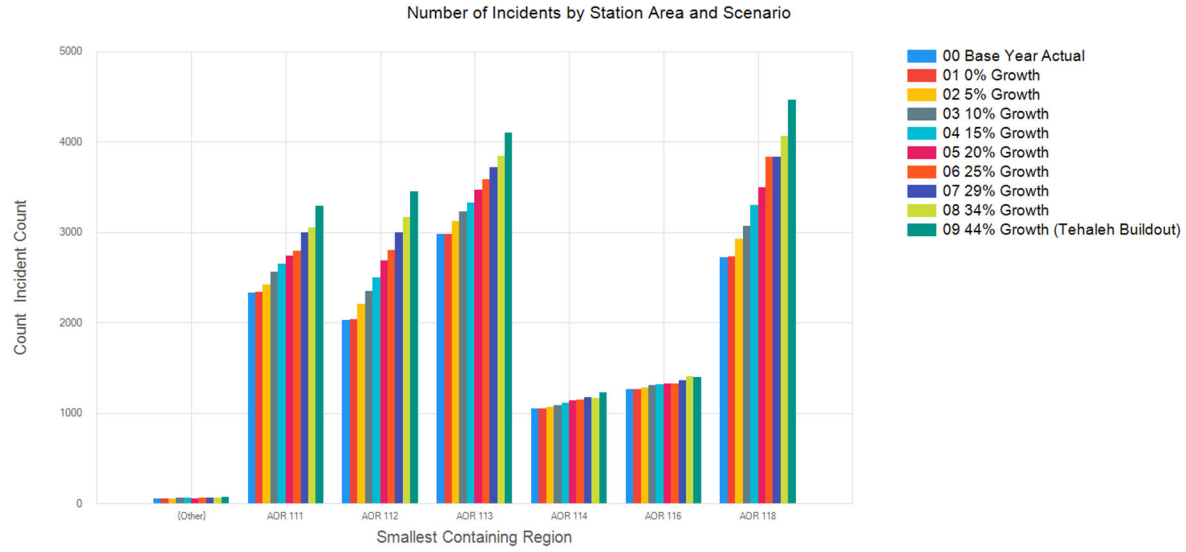


Figure 53: Scenario Call Volume Breakdown by Station Area

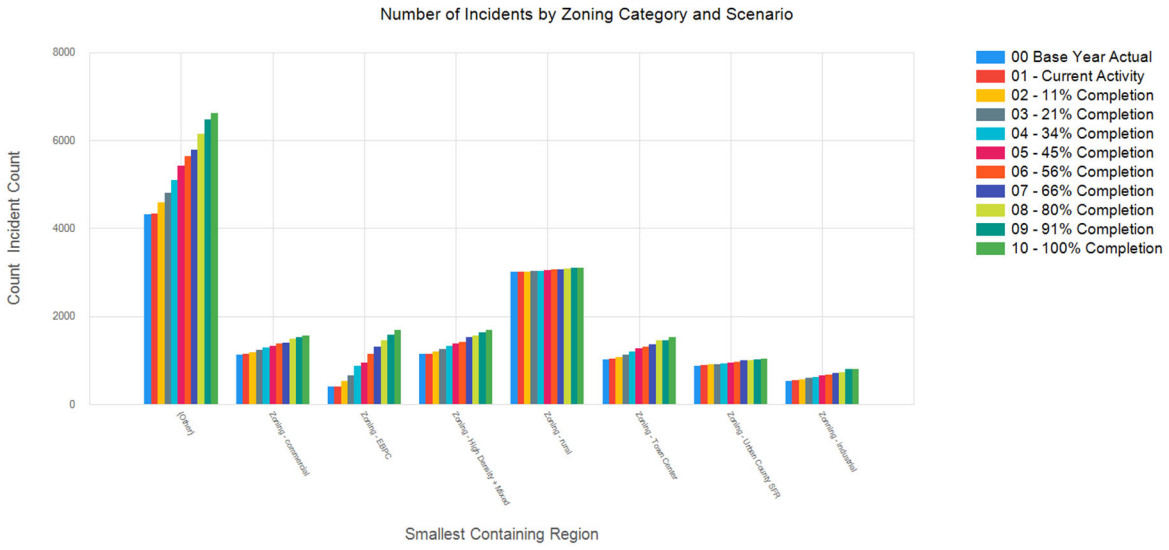


Figure 54: Scenario Call Volume Breakdown by Zoning Class

Figure 54 shows the breakdown of scenario call volumes by zoning class. This chart re-presents the data from

Table 4. The model predicts the municipal SFR category to yield the largest absolute growth. The EBPC category, which exclusively applies to Tehaleh, showed the highest proportional growth.

8.5 Projected Service Impact

We used Code3 Strategist to perform simulation, assessing the impact of these growth scenarios on EPFR's current operational model. We did NOT include potential service enhancements contemplated for Station 117 or 124. We used the simulation results to assess the impact on unit workload and travel time performance as detailed in the following subsections.

8.5.1 Unit Workload

We used simulation results to evaluate impact on unit workload for key units. We evaluated unit hour utilization (UHU) in terms of the amount of time committed to emergency operations, as a percentage of a 24-hour day. (UHU figures for part-time-staffed units as well as units that are intermittently staffed do not reflect their reduced in-service time).

Figure 55 shows the impact of the growth scenarios on medic units' overall UHU. A published study [14] suggests 30% as a recommended limit for overall medic unit utilization, to avoid adverse wellness effects on crews and degradation of transport unit availability and performance during emergency operations. This limit is shown as a horizontal red line in the figure. In the current operational model, with current workload Medic 111 is currently at that threshold. In the development scenarios at 34%, 66% and 100% buildout levels, Medics 111, 113, 118 and 116 successively reach or exceed this level.

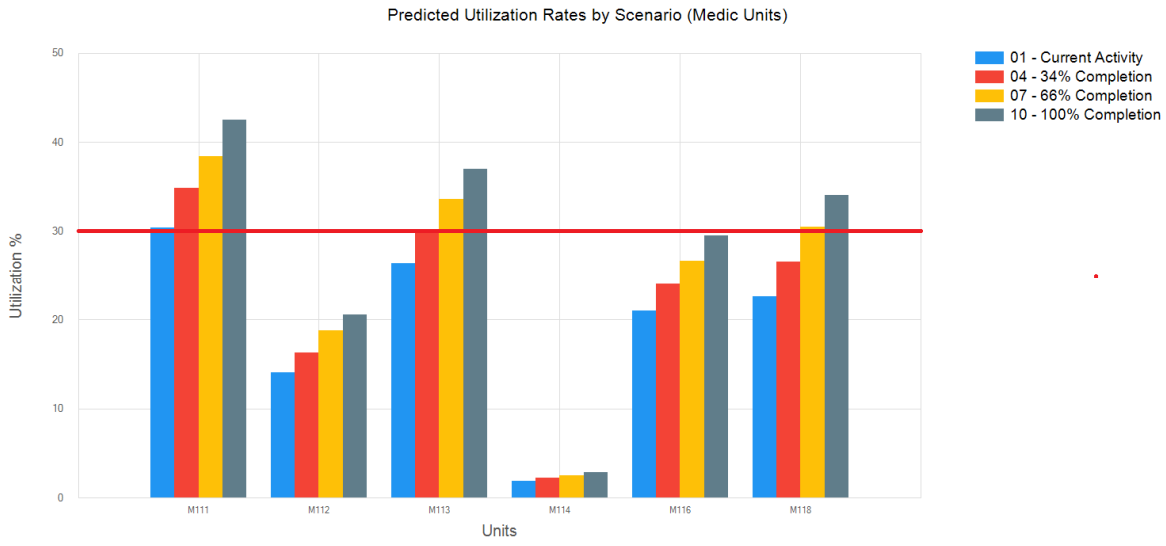


Figure 55: Unit Hour Utilization Impact on Medic Units

We used this data to evaluate medic unit UHU on an hourly basis as well. Figure 56 illustrates this process, using M111 as an example. Each colored trace presents predicted hourly UHU rates throughout a typical day for M111 within a single scenario. For example, the yellow line at 1400 hours has a value of approximately 0.47, indicating that M111 is predicted to be committed to emergency operations 47% of the time at the 1400 hour in the 66% buildout scenario. The 30% threshold Is again marked on this example chart.

Note that these figures do not reflect non-incident-related activity such as documentation, training, maintenance and other duties of response crews. It may also significantly under-estimate the amount of time units, particularly medic units, are out of quarters due to incident activity. This is due to the fact that SS911's CAD system (like most CAD systems) ends incident tracking for a unit as soon as the unit marks available on the radio. In other words, unit committed time (from which UHU is calculated) will not usually include time required to return to quarters after an incident.

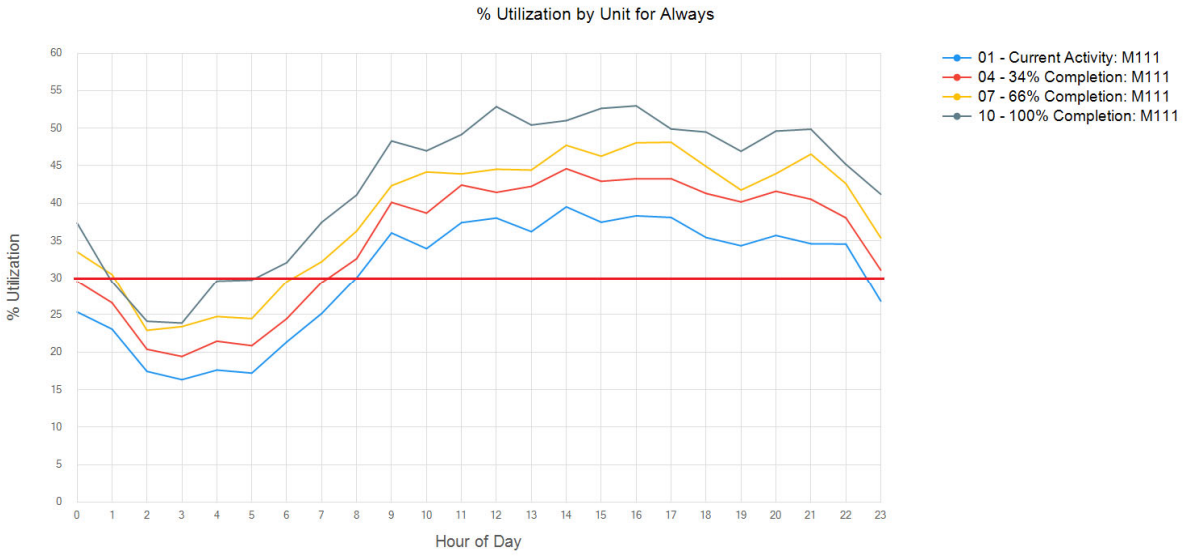


Figure 56: Hourly UHU Example - Medic 111

We summarized combination of all medic units' hourly UHU data to identify the number of hours in a typical day during which each medic unit's hourly UHU was predicted to be over the 30% threshold. Table 5 shows this information in terms of numbers of hours per day.

Table 6 adjusts this information, presenting it in terms of percentage of total duty time during which a unit's hourly UHU is predicted to be over the 30% threshold. This adjusts for the fact that M112 is available during 12-hour shifts and M114 is intermittently available as staffing allows, approximately 10% of the time.

Number of Daily Hours Over 30% UHU						
Scenario:	**M111**	**M112**	**M113**	**M114**	**M116**	**M118**
01 - Current Activity	15	1	11	0	1	3
04 - 34% Completion	16	10	15	0	4	11
07 - 66% Completion	19	11	17	0	9	15
10 - 100% Completion	19	11	18	0	14	16

Table 5 Medic UHU Over 30% (Absolute Hours):

Percent of Available Time Over 30% UHU						
Scenario:	**M111**	**M112**	**M113**	**M114**	**M116**	**M118**
01 - Current Activity	63%	8%	46%	0%	4%	13%
04 - 34% Completion	67%	83%	63%	0%	17%	46%
07 - 66% Completion	79%	92%	71%	0%	38%	63%
10 - 100% Completion	79%	92%	75%	0%	58%	67%
Daily Availability (Hrs)	24	12	24	2.4	24	24

Table 6: Medic UHU Over 30% (Percentage of Available Time)

There does not appear to be recent literature on acceptable rates of utilization for fire suppression companies, though one source [15] indicates that 25-30% has "traditionally" been viewed as a threshold for suppression company UHU over a 24-hour shift to avoid adverse health effects on crews. It is not quantitatively reported whether lower UHUs may have additional adverse effects on response time, crew performance or interference with other duties, though such links are subjectively suggested. Accordingly, we report here only predicted overall UHU figures for suppression companies, as shown in Figure 57.

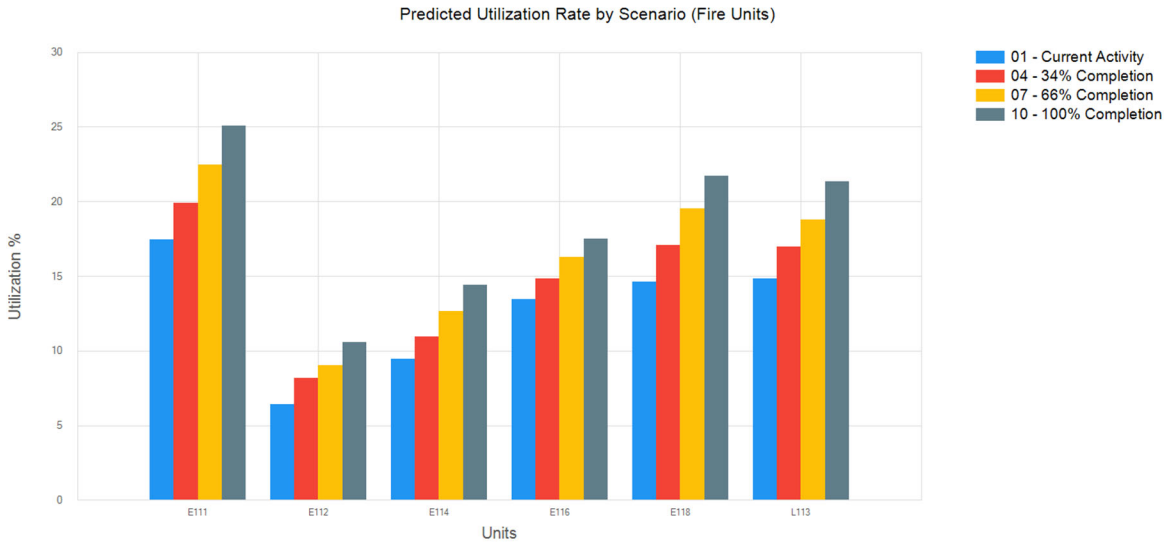


Figure 57: Predicted Suppression Unit UHU (Overall)

8.5.2 Travel Time

We used the simulation process to analyze effects on predicted 90th percentile travel times for initial units, as shown in Figure 58. Significant findings include:

- Station 112's travel times increase dramatically, due primarily to the added workload in the Tehaleh area.
- Station 118's travel times also increase dramatically].
- The remaining station areas see slight, but noticeable increases in response time.

Relative rates of increase in 90th percentile initial unit travel times by station area are shown in the following table.

AOR 111	AOR 112	AOR 113	AOR 114	AOR 116	AOR 118
2.14%	12.47%	1.88%	1.80%	4.54%	18.87%

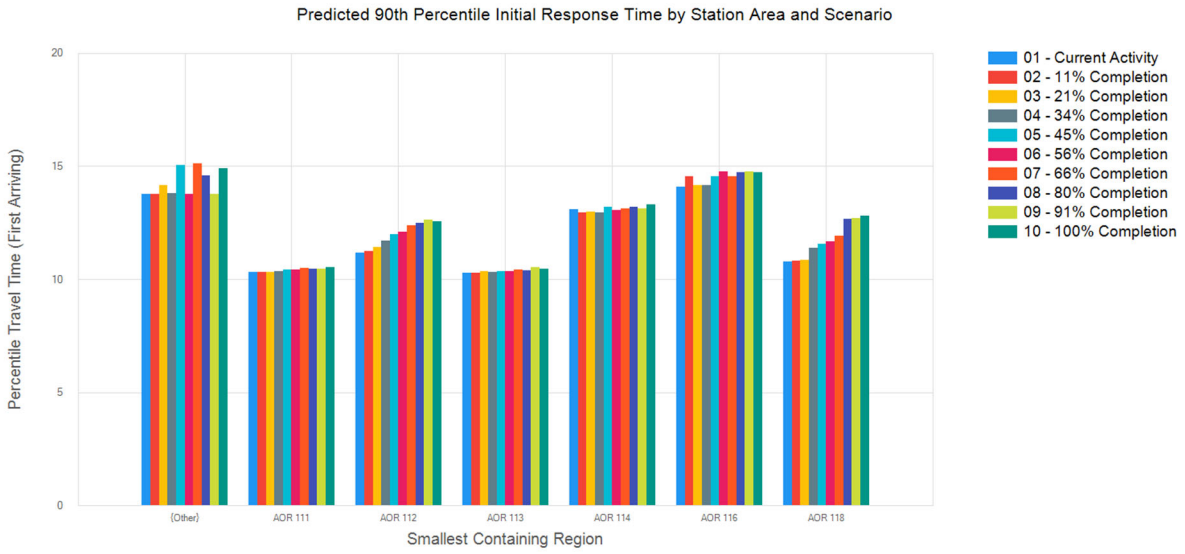


Figure 58: Changes in Travel Time by Station Area

8.6 Interpretation

EPFR is currently a moderately busy organization. One medic unit (M111) is currently at the recommended threshold of 30% UHU [14] on an overall basis. Two medic units (M111 and M113) are currently above that threshold for more than 10 hours per day. Most suppression units are currently below the 25-30% threshold mentioned in available literature but are subjectively busy enough that there appear to be significant numbers of unit substitutions resulting in initial response delays as described in Section 3.3.6.

Under the growth scenarios considered, unit workloads increase still further. In the fully-built-out scenario, E111 is projected to be at the 25% UHU threshold. By the 34% completion scenario, five of six frontline medic units are projected to be over the 30% UHU threshold for more than 10 hours per day.

In the growth scenarios, response times are projected to increase significantly in the AORs of Station 112 (due to the Tehaleh construction) and Station 118. They are projected to increase slightly to moderately in the other AORs.

It appears likely from these projections that EPFR leadership will find it necessary to augment staffing and apparatus deployment in order to meet these challenges, depending upon the organizational goals established and updated within the Strategic Plan framework as an outcome of this study.

8.7 Analysis Limitations

The analysis presented in this section provides a reasonable set of growth scenarios for evaluating potential deployment changes to deal with anticipated growth. Time and data constraints imposed several limitations on this work that could be addressed with additional research:

1) Buildable lands inventories were sampled from uniform distributions of parcels, rather than adjusting for total potential units per parcel. E.g., any hypothetical new call was equally likely to be placed at a 5 acre rural lot that could support one new dwelling unit, as at a 100 acre parcel that

could accommodate 20 new units. This limitation is estimated to have minimal impact because the number of large multiunit parcels is relatively small.

2) UHU figures in this study differ by as much as 0.7% from official ones provided by EPFR. This may be due to different methods for eliminating outliers, or from different original data pools. UHU figures in this study were calculated on the most recently available year (6/1/2021 – 5/31/2022).
3) The growth projections in this section were built upon a single set of assumptions of intrinsic and general development growth rates relative to the completion of the Tehaleh project. These assumptions were toward the higher end of the range of observed growth rates. It would be useful to make additional scenario sets with more and less aggressive background growth rates relative to Tehaleh.

9 Findings, Conclusions and Recommendations

9.1 Summary of Findings, Conclusions and Recommendations

A community's desired level of service is a uniquely individual decision. No two communities are exactly alike. Performance goals must be tailored to match community expectations, community conditions, and the ability to pay for the resources necessary to attain the desired level of service.

Levels of service and resource allocation decisions are the responsibility of the community's elected officials, in this case the EPFR Fire Commissioners. The policy-making body carefully balances the needs and expectations of its community when deciding resources to allocate to all the services it provides.

As part of the Community Risk Assessment: Standards of Cover, strategic recommendations are proposed to measure current performance and support future improvements. These strategic recommendations also support continued compliance measurement should the District decide to pursue Fire Accreditation. The objective of the strategic recommendations is to support continued organizational improvement.

These recommendations should be included in future strategic planning, annual budget planning, and work plan prioritization. Modifications and new recommendations are encouraged as the internal and external stakeholders continually improve EPFR and new or emergent community expectations arise.

9.1.1 Improvement Goal 1: Establish and Adopt Service Level Benchmark (Goal) Objectives in alignment with EPFR's Mission, Vision, Core Values and Guiding Principles

The EPFR should establish and adopt Performance Benchmarks in alignment with its Mission, Vision, Core Values and Guiding Principles. This goal reinforces EPFR's commitment to providing a consistently high level of service to community members in all areas of the District, regardless of the type of emergency. To achieve this, should establish and measure EPFR performance against benchmark objectives.

9.1.2 Improvement Goal 2: Adopt a plan to maintain and improve response capabilities

This goal supports performance benchmarks by objectively and regularly measuring EPFR's performance. The following are recommended as EPFR's fire and life safety response performance goals for the District's urban and rural zones. These are not levels of service that must be achieved immediately but, instead, are targets for continued excellence. As one benchmark is achieved, or new technology and resources become available, then set a progressively higher benchmark.

9.1.2.1 Improvement Goal 2a: Improve Turnout Time

The single biggest performance time improvement the EPFR can make is to reduce turnout time. This is the time interval between when the crew is alerted of a call by South Sound 911 and when the crew begins responding.

There are two primary causes of increased turnout time. One is station design where the apparatus is a distance away from the crew quarters. Large fire stations or those with multiple floors by their design, make it difficult to quickly exit the station. The second cause is behavioral mindsets where crews may move at a deliberate pace to get to the apparatus based on a perception of a lower acuity call. It is interesting to note the crew's turnout speed when they know the call is a structure fire with smoke showing and multiple calls versus a lower priority EMS call to a senior care facility the crew responds to frequently.

Management should make improving turnout time a priority and frequently share the benchmark expectations, reasoning, and performance results with crews and company officers. Quarterly performance reporting, broken down by shift and company, should also be widely shared across the organization, with the Fire Commissioners and community via EPFR's website.

Turnout Time: 2017-2020 Emergency Calls Only (90th percentile)

Call Type	NFPA 1710 Performance Objective (min:sec)	EPFR Turnout Time All Units (min:sec)/ # Responses	Proposed Benchmark Turnout Time (min:sec)
EMS	00:01:00	02:29/ (18,551)	00:02:00
Fire*	00:01:20	03:07/ (1,374)	00:02:00
Hazardous Condition*	00:01:20	03:00/ (187)	00:02:00
MVA*	00:01:20	03:02/ (1,191)	00:02:00
Technical Rescue*	00:01:20	03:02 / (844)	00:02:00

*The additional time (20 seconds) is allocated for firefighters to don turnout gear or other specialized safety gear.

9.1.2.2 Improvement Goal 2b: Continue Reducing Call Processing Time

Call Processing has generally been improving except for the final three quarters of the study period, roughly consistent with the implementation of Priority Dispatch™ in the South Sound 911 dispatch center.

In collaboration with South Sound 911, establish call processing benchmarks in alignment with NFPA 1221: Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems including calls answered and call processing performance objectives.

The current baseline performance is higher than NFPA 1221. In reviewing Standards of Cover and other documentation from fire agencies in Pierce County who utilize South Sound 911, turnout time reduction has been highlighted in those reports.

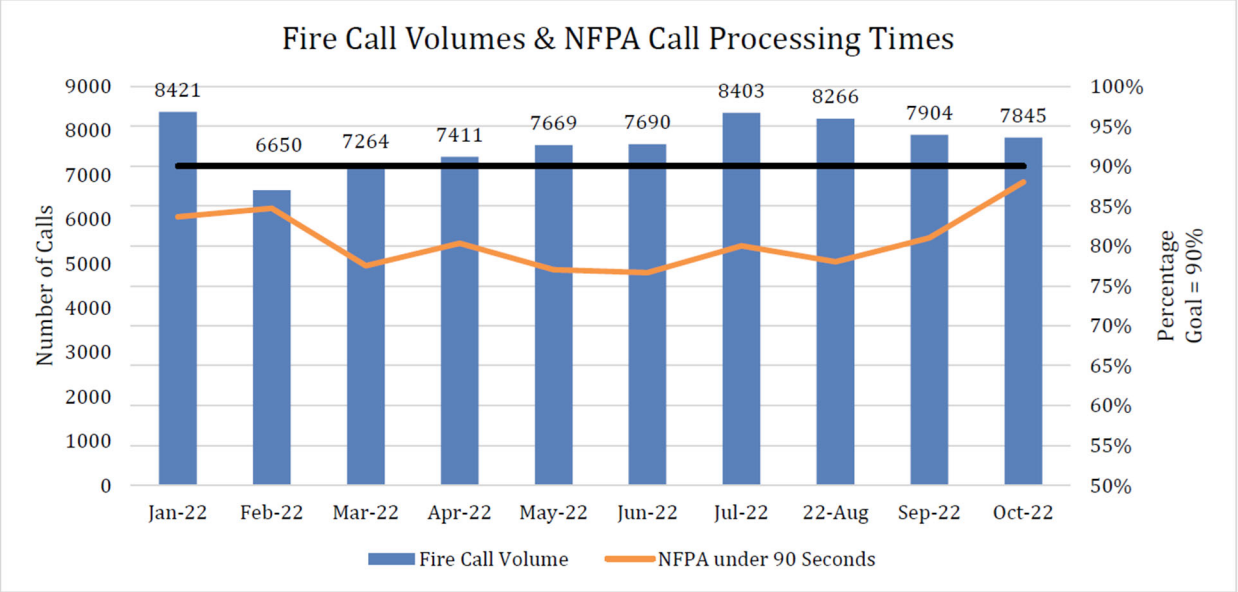
To the credit of EPFR, all Pierce County Fire agencies, and South Sound 911, improvements are to be commended. Leaders of South Sound 911 have also been an important stakeholder and their continued collaboration is encouraging. In addition to collaborating with South Sound 911, EPFR should continue its partnership with all Pierce County fire agencies for regional shared solutions.

NFPA 1221 (2016 edition) specifies call processing performance objectives:

- 90 percent of emergency alarm processing shall be completed in 64 seconds, and 95 percent of alarm processing shall be completed in 106 seconds.
- Emergency alarm processing for the following call types shall be completed within 90 seconds 90 percent of the time and within 120 seconds 99 percent of the time:
    - Calls requiring emergency medical dispatch (EMD) questioning and pre-arrival medical instructions.

- Calls requiring language translation, the use of TTY/TDD device or audio/video relay services.
- Calls of criminal activity that require information vital to emergency responder safety prior to dispatching units.

SS911 data table shows a ten-month period of call processing times through their dispatch center. The black line represents the NFPA 1221 standard, and the orange line represents the actual call processing times.



It is recommended that units be dispatched to priority 0 and 1 calls prior to the completion of emergency medical dispatch (EMD) questioning and instructions. Once EMD is completed, units can be downgraded in their response if the call is not emergent. The goal would be to get units altered and initiate response as soon as safely possible.

9.1.2.3 Improvement Goal 2c: Adopt Workload and Deployment Trigger Points to assess the need for additional Resource Staffing and Station Locations

As growth occurs in EPFR, particularly in the Tehaleh planned community, the EPFR should adopt a formal review process to assess the need to additional resources or fire station locations. Objective standards based upon adopted service level benchmark policies should be utilized. Three objective criteria should be prioritized:

1) Establish benchmarks for Unit Hour Utilization.
2) Establish travel time benchmarks to urban, suburban, and rural areas.
3) Establish unit reliability benchmarks.

9.1.2.4 Improvement Goal 2d: Implement a Risk-based Response to Target Hazards

It is recommended that EPFR use a risk assessment methodology and dispatch protocols to customize response to these locations.

EPFR already objectively identifies target hazards and maintains a database of approximately 500 target hazards. Target hazards would be those with high life hazard, a significant impact either from economic loss, job loss or environmental impacts. Any target hazard incident that could harm the District and community for many years should be considered for an enhanced initial response.

Sending an enhanced response to the first alarm places additional resources on-scene faster, allowing for more critical tasks to be accomplished sooner, bringing the incident under control and stopping the loss faster.

Target hazards that exceed five miles of road coverage and are at the furthest edges of the road network should be prioritized.

9.1.3 Improvement Goal 3: Enhance Utility of Strategic Decision Data

It is recommended that EPFR's senior command staff continue to enhance their demonstrated commitment to data-driven decision making, specifically regarding integration of key information sources; timely access to reliable, relevant growth planning information; and collaborative data initiatives with regional partners.

9.1.3.1 Improvement Goal 3a: Enhance Integration of Key Information Systems

The data systems that underly much of the work presented in this study are robust, highly capable and contain high quality data. However, access to some of this data, most notably that held by South Sound 911, is not under EPFR's control, but must be mediated through requests to external parties with separate policies, priorities, and workloads. This can result in delays, obstacles to obtaining necessary data, and the need to perform various mitigation procedures to address issues in data. It is recommended that EPFR's command staff negotiate data sharing arrangements with key data providers (South Sound 911, WSRB, … others?) that allow (a) EPFR to be in control of its own data and retrieval/manipulation procedures, (b) multiple data related data streams (e.g., CAD and RMS) to be integrated and (c) EPFR to maintain a consistent, ongoing historical archive.

9.1.3.2 Improvement Goal 3b: Ensure Timely Access to Relevant, Reliable Growth Intelligence

Timely access to accurate intelligence on coming development and other changes that will affect service demand will continue to be critical to the planning processes described in this study and prescribed in Goal 2c. EPFR command staff should build and continually reinforce strong relationships with experts in the Pierce County Planning organization. The success of the future workload modeling portion of this study was due in large part to the assistance of Senior Planner Jessica Gwilt, who has since departed the Pierce County Planning organization. EPFR command staff should cultivate a similar relationship with Ms. Gwilt's successor (when appointed) and should confer quarterly with this expert to identify (a) changes in development pipeline since the last update, (b) noted differences between plans and actual development, (c) updated growth projections for population, employment, etc., by land use class, and (d) digital materials suitable for automated analysis that embody this information. Data derived from this ongoing relationship should be continually analyzed by methods analogous to those used in this study, to evaluate upcoming needs for deployment changes.

9.1.3.3 Improvement Goal 3c: Explore Collaborative Data Initiatives

Organizations thrive through collaboration. EPFR is fortunate to have strong regional partners with unique capabilities, and strong inter-agency cooperation, specifically including the development of

localized expertise consortia. EPFR should pursue this initiative specifically with regard to data, to allow shared access to key resources (e.g., South Sound 911 data), and collaborative planning efforts as appropriate.

10 References

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11 Appendix A: Technical Methods

The 2.10.0.1074 build of the Code3 Strategist software was used to perform the future demand modeling and impact assessment analyses presented in Section 8.

11.1 Data Import

We received incident and response data from Mark McNamar of SS911 on August 31, 2022. This data consisted of an incident file and a unit response file, both in Microsoft Excel™ XLSX format. We performed minor usability transforms in these files, converted them to the text CSV format and imported them using the Code3 Strategist CSV import utility. Overall data quality was good. The import process accepted 93.3% of incident records and 98.2% of unit response records. The most common reasons for incident rejections were invalid dispatch dates (6.7%) and duplicate incident IDs (3.5%) for incidents (note that an individual record can be rejected for multiple reasons). Almost all unit response rejections were due to prior rejections of incident records. The display below provides detailed information on the import process.

```
Summary of record dispositions for import to C:\_coelo\Code3Sim\config\CallFiles\C3ImportData.txt 12/21/2022
7:14:33 PM
      Count:     Data Category:
      ======     ==============
       70703     Total call records
        4710     Invalid dispatch date
       65993     Total Incidents
       63495     Incidents imported
       63495     Calls queued to call file
        2461     Incident ID duplicated in input
         376     Call received is after initial dispatch (default value assigned)
          36     Incident coordinates missing
           1     Incident coordinates invalid
      150194     Total Response Records
      677059     Benchmarks imported
      147444     Response Records Imported
        2749     Response without incident
         182     On-scene prior to responding
         753     Invalid response dispatch date/time (defaulted to call dispatch)
         819     Enroute prior to dispatch
          31     On-scene prior to dispatch
           3     Negative 'InService' interval
        3763     Invalid/missing date for 'InService'

  User: Carl
  Call File: C:\_coelo\Code3Sim\data\EPF_2201\SS911\EPF_CFS_110115-062222-1.csv
    Date: 2022-09-18 15:47:01
    Size:   15.176 Mb
  Response File: C:\_coelo\Code3Sim\data\EPF_2201\SS911\EPF_2201_ResponsesPivoted_FixedInService.csv
    Date: 2022-12-14 15:40:46
    Size:   28.872 Mb
```

This process yielded a dataset of 63,495 incidents spanning the date range 11/1/2016 – 6/22/2022. For most historical analyses, we filtered this dataset to the period 1/1/2017 – 12/31/2021. For model tuning and forward-looking comparisons, we filtered a “base year” data from the period 6/1/2021 – 5/31/2022 to capture the most recent possible state of operations and service demand, resulting in a base year dataset of 12,429 incidents.

11.2 Deployment Modeling and Validation

We built a digital model of current operations in Code3 Strategist, including apparatus, staffing, station complements, incident classification and dispatch policies [16]. This model facilitated many of the data analyses in Section 3 that involved data interpretation, as well as the impact analyses in Section 8.5 and the Station 117 analyses in Section 12.

We followed a calibration process to tune the fidelity of the model to actual operations. No simulation model will ever exactly duplicate "real-life" behavior, as computer simulations follow rules and policies exactly, and make generalizing assumptions based on statistics for parameters like travel speeds, turnout times, etc. However, the objective of calibration is to ensure that the simulation mimics current operational behavior as closely as possible. We applied an iterative process of refinements over approximately 30 versions of the model, matching dispatch rules, staffing, scheduling and statistical parameters. We evaluated the fidelity of the model on unit workload and travel time, and obtained reasonable fidelity.

11.2.1 Unit Utilization Calibration

The final model achieved good fidelity relative to unit utilization. Figure 59 compares unit utilization between actual observations for the base year, and the model's predicted values for the base year. Average differences between the two predictive datasets were 1.38% for suppression companies and 0.97% for medic units. The model generally over-predicted UHU for suppression companies, and matched medic unit utilization quite closely, except for M116, which it under-predicted by approximately 3%.

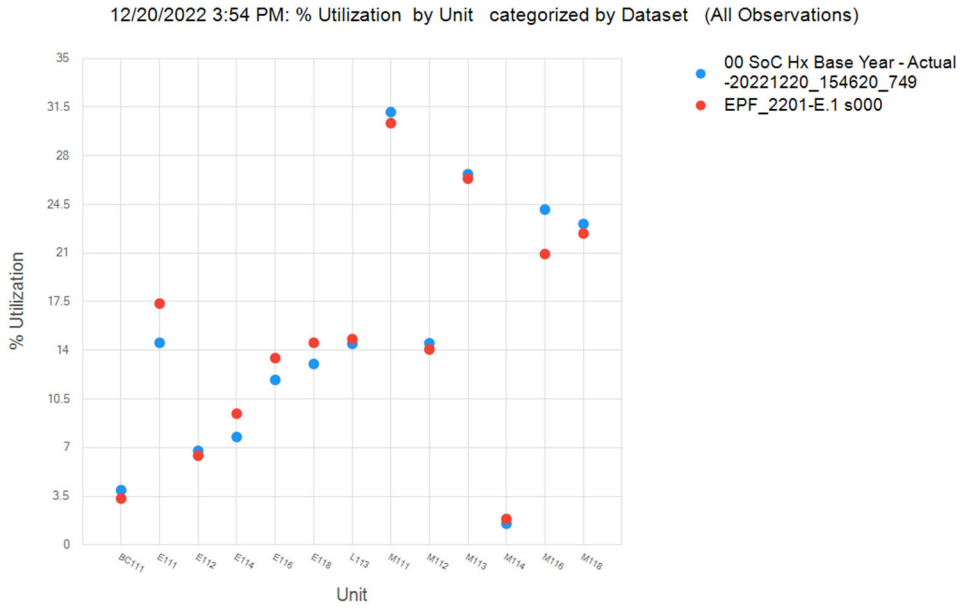


Figure 59: Unit Utilization Calibration

11.2.2 Travel Time Calibration

Travel time calibration was also reasonably successful. Figure 60 shows the results of travel time calibration, station area by station area. For most station areas, 90th percentile travel times were quite similar between model predictions and historical data for the base year. For out-of-district responses ("Other" in the figure), there were relatively few data samples. In Station 118's AOR, responses originated from Station 124 during much of the base year, but the model had units quartered at Station 118, as this will be the "base" deployment in the future. Eliminating these two categories yields an average deviation of 3.17% in 90th percentile travel time in AORs 111, 112, 113, 114 and 116.

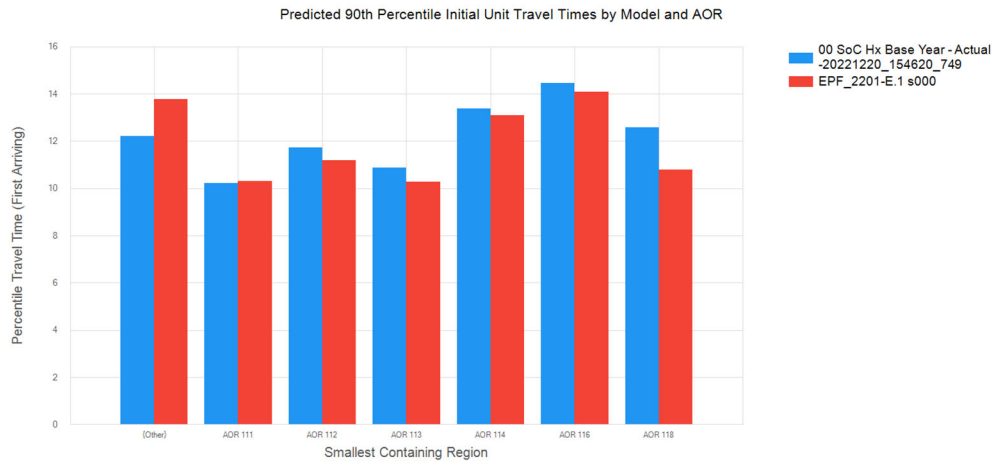


Figure 60: Travel Time Calibration

11.3 Data Archive

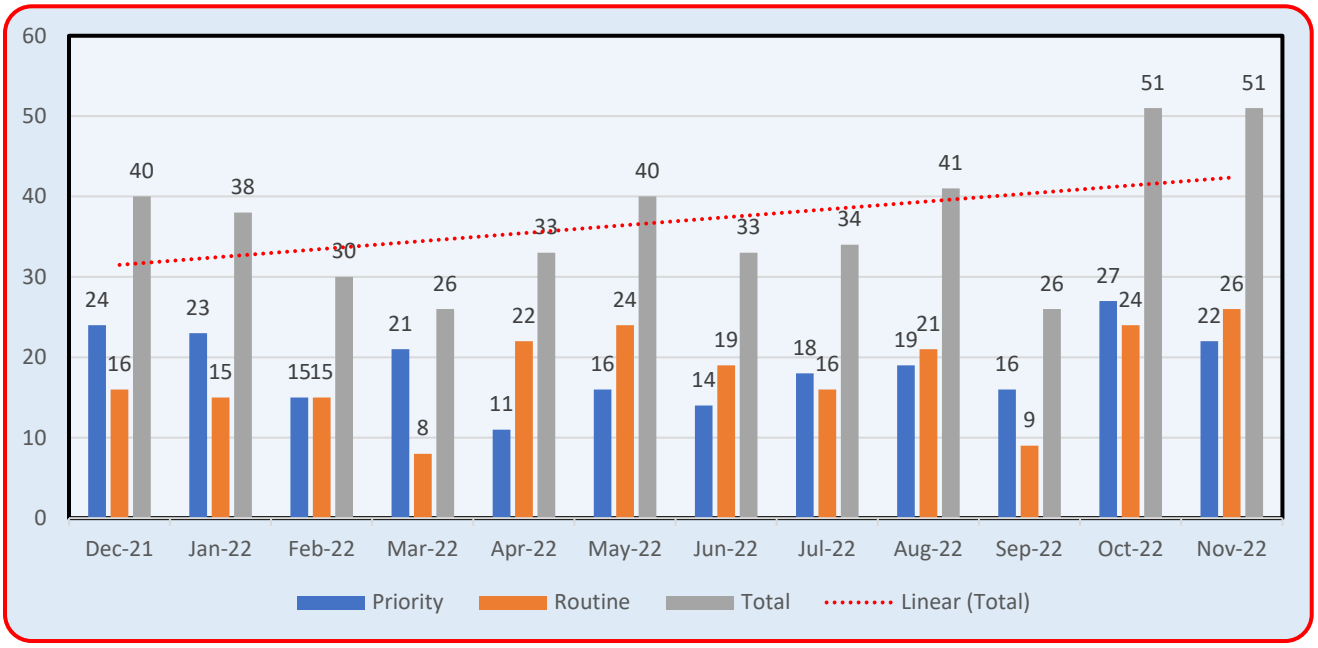
A digital archive of project artifacts is supplied as part of this study. The archive is quite comprehensive; several of the most important elements of the archive are identified in the following table.

Data Files	Code3 Strategist Items
• EPF_CFS_110115-062222-1.csv: transformed incident file • EPF_2201_ResponsesPivoted.csv: transformed response file • EPF_2201GrowthCalcs.xlsx: calculations/validation for background growth rates • EPF_2201GrowthImpactAnalysis.xlsx: tables and charts showing operational impacts of growth • ModelTuning.xlsx: documentation on model tuning and validation • DQR*.txt: data quality reports from import processes • EPF_2201BuildingPermits.xlsx: data analysis of building permit data provided by PCPWP • TargetHazardCoverage20220928cdn01.xlsx: analysis of target hazard mileage/coverage •	• Models: ○ EPF_2201-A.1 – EPF_2201-D.4b: base model tuning iterations ○ EPF_2201-E.1: base model for future workload / impact analysis ○ EPF_2201-E.2: cosmetic changes for reports ○ EPF_2201-E.2R: added infrequently-dispatched units for balance of trade analysis • Dashboards: ○ EPF_2201.A: Perf – performance snapshots ○ EPF_2201.B: Counts – various historical incident count trends ○ EPF_2201 CPT: call processing time ○ 2201 Turnout: turnout time ○ EPF_2201 Util Comp: comparative scenario analysis, utilization ○ EPF_2201 90%: comparative scenario analysis, 90th percentile travel time

12 Appendix B: SAFER Grant Award Analysis

12.1 Possible Station 117 Addition

Construction and staffing of Station 117 in the Tehaleh community proves to be a valuable resource in predictive modeling scenarios. The fast-growing community currently has approximately 7,000 residents and includes a 400-bed assisted living facility that is currently at 50% capacity. Tehaleh is expected to peak at nearly 30,000 residents. Current trends based on rolling year data are as follows:



Additionally, due to the fact parts of the community in Tehaleh are more than 5 miles from the nearest fire station, (currently Station 112) the Fire Classification rating is 9 for some of the areas while other remain fire classification of 4. Station 117 opening positively impacts the community in safety, response time for first-due apparatus and property insurance ratings.

12.2 Addition of Station 124

Station 124 currently houses E118 as a temporary measure while the new Station 118 completes construction (scheduled for early 2023). The volume of incidents in the area as well as geographic and topographic factors merit consideration for full-time staffing after re-opening station 118. The impact to call volume and responses paints part of the picture. Staffing Station 124 has a watershed effect for the remainder of the district, by keeping responders in their first-due areas for longer periods of time—keeping them in their primary response zone.

An analysis of Station 124 staffing from historical data projections shows significant reduction in responses from other areas:

12.3 Other possible deployment strategies:

12.3.1 Peak Activity Hour Staffing

Predictable patterns of calls by hour of day illustrate where higher demands on resources occur. One possible solution adds alternative staffing schedules to offset higher system utilization times and adding vehicle staffing to compensate.