Horry County Fire Rescue

South Carolina

Fire/Rescue Efficiency Study and Volunteer Services Financial Review

April 2008

SYSTEM PLANNING CORPORATION
TriData Division
1000 Wilson Boulevard, Arlington, Virginia 22209 • (703) 351-8300 • (703) 351-8383 fax • www.sysplan.com/TriData

FIRE/RESCUE EFFICIENCY STUDY AND VOLUNTEER SERVICES FINANCIAL REVIEW

Horry County, South Carolina

Submitted to:

Paul Whitten, Director of Public Safety
Garry Alderman, Fire Chief
M. L. Brown Public Safety Building
2560 North Main Street, Suite 1
Conway, SC 29526

Submitted by:

Philip Schaenman, President
TriData, a Division of System Planning Corporation
1000 Wilson Boulevard
Arlington, Virginia 22209

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We particularly want to acknowledge the efforts of Assistant Chief Jerry Casteel, who acted as the designated project coordinator for the County. He efficiently handled the administrative responsibilities of the project, coordinated our visits, handled data requests, and scheduled meetings. Chief Casteel also coordinated the draft report review process.

We also wish to thank the following for their help on this project:

County Officials and Staff

Liz Gilland	County Council, Chairperson
Kevin Hardee	County Council, District 10
Carl Swartzkopf	County Council, District 8
Paul Prince	County Council, District 9[1]
Al Allen	County Council, District 11
Howard Barnard	County Council, District 5
Brent Schultz	County Council, District 1
Danny Knight	County Administrator
Westley Sawyer	Director, Budget and Revenue
Don Foote	Director of Fleet Maintenance
Paul Whitten	Public Safety Director
Garry Alderman	Fire Chief
Alvin Payne	Fire Chief, Myrtle Beach, SC
Kenneth Beans	Deputy Chief
Scott Thompson	Assistant Chief
Jerry Casteel	Assistant Chief
John McGarrahan	Assistant Chief
Ernest Gerrald	Division Chief

[1] Mr. Prince is also a long-time dedicated volunteer firefighter in Loris.

Richard Gerrald	Division Chief
John Tyler	Division Chief
Dr. Thomas Martel	Medical Director
Ed Langdon	Volunteer District Chief
J.B. Johnson	Volunteer District Chief
Missy Belflowers	Battalion Chief 1
Randy Gardner	Battalion Chief 2
Greg Richardson	Volunteer Captain
Richard Shupner	Volunteer Captain
Scott Cyganiewicz	EMS Captain
Tim Prince	EMS Captain
Rebecca Pavlick	EMS Captain
Michael Hodge	NFIRS/GIS Coordinator
Sharon Buckwell	Dispatch Supervisor

In addition to these individuals, we also want to thank the volunteers who participated in the open discussion forum. Twenty-eight individuals took time from their busy schedule to meet with us and offer their insights about Department operations. This forum and most other meetings were conducted at the M.L. Brown Public Safety Complex in Conway.

Although we received valuable input from a variety of sources, the findings and recommendations contained in this report are those of the TriData project team. Principal members of the team and their areas of responsibility are shown below.

TriData Staff

Philip Schaenman	Corporate Oversight
Stephen Brezler	Project Manager; Management and Organization; Operations, and Support Services
Jeff Beam	Volunteer Funding
Markus Weisner	Risk Assessment and Demand
Lorrie Jacobson	Senior GIS Analyst
Shania Flagg	Data Analyst
Joe Laun	Inter-jurisdictional Comparisons
Maria Argabright	Production Coordinator and Project Support

Executive Summary

A comprehensive study of the Horry County Fire Rescue Department (HCFR) has been completed by TriData, a nationally known firm specializing in evaluation of fire departments and their master plans. Central to the study was a comprehensive review of each department function and a demand analysis to determine how fire and emergency medical services should be deployed to meet current and future demand. Also included was a review of volunteer funds and accounting procedures. These included state one-percent monies and locally authorized Volunteer Incentive Program (VIP) funds.

The TriData project team met with many fire department and county officials during the project, and over two dozen volunteers, who provided valuable feedback.

The report addresses in separate sections the following topics: management and organization; risk and demand analysis; fire and EMS operations; station location, response time, and workload analysis, and; training, apparatus, and capital needs.

HCFR Organization

The fire department operates from 38 strategically located stations with career personnel assigned to 11 stations and all 16 of the county's advanced life support (ALS) transport units. At the time of this study, 303 FTE career positions were authorized; 184 in the EMS budget (460) and 119 in the fire budget (459). Volunteers augment the career staff; however, the number of active volunteers is low, which is a major concern. The combined fire and EMS budget in FY08 was $29.9M.

Present language in the county code does not reflect the current HCFR organization or the services it provides. Medical service, which is the highest percentage of calls, is not even mentioned in the code, and there is no reference to the fire chief. As a first step, the county should update the code to reflect the department's expected mission and organization.

Other recommendations to improve organization and management include:

- Creating a blue ribbon panel to develop an updated code
- Developing a methodology to show the budget apportionment for suburban and rural districts, using Highway 701 (S) and Highway 905 as the demarcation line
- Promoting/assigning staff-level chiefs at headquarters from those already in the department, rather than hiring from outside
- Rotating support and field officer positions periodically to improve the professional development of chief officers

- Creating a planning and research unit
- Revising the fire department organization to include four divisions: Operations; Executive Services; Planning & Logistics; Risk Management

A restructuring of the department to improve efficiency is also recommended. The restructuring requires hiring a new civilian executive officer, who would manage the department's budget, personnel, and administrative functions. It also civilianizes two management positions currently held by uniformed personnel.

The fire department is managing the volunteer funds properly and recent changes have improved the process. Concerns that state-provided one-percent funds are not properly disbursed or accounted for were unfounded. Minor recommendations to improve VIP and state one-percent fund oversight are provided, however.

Demand Analysis

Fire risks in Horry County are in the range normally found in similar counties. In 2006, HCFR had 667 structure fires, 243 auto fires, and 1,295 alarms. Horry County has lower than average number of fires but higher than average fire casualties. Over the next twelve years, 250 structure fires and 10,000 more EMS incidents are likely to occur annually, if the growth and population increases continue as projected.

Although the increase in structure fires is manageable, the additional 10,000 medical calls will require more EMS resources.

In the course of doing the analysis, we found the fire incident data to be deficient. Incident reports must be completed properly for every incident; this data is needed to identify risks and determine workloads, which both affect near and long range planning.

Fire/EMS Operations

The overall framework to deliver fire and EMS service effectively is in place. However, fire unit staffing is inadequate in most areas of the county as are on-scene responder complements, typically referred to as 'weight of response'.

A result of the low 'weight of response' is less than effective fire operations. There are also an insufficient number of volunteers and volunteer officers and the rank structure and distribution of volunteers is inconsistent throughout the county. Likewise, there are too few career personnel on each unit and there are not enough active volunteers to make up the difference.

To improve the situation, additional career personnel and better volunteer recruitment (and retention) are needed. To obtain adequate personnel on-scene, fire commanders typically use EMS personnel, which then increase the response times for medical calls.

Recommendations to improve fire and EMS operations include:

- Establishing service delivery standards for the rural and suburban areas; the line between the two levels can be Highway 701 (S) through Conway to Highway 905 (N)
- Increasing staffing levels on all career suppression units such that minimum staffing is three personnel in the suburban area and four in the rural area
- Adding cross-trained firefighter/paramedics (FF/PM) to units with high EMS call rates in the rural areas
- Initiating an aggressive recruitment program to increase the number of active volunteers
- Identifying the service levels to be provided by each station using the suburban and rural designation such that services in the suburban are primarily career augmented by volunteers and volunteer augmented by career in the rural area
- Adopting a 'wagon-wheel station configuration' in the rural area such that one career station supplements several mostly or all-volunteer stations surrounding it
- Establishing training standards for all career and volunteer officers
- Establishing minimum staffing levels for units to respond, including those for volunteers
- Establishing minimum numbers for trained volunteers and officers for all-volunteer or mostly-volunteer stations

A future strategy to contain cost and improve service is to require residential sprinklers in all new construction. Unless the county takes this tack, additional fire suppression resources will be needed and the cost to provide these resources, which are already expensive, will be more so in the future. If volunteer participation continues to decline and more career personnel are added, costs will be even higher.

For EMS we recommend:

- Hiring part-time paramedics and EMTs to staff the extra EMS units needed during peak-demand periods and special events like "Bike Week"
- Introducing the paramedic-engine concept and selecting several stations (primarily in the rural area) for a pilot program
- Providing EMS service from each new station the county builds

- Increasing the number of on-duty EMS supervisors from one to four on each shift (one captain and three lieutenants)

The volunteer and career staffing increases recommended by this study will require a substantial investment by the county. To make these changes possible financially, we suggest a phased-in process over five years.

Response Time

Response time includes three segments: call processing/dispatch time; turnout (reaction) time, and; travel time from the station to reach the scene.

Call processing times for HCFR averaged 59 seconds with a 90th percentile time of 1 minute 59 seconds, which is nearly double the recommended goal of one minute. Turnout times were closer to their recommended goal, also one minute. However, it appears that volunteers may be notifying the dispatch center of their response when they are not yet actually on the apparatus but are en route to the station. As a result, the actual turnout times may be worse than appears. The data needs to be accurately reported.

There is a large variation in travel times to calls between the suburban and rural areas, as one might expect. Rural areas had an average travel time of 8 minutes 6 seconds with a 90th percentile travel time of 13 minutes 36 seconds. Suburban areas averaged almost a full minute less. County-wide, the total response time averaged 9 minutes 20 seconds with a 90th percentile time of 14 minutes 42 seconds, which is not very good relative to national standards.

In addition to adding career personnel at stations where there are none located now and increasing volunteer activity overall, implementing the following recommendations will improve coverage:

- Building a new station in the vicinity of Pitch Landing Road just to the west of Conway
- Consolidating Stations 5 and 12 at a new station to be located in the vicinity of Highway 90 and Vaught Ridge Road
- Placing ALS engines(or quints) at Stations 2, 4, 5, 6, 8, 26, 39, and 41
- Adding an engine to Station 34

Support Services

Training- For a department of its size, HCFR is one of the most understaffed training divisions we have evaluated and the department's training effort is too low. Necessary training for responders includes fire and medical training as well as specialized training like hazmat and technical rescue. There are an insufficient number of instructors to provide the required training. Compounding the problem, the training facility is inadequate. To their credit, the training staff is making the best of a bad situation. With ingenuity, the training cadre has made some useful low-cost improvements to the training center.

Recommendations to improve training include:

- Providing officer training for newly promoted officers and developing officer educational standards
- Updating the training plan to include staffing and cost requirements and prioritize the programs based on their need
- Raising the minimum training standard for new volunteers to the NFPA Firefighter I level
- Decentralizing more of the department's training by incorporating classroom space and small drill areas into several of the new stations
- Merging fire and EMS training under the same division chief
- Partnering with other departments in the Grand Strand region to build (and staff) a regional training facility

Fleet Maintenance-Overall, the fire and EMS fleet is in good shape, with medic units being in the best condition. However, there are too few fire apparatus mechanics, which is causing the maintenance program to be reactive rather than proactive. There is also a critical need for space to perform maintenance on fire vehicles. The county's fleet services division performs maintenance on EMS and staff vehicles while the fire department performs most maintenance on fire vehicles, which are purchased from the fire tax.

Recommendations to improve the department's fleet include:

- Hiring at least one additional heavy-duty mechanic
- Expanding the county's maintenance facility to provide several bays for fire apparatus maintenance
- Updating the county's AS400 fleet management system to a newer, records management system (RMS)

- Establishing minimum training standards for new heavy-equipment mechanics and providing annual training opportunities
- Increasing the level of funding for apparatus replacement using the fire department's apparatus replacement plan to include a revolving-fund program

The fire department also needs to standardize its apparatus, which will require modifications to the county's bid and purchasing process.

Station Facilities- The most pressing facility situation is to address property leases. At the time of this study, 14 stations were located on property leased from private owners. In the case of Station 27 (Allens), the owner will not renew the lease.

Fire department capital projects include $4.7M for two new stations and purchasing currently leased property. Each planned capital project is necessary.

The highest priorities for capital improvements include:

- Identifying the location and funding source to relocate Station 27
- Negotiating a new property lease for Station 8
- Renewing the property leases for Stations 10, 13, 14
- Adding showers, lockers, and sleeping facilities to Stations 10, 13, 19 and 26
- Renewing the property leases for Stations 9, 21, and 24
- Identifying the location and funding source to merge Stations 5 and 12
- Renewing the existing property lease for Station 14, or constructing a new facility at or near its present location

The county should also evaluate whether fire station construction methods are adequate to sustain hurricane-force winds.

Many of the volunteer stations also lack amenities to house personnel for long periods. These include kitchens, day rooms, and sleeping facilities. In the event of a long-term event, such amenities will be necessary so that volunteers can remain at the station and provide coverage.

I. Introduction

Horry County requested the assistance of an outside firm to provide a fire/rescue study and financial audit of HCFR volunteer programs. Central to the study was a comprehensive demand and workload analysis to determine how the county's fire and emergency medical services should be deployed to best accommodate continued population growth. Also important was an audit of locally-used government funds by county volunteers, which are considered part of the Horry County Fire/Rescue Services (HCFR).

TriData, a division of System Planning Corporation located in Arlington, VA was selected by competitive bid to conduct this study. TriData has conducted technical research on fire and EMS-related issues for over 26 years and has undertaken over 150 studies of this type, including studies for cities such as Fort Worth, Houston, Chicago, Cincinnati, and Portland. On the national level, TriData works closely with the United States Fire Administration to compile annual data and complete topical studies on current issues affecting fire and emergency medical response.

Scope of Work

The primary objective for the study was to conduct thorough reviews of Horry County Fire Rescue and the Volunteer Fire/Rescue Program (VFRP). While there are important links between both organizations, Horry County desires to better understand them independently as well as collectively. To achieve this, a comprehensive assessment of HCFR was undertaken, focusing on each of the following topic areas:

- Organizational Structure
- Operational Policies and Procedures
- Involvement, Participation, and Management of Volunteers
- Geographic Operational Areas
- Contracts with Cities
- Training Requirements
- Retention of Career and Volunteer staff
- Workloads and Response Times
- First Responder Program
- Equipment Allocation
- Specialized Teams
- Operational Budget

Concurrently, a review of the VFRP was conducted, focusing on the following areas:

- Training Standards
- Incentives
- Recruitment and Retention
- Policies and Standard Operating Procedures (SOPs)
- Fund Raising Procedures and Guidelines

The other major part of the study was a financial audit of the volunteer funds, including state 1 percent monies and locally authorized VIP funds. Accepted standards and practices of the American Institute of Certified Public Accountants were used to conduct the audit.

Study Process

This study was a complex undertaking, and the methodology was built on successful approaches developed by TriData over the past 26 years. Effective studies require input from all major stakeholders. Consequently, extensive interviews were conducted with key county officials and volunteer officers, and information was gathered through site visits, conference calls, and e-mail exchanges.

The study began in September 2007 with a kickoff conference call with the County's project staff. During the call we reviewed the scope of work, the goals of the study, and the specific information needed to ensure accurate analysis. Coordination of the first visit and the first round of meetings were also discussed.

TriData project team members made their initial site visit to Horry County in October where they met with representatives of the fire department and county staff, and familiarized themselves with the geography and area-specific risks. The project team members visited several stations to meet with career and volunteer first responders. Meetings also were conducted with the fire chief, county officials, and many of the county departments. At the end of the site visit, the project team met with the fire department staff to discuss our initial observations and to coordinate the next phase of the project.

Over the next months, the project team and consultants gathered additional information and conducted additional interviews. Data and background information, including call statistics, budget information, personnel figures, staffing reports, apparatus and maintenance reports, and CAD and GIS data were collected. Throughout the project, team members reviewed information collected from interviews and analyzed data. The project team met regularly to compare information, share ideas, and solicit input on major findings and recommendations. While

individual project team members were assigned specific responsibilities, the end product is a collaborative effort.

In December 2007, briefings were provided to Horry County officials regarding the major findings and recommendations. We also met with members of the volunteer community. Also discussed were the draft review process and timing of the draft and final reports. The draft report was delivered in February where it was reviewed by various individuals in the fire department and county government.

Overview of Fire/Rescue Services

Horry County Fire Rescue is a combination career and volunteer agency that serves approximately 230,000 residents of Horry County. With nearly 300 full-time career staff and over 200 volunteers, HCFR provides fire suppression services to unincorporated Horry County and emergency medical services to the entire county.

Including career and volunteer services, the County operates a total of 38 fire stations. HCFR currently staffs career personnel at 11 fire stations and on 16 ALS transport units positioned throughout the county. The department is split into two battalions, one for the north and the other south.

HCFR accomplishes its mission of fire and EMS protection under the direction of the Fire Rescue Chief. Reporting to him are one deputy and three assistants. Assistant chiefs are responsible for the department's major programs.[2]

Background of the County

Covering 1,134 square miles, Horry County is the largest county east of the Mississippi River. Eight municipalities are located within the county: Atlantic Beach, Aynor, Briarcliffe Acres, Conway, Loris, Myrtle Beach, North Myrtle Beach, and Surfside Beach.[3] Conway is the county seat, and the largest city is Myrtle Beach, which is also a major tourist destination and retirement community. Myrtle Beach is part of what is known as the Grand Strand, a strip of Atlantic beaches and barriers islands that forms Horry County's southeastern border. With a

[2] Horry County Fire Rescue. http://www.horrycountyfirerescue.com/?section=about. Accessed 8/28/07.
[3] Horry County Government. http://www.horrycounty.org/hcgPortal.asp. Accessed 8/28/07

thriving tourist industry and a permanent population of over 230,000, Horry County is one of the fastest growing areas in South Carolina.[4]

Organization of the Report

The report is organized as follows:

Chapter II, Review of Management and Organization – This chapter looks at the logic of the organizational chart, as well as the organizational issues of management structure, spans of control, capability within the department, and workflow between individuals. Also examined are relationships between career and volunteer personnel. This chapter concludes with a review of volunteer funding including state one-percent monies and local Volunteer Incentive Program funds.

Chapter III, Risk and Demand Analysis – This chapter includes important baseline information on the existing and projected demands for service in the county.

Chapter IV, Review of Fire and EMS Operations – This chapter examines fire/rescue operations, including weight of response, staffing, and deployment strategies. Based on these reviews, several recommendations are made to improve the overall effectiveness of the department. We also discuss volunteer responses, recruitment, and retention.

Chapter V, Station Location, Response Time, and Workload Analysis – This chapter discusses the pressures on the fire/rescue system, including population growth, demand for services, and unit workloads. These factors are important in evaluating future viability of the system and identifying resource needs. A geographic information systems (GIS) based analysis of station locations and resource deployment is also presented with models for modified station configurations that more effectively meet demand. Additionally, this chapter contains an in-depth review of response times.

Chapter VI, Review of Training, Apparatus, and Capital Needs – This chapter discusses the condition and appropriateness of vehicles and assesses replacement plans. A review of training programs is also provided, including an evaluation of the quality and quantity of training for career and volunteer personnel. Finally, we review the fire department's capital facility needs and current plans.

[4] Wikipedia. Horry County, South Carolina. http://en.wikipedia.org/wiki/Horry_County%2C_South_Carolina. Accessed 8/28/07.

II. Organization and Management

In this chapter we discuss the fire department's organization and the distribution of personnel within its various divisions. Also included here is a review of the fire and EMS budget and volunteer funds, which include one-percent, and Volunteer Incentive Program (VIP) accounts.

Nationwide experience shows that there is no perfect organizational structure for a fire department—many forms work quite well. However, some are more effective (and efficient) than others. In its present form, the Horry County Fire/Rescue's (HCFR) organizational structure is not very effective nor is it efficient. There is also a need to improve communication with the various stakeholders. And the county code needs to be updated to reflect the actual services being offered and the fire department's organization.

Like many combination departments in growing communities, HCFR has difficulty balancing the desires of multiple stakeholder interests. Stakeholder groups include career firefighters, volunteer firefighters, EMS personnel, taxpayers, and county leaders. There are also geographic groupings; for example, the volunteer personnel in the rural areas have different opinions from their suburban counterparts about the level of service that should be offered. In many cases the expectations of the stakeholder groups do not match the direction of the HCFR administration and some feel disenfranchised especially within the volunteer community.

To improve the organization we recommend a new structure with four divisions. In the proposed structure uniformed personnel are assigned only to operations and civilians staff the support areas. There is also need to revamp the budget process because the current EMS budget (460) and the fire budget (459) do not represent the actual service levels provided to county residents. Fiscal accountability can be improved if the both budgets have program accounts that mirror the organizational structure.

Overview of the Organization and County Code Questions

HCFR provides a full range of response services including fire suppression, EMS, and special operations such as hazmat and water rescue. The fire department does not however, provide code enforcement nor does it have much of a fire prevention program.

The fire department is managed by a fire chief who reports to the public safety director. In addition to his oversight of the fire department, the public safety director has general oversight responsibilities for police, 911/emergency communications, and corrections. Because of its

importance and linkage to public safety, information technology is also under his purview. The public safety director reports to the county administrator.

At the time of this study there are 303 FTE positions budgeted to the fire department. Of these, 184 are in the EMS budget (460) and 119 in the fire budget (459). The number of FTE positions, pay grade and titles are depicted in Table 1.

Table 1: HCFR Positions, FY08

Fire Budget (459)	Grade	FTE Positions
Fire Chief	42	1
Assistant Chief	27	1
Battalion Chief	24	5
Fire Captain	21	17
Public Information Officer	20	1
Fire Lieutenant	19	23
Wellness Coordinator	19	1
Public Education Specialist	17	1
Firefighter/Paramedic	17	15
Firefighter I	14	45
GIS Technician	13	1
Administrative Assistant	12	3
Trades Worker	10	2
Sub-Total Fire		***119***
EMS Budget (460)	**Grade**	**FTE Positions**
Deputy Chief	32	1
Assistant Chief	27	2
Battalion Chief	24	3
Division Chief	24	3
Training Officer	21	3
Firefighter/Paramedic	17	58
Compliance Coordinator /Supervisor I	16	1
Paramedic	15	12
Auto Mechanic	15	1
Firefighter I	14	88
Emergency Medical Technician	13	8
Administrative Assistant	12	3
Trades Worker	10	1
Sub-Total EMS		***184***
Total Positions		**303**

Positions budgeted for fire suppression and EMS are not reflective of the actual services being delivered under each budget. The EMS budget, which is funded by General Fund revenue,

is underwriting the fire service operation though the fire service district tax for the unincorporated areas of the county is intended to be self-sustaining. Clearly, there are positions in the EMS budget which are supporting fire service. We discuss the budgets later in this section.

The county code provision for the fire department is also outdated. It appears that the last update occurred in 1984, when the independent volunteer fire companies were consolidated under a fire coordinator when a change was made to improve fire service, especially for the rural areas of the county. Under the current code, the "County Council is empowered" to:

- Establish, operate, and maintain a system of fire protection
- Buy such fire-fighting equipment as it deems necessary
- Select sites where fire-fighting equipment shall be kept
- Employ all necessary fire protection personnel
- Employ and supervise the training of firemen
- Be responsible for the purchase, acquisition, upkeep, maintenance, and repairs of equipment and stations
- Promulgate rules and regulations
- Construct buildings to house equipment
- Place into effect or revise by resolution a schedule of rates for fire protection
- Appoint officers, agents, employees, servants and to prescribe their duties and compensation
- Effect the levy and collection of ad valorem taxes in the amount of six (6) mills
- Exercise any and all powers to operate and maintain a system of fire protection

Although the fire department organization and service delivery have changed dramatically since 1984, the authority to manage the fire department still resides with the council (through a coordinator), who is acting under the authority of the county council.

Present language in the county code does not reflect the current HCFR organization or the services it provides and it should be changed. EMS services are not mentioned in the code, and there is no reference to the fire chief in place today. The intent of the existing code language appears to be that the county council have the final say about decisions on fire-fighting services, which was probably appropriate when the fire department was merged into a single organization and the county did not want to hire a fire chief.

In an attempt to resolve the code issues, fire management staff developed a new code which would include EMS and pre-hospital care. The amended code also replaced the coordinator with the fire chief, who is "responsible for the administration and enforcement of the provisions of this article".[5] The new code was not passed by the county council. A review of the draft code proposed by the fire department shows that it is an improvement over current language. However, the new draft code does not include some very important sections such as the administrative hearing policies for uniformed members. Such sections are important for sworn personnel because they are held to higher standards than are other county employees because of their 'position of trust'.[6]

Making the requisite changes to the code will also reduce some confusion in the department about decision-making authority. During our meetings with various individuals and groups, it was apparent that many did not have a clear grasp of where the overall authority to run the department lies.

Recommendation 1: Create a blue ribbon panel to develop and recommend an updated code provision for HCFR. Use model templates from other jurisdictions and those available from the International City/County Management Association (ICMA) as a starting point. . The new code should clearly identify the fire chief as the individual who is authorized to manage the fire department.

Fire and EMS Budgets

HCFR operates from two budgets. The general fund budget pays for EMS while a fire tax pays for fire and rescue service. The EMS portion of the GF budget is also supported by EMS fees. EMS fees generate approximately $4.0M each year. Horry County reportedly has the lowest tax rate in the State and legislators are understandably reluctant to raise taxes. However, fire and EMS service resources are very thin in many areas of the county, and there are unmet infrastructure needs such as updating fire stations and improving the apparatus fleet. Following are our observations concerning the FY06 to FY08 budgets.

Fire (459)

- Salary costs increased by 26 percent, which is an average of 8.7 percent per year
- Authorized positions in the fire budget increased by 15 FTE positions, which accounts for some of the salary increase

[5] Draft as provided to us by the HCFR administration.

[6] If requested to do so, we would be happy to put the fire department in touch with organizations that have good code sections.

- Overtime decreased by $186K or 32 percent
- Total cost for personal services increased by $1.84M, a 31 percent increase
- Transfer-out costs increased from $1.9M in FY06 to $4.92M in FY08

EMS (460)

- Salary costs increased by $1.49M or 34 percent
- A majority of the salary cost increase resulted from the addition of 19 positions, a majority of which were used to staff fire units
- Overtime was significantly reduced from $.762M in FY06 to $.161M in FY08
- Personal service costs rose by $1.78M, or 18 percent
- Contractual service costs increase by 92 percent, the largest portion of the increase being for service contracts
- Transfer-out costs, which were not included in FY06, increased to $600K in FY08

To improve the budget accounting process, several changes should be considered:

- Move the resources actually used to deliver fire service from the EMS budget to the fire budget
- Recalculate the actual cost for delivering both services based on the budget change, then modify the fire tax rate and EMS budgets accordingly
- Re-align both budgets to fit the proposed organizational structure such that each of the four major divisions become separate programs; each program will use the same line item codes
- Consider the actual cost of delivering services to the rural and suburban areas of the county

The County's annual budget cycle is July to June. HCFR does an excellent job managing their budget, according to the Director. In previous years, overtime was reported to be somewhat excessive, especially in EMS. Specific figures on the percent of salary provided to each employee for benefits was not available, but it is believed that benefits are in the high 30 percent range.

The HCFR administration recently instituted a policy where senior management salaries and benefits are paid from both the GF and the fire tax budgets, since the chief and senior staff

manage individuals paid under both budgets. This is a good practice that should be continued. In the future, the department should explore other areas where costs should be shared.

EMS and fire budgets are separate, with EMS funded by General Fund appropriations and the fire service by a county fire tax with no GF support. EMS fees of approximately $4.0M are collected annually and offset part of the GF expenditure.

The current mill rate for the fire tax is 16.5, which is equivalent to $4 per $1K of assessed valuation. In FY07, the fire tax generated approximately $12.9M. Some of the collected amount is apportioned for debt service and 15 percent is held in reserve, according to the county's budget office. As noted above, though the fire fund is intended to be totally self-supporting, the reality is that the EMS budget is supporting the fire budget, which means that fire services are being augmented substantially from the general fund.

Table 2 and Table 3 depict rounded cost figures for the program areas of each budget and the cost per capita. Both tables also show the cost per hour of operation. Per capita costs are calculated on the county's 2006 census population figure of 238,493.

Table 2: Fire Tax Budget Overview, FY06–FY08 ($000,000)

Program Area	FY06	FY07	FY08	Average	Percent Increase /FY06–FY08
Personal Services	$6.00	$6.90	$7.90	$6.93	32
Contractual Services	$1.00	$1.20	$1.20	$1.13	20
Supplies and Materials	$.66	$.80	$.82	$.76	24
Business and Travel	$.45	$.77	$.55	$.59	22
Capital Outlay	$.19	$.06	$.30	$.18	58
Other	$2.53	$3.14	$4.92	$3.53	94
Total Budget	**$10.82**	**$12.87**	**$15.69**	**$13.13**	**45**
Cost/Hour of Operation[7]	**$1,236**	**$1,469**	**$1,791**	**$1,499**	**45**
Cost per Capita	**$45.29**	**$54.00**	**$65.79**	**$55.05**	**45**

[7] Not including benefits.

Table 3: EMS (General Fund) Budget Overview, FY06–FY08 ($000,000)

Program Area	FY06	FY07	FY08	Average	Percent Increase /FY06–FY08
Personal Services	$9.83	$10.26	$11.61	$10.6	18
Contractual Services	$.20	$.32	$.38	$.30	90
Supplies and Materials	$.46	$.58	$.77	$.60	67
Business and Travel	$.72	$.83	$.86	$.80	19
Capital Outlay	$.43	$0	$0	$.14	0
Other	$0	$0	$.60	$.20	-
Total Budget	**$11.64**	**$11.99**	**$14.21**	**$12.6**	**22**
Cost/Hour of Operation[8]	**$1,329**	**$1,369**	**$1,623**	**$1,440**	**22**
Cost per Capita	**$48.81**	**$50.27**	**$1.623**	**$52.83**	**45**

The combined fire and EMS budgets in FY08 were $29.9M. Using the county's latest population figures, the cost per capita to provide services in FY08 is just under $105. Table 4 shows the combined budgets over the last three years, the cost per hour to operate the department, and the cost per capita. To depict the actual net cost, we subtracted $4.0M from each year to represent the EMS fees typically recovered by the county. EMS fees are not returned to the fire department, but to the county's general fund.

Table 4: Combined Budget Overview, FY06–FY08

	FY06	FY07	FY08	Average
Fire & EMS Budgets	$18.46	$20.86	$24.9	$21.74
Cost/Hour of Operation	$2,107	$2,381	$2,842	$2,482
Cost per Capita	$77.40	$87.47	$104.41	$91.16

Although fire units provide EMS first response and therefore some medical services, the current tax and budget system is not truly reflective of the services being provided under each budget. In terms of personnel resources, the GF budget is supporting the fire tax budget. Further, the fire budget process is not automated to the extent that it provides needed information for management decision-making. For example, the fire department is often asked about overtime in various program areas and the current system is unable to provide the information without a lot of staff time.

As exists now, there is little distinction between the levels of service provided to suburban and rural residents from a budgetary perspective. The issue is often a point of contention with rural constituents expecting the same level of service as those offered in the

[8] Not including benefits.

suburban area. While it can be argued that it is reasonable to provide similar quality of service in the two areas, services in the suburban area are necessarily higher because of the greater population density. As a result, more of the available fire and EMS dollars should be apportioned where demand is the highest. As it exists now, the budget system does not consider the difference between rural and suburban service needs.

Map 1 and Table 5 show the cost per capita if service-level costs are proportioned by population. For this analysis, the latest population figures (2006) were used and we assumed that the geographic distribution of residents would reflect the 2000 census information used in Map 1. Using the suburban/rural demarcation line established for this project, the suburban population is estimated to be 70 percent and the rural population is 30 percent.

Map 1: Rural and Suburban Population

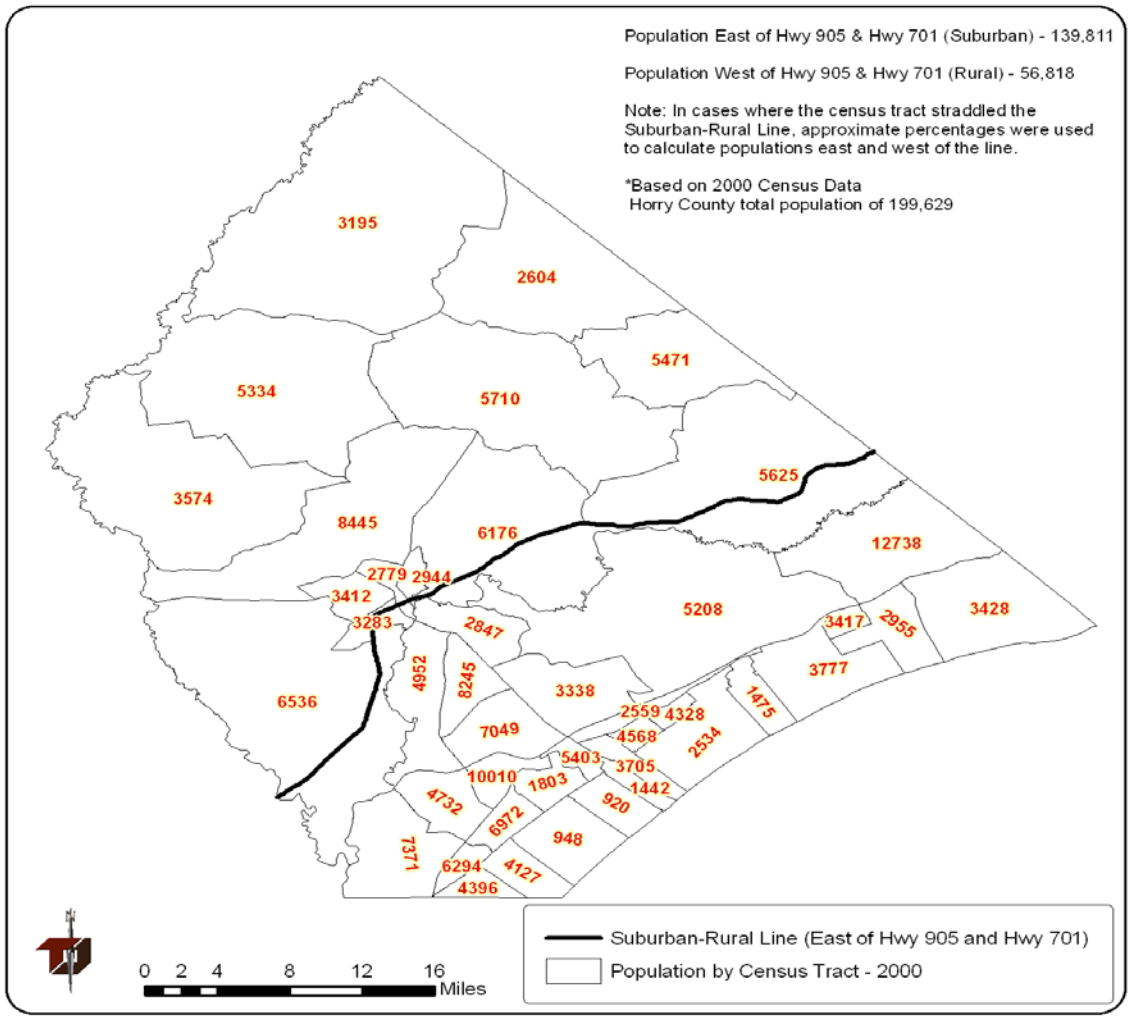


Table 5: Cost Apportionment for Suburban and Rural Service Areas[9]

Current Formula	FY06	FY07	FY08	Average
Fire & EMS Budgets	$22.46M	$24.86M	$29.9M	$25.74M
Cost per Capita	$77.40	$87.47	$104.41	$91.16
Proposed Service-Cost Apportionment				
Rural Population	71,548	71,548	71,548	71,548
Rural-Area Budget @ 30%	$6.74M	$7.46M	$8.97M	$7.72M
Rural-Area Cost per Capita	$94.20	104.27	125.37	107.95
Suburban Population	166,945	166,945	166,945	166,945
Suburban-Area Budget @ 70%	$15.72M	$17.40M	$20.93M	$18.02M
Suburban-Area Cost per Capita	$94.16	$104.23	$125.37	$107.94

Under an apportionment process the cost-per-capita remains the same; however, the total fire and EMS budgets for the rural should naturally be less since the deployed resources are less (mostly personnel). If for no other reason, rationalizing the budgets in terms of different service levels will help in understanding. As it is, the expectation of rural residents is such that they believe they should receive an identical level of protection as those in the suburban area, which is not true.

Although the cost apportionment analysis we conducted is based on population, a similar process using assessed property values could also be used; the results would be interesting and shed more light on the situation. Regardless of the methodology, the end result should be that more of the available budget dollars are apportioned to the suburban district.

Making the budget changes will not be easy given that EMS services are delivered to all areas of the county while fire service is provided only to the unincorporated areas. Still, the budgets should be aligned better than they are and represent the actual cost for what are two very different areas of the county. A more thorough analysis of the county's population and demand is presented in chapter 3, Risk and Demand Analysis.

Recommendation 2: Develop a methodology to show the budget apportionment for suburban and rural districts, using Highway 701 (S) and Highway 905 as the demarcation line between these areas.

HCFR: An Organization in Distress

HCFR is currently dealing with some difficult issues and the organization is showing signs of distress. There are internal and external factors involved and the decentralized

[9] Suburban and rural area cost apportionments are based on the most recent population data from 2006.

organization creates its own problems. For example, the large geographical area of the county (over 1100 square miles, larger than the state of Rhode Island) makes management a difficult challenge as does the very different rural vs. suburban/urban areas that require different service levels. There is also a question of where the authority lies with an outdated county code. That fire and EMS services are decentralized over such a large area also make it a difficult organization to manage. A number of the senior staff in the fire department have managed smaller organizations unlike Horry County, which is a large department. Combined, these factors and the varying opinions from different stakeholders are creating a situation where policies are viewed by personnel as inconsistent.

The senior staff is overtaxed trying to address so many areas (and many constituencies) and it was obvious that the senior staff is becoming frustrated. As a result, there are difficulties getting plans from the conceptual phase to implementation and the organization changes directions frequently based on the latest issue.[10] As a whole, the command staff, although capable as individuals, does not have a definitive understanding of the organization's direction, vision, or the priority of various programs and initiatives. To their credit, it is not for lack of effort since managing a large combination department is a significant challenge, even in the best of circumstances. When a community is growing like Horry County, the challenges are even greater.

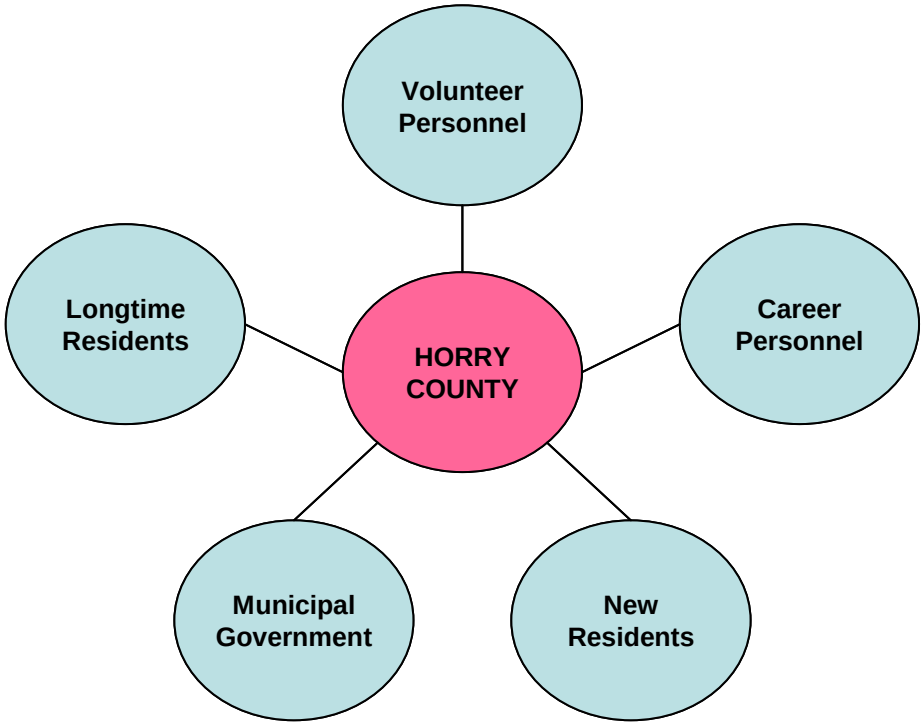
As a relatively new fire and EMS organization, HCFR is dealing with competing cultures. There are the volunteers, some of whom want the organization to return to the way it was or are unhappy with the fire administration overall. On the career side, a great many believe that more career personnel is the answer. There are also the long-time county residents in the western end of the county, many of whom are unhappy with their service level but want taxes to remain low. In the urban/suburban area, there are many new residents who want the same (or better) levels of service they enjoyed 'up north'. For the HCFR command staff, these competing interests are difficult to balance.

To correct the situation the fire administration must first begin to communicate with these competing interest groups more effectively than it has in the past. It can start by including the volunteers and career personnel at the field level to solve problems, not just edict its direction. Best practice organizations understand that the knowledge of how best to improve the system lies mostly within the personnel who actually provide the service. They use the senior staff as facilitators who work to shape the organization. Though a continuous challenge, to say the least,

[10] The term "command staff" used here refers to the ranks of division chief, assistant chief, deputy chief and fire chief. Because they implement policies at the mid-management level, battalion chiefs can also be included as well.

this participative approach is effective, especially in combination departments. Figure 1 depicts a few of the stakeholder groups having an interest on HCFR decisions and direction.

Figure 1: Stakeholder Interest Groups



Recommendation 3: Take steps to improve communication between all levels of the organization and with constituent groups outside the fire department. Suggested ideas to improve communication with various stakeholders groups might include:

- Conducting open-forum meetings in the community
- Inviting elected officials to attend training sessions, or participating in a hands-on demonstration[11]
- Establish a core-group of volunteers and career personnel to meet and discuss policies and new initiatives
- Hold semi-annual sessions where new county residents are invited to inform them of emergency services
- Include a simple information bulletin in utility bills, tax bills, or other mailers going to the general public

[11] We understand the fire department conducted a hands-on exercise while this project was being conducted, which is excellent.

The Fire-EMS Merger

Career firefighters were first introduced into HCFR about 1993. This was followed by the full merger of fire and EMS in 2001, when a separate and totally career EMS system was merged into fire. Changes over the years have resulted in many different organizational structures, including one being implemented just prior to this study. One informed person told the project team: "many of the organizational structures we tried have just not worked".

The question of whether the EMS merger with the fire department was a good move by the county is still being asked. The merger has improved EMS response times with fire units now being routinely dispatched to medical calls as first responders. The merger also elevated the professional standing of HCFR and its personnel as higher training standards are now being required. Likewise, cross-training of department personnel to handle both EMS and fire fighting is a byproduct of the merger, which is good for efficiency. On the downside, the merger has expedited the exodus of volunteers since the higher training levels for volunteers require more of their time. During the pre-merger, most of the training for volunteers was to fight fires. The merger also raised the expectation of citizenry who expected the change to improve services overall, especially in rural areas. Whether the system is more costly now than if the fire and EMS had remained separate is difficult to answer (and not included in the scope of this study).

The HCFR Organization of Today – There are three divisions within the current HCFR organization: Operations; Support Services; Training & Life Safety. A deputy chief is considered second in command of the department and has general oversight of the three divisions. Direct fire and EMS services are provided by the operations division, which is commanded by an assistant chief. Likewise, the divisions of Support Services and Training/Life Safety are both commanded by an assistant chief.

Field battalion chiefs and division chiefs are currently at the same salary grade. However, division chiefs are viewed as staff positions and they do not routinely respond to emergencies. Battalion and division chiefs also do not rotate their assignments on any regular basis. To fill division chief positions, HCFR has often gone outside the organization since battalion chiefs often do not want to work the weekday schedule. Battalion chiefs are considered 'non-exempt' employees, primarily because they work shift work. As non-exempt employees, battalion chiefs are entitled to overtime when they work over their regular schedule.

HCFR can strengthen its organization (and management) if division chiefs were selected from the ranks of the battalion chiefs. The selection process should be similar to that of a promotional process with the exception that selection to a division chief's position is limited to the time actually served in the position. At any time, the department could choose to return the

division chief to their former rank, at which time their status is considered exempt once again. Under the proposed structure, battalion chiefs would periodically rotate through support positions to gain experience in administration. A new organizational structure should allow cross utilization of battalion and division chiefs.

The fire department does not have a good succession management plan. Unlike most fire organizations that promote from within, HCFR has hired many of its senior commanders from outside. This is a signal that continuity of the command structure is questionable. It is also a signal that individuals within the organization are not being adequately prepared for more responsible positions.

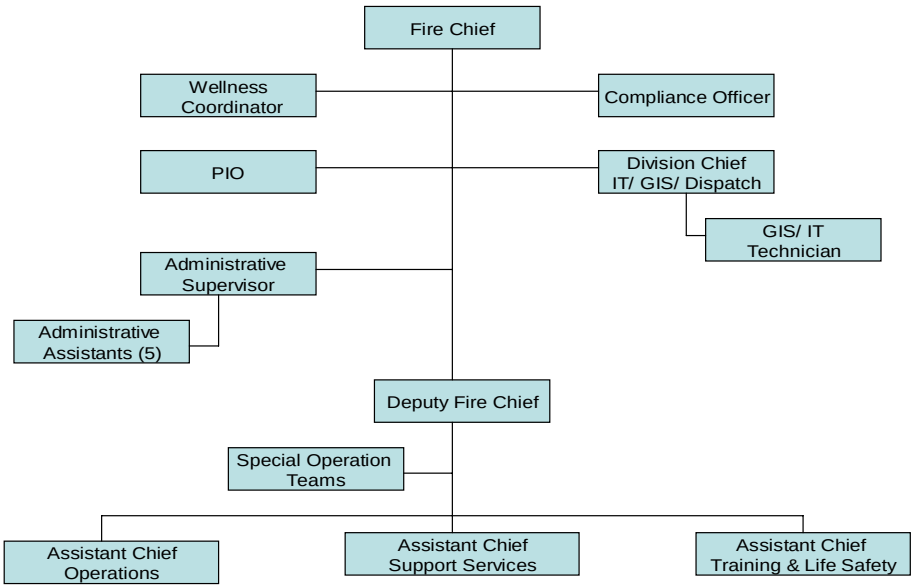
The absence of succession has produced a palpable separation between the administrative chiefs, who are hired as 40-hour employees, and the operational chiefs assigned to the shifts. To improve the long term effectiveness of the organization, chief officers in administrative positions should come through the ranks whenever possible and not be hired from the outside. To accomplish such a goal, HCFR will need to offer more professional development opportunities.

Recommendation 4: When possible, promote or assign staff-level chiefs at headquarters from those in operations, rather than hire them from outside.

Recommendation 5: Rotate support and field officer positions periodically to improve the professional development of chief officers. A two-year rotation plan works well.

Figure 2 depicts the overall command structure at the time of this study.

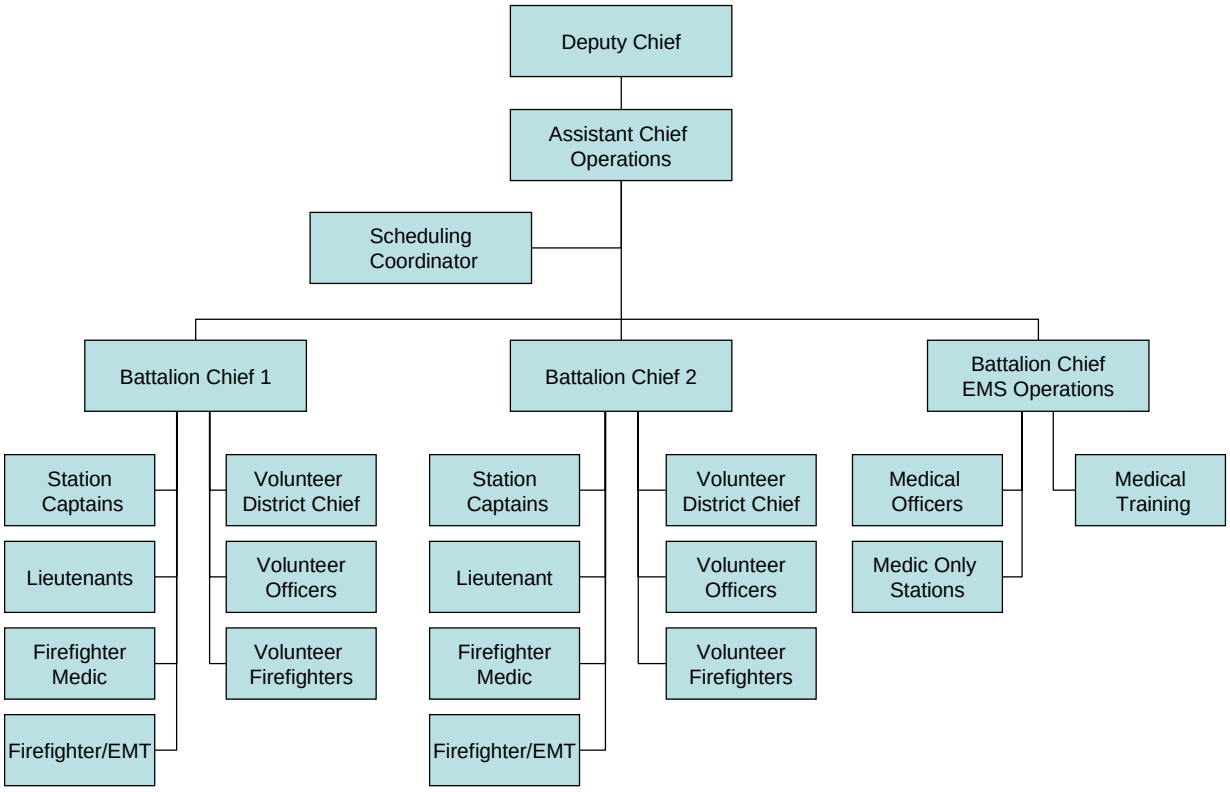
Figure 2: Current Command Structure



Reporting to the fire chief in addition to the deputy chief are five individuals; a wellness coordinator, compliance officer, PIO, administrative supervisor, and a division chief. The division chief coordinates IT, dispatch, and GIS. Only one individual reports to the IT division chief. In addition to the division chief, the wellness coordinator and public information officer are also uniformed personnel (firefighter/EMT).

Operations Bureau – By far the largest HCFR function is operations as it is this division which is responsible for the daily delivery of fire suppression and EMS services. The operations division is comprised of two field battalions (north and south) and an EMS section. Six field battalion chiefs (two on each of three shifts) work a 24-hour on duty and 48-hour off duty rotating shift schedule, the same as all other field personnel. The EMS battalion chief is a staff position and works weekdays. Three EMS supervisors (captain equivalent) are also assigned to shift work to coordinate the activities of EMS. EMS supervisors are also responsible for the oversight and direction of the personnel assigned to the county's stand alone medic units.[12] A medical training section with three instructors also reports to the EMS battalion chief. Figure 3 depicts the operations division.

Figure 3: Operations Division



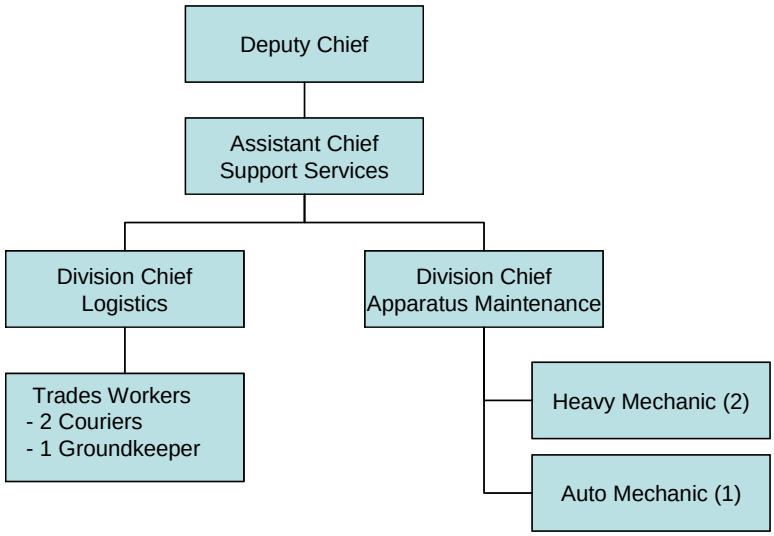
[12] The term "stand alone" medic unit refers to EMS units which are not located within a Horry County fire station.

A civilian scheduling coordinator is also assigned to operations. This individual is responsible for managing the schedule of personnel assigned to the field and coordinating a new 'TeleStaff' system. TeleStaff is an electronic staffing system that will contact personnel needed for overtime and it will track their overtime hours. Because the new system will be more efficient, the responsibilities for this individual can be expanded, or the position can be eliminated.

Support Services Bureau – This function is responsible for the logistics and maintenance activities. Managed by an assistant chief, this bureau has two subordinate chief officers reporting to the assistant chief.

One division chief is responsible for fire vehicle maintenance and coordinating the EMS vehicle maintenance with the county's fleet manager. This individual has oversight of two heavy equipment and one light-duty mechanics. The second division chief (logistics) has responsibility for procuring and distributing the department's wide array of equipment and uniforms. Logistics also handles the repairs for fire department facilities, which includes three trades-worker positions. The present organization with two division chiefs supervising only six civilian positions is not as efficient as it could be. Figure 4 shows the support services division.

Figure 4: Support Services Bureau

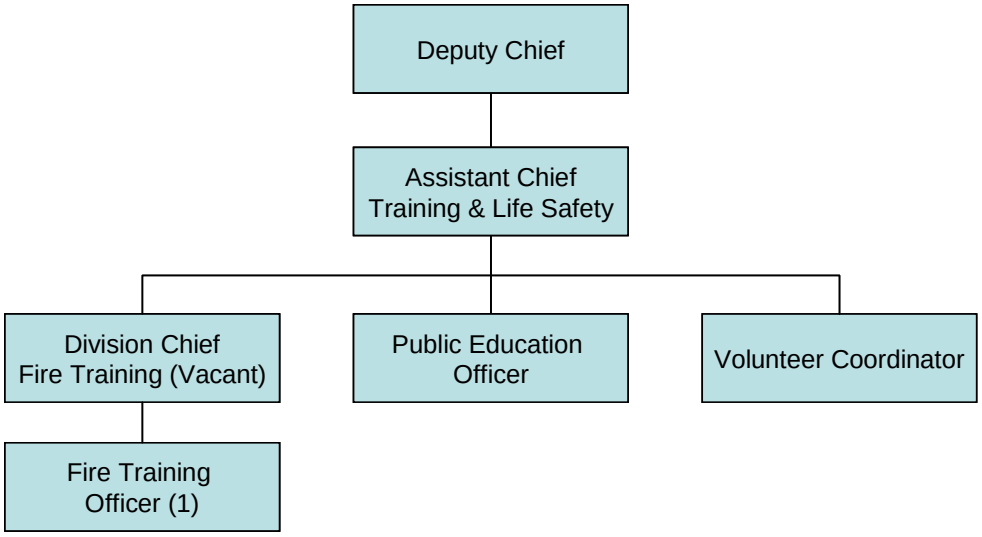


Training & Life Safety Bureau – This function is also small, with only four individuals assigned to it. Although "Life Safety" is part of its name, only one public educator is assigned. There are no other inspection services conducted by the fire department as these are performed by the county's code enforcement division.

As important as training is to fire and EMS delivery, staffing allocations to this function are inadequate, and training has been plagued with turnover.

Within this bureau is also a coordinator responsible for oversight of volunteer programs, including recruitment and intake. Figure 5 depicts the Training and Life Safety Bureau.

Figure 5: Training & Life Safety Bureau



In terms of management, HCFR is not a top-heavy organization. However, it can become a more efficient organization by civilianizing several positions that are currently occupied by uniformed personnel, particularly those in Support Services.

Going forward, the fire department must improve its fire prevention program. Key elements of a successful program are often referred to as the three E's: education, engineering, and enforcement. A fire educator and fire investigator are currently in place but the division is limited in its ability to prevent incidents from occurring in the first place. Future efforts to lower demand and lessen the need to hire more personnel and construct more facilities will result if prevention efforts are enhanced. Although a full review of fire prevention was not within the scope of this study, we highly recommend that it be considered when future enhancements are made.

The fire department is also hampered by limited safety and health and research/planning programs. Portions of these functions are being performed by individuals such as a wellness coordinator. However the level of effort is not high enough to meet the department's needs.

Safety and Health – A compliance officer is assigned to the fire chief. This individual is responsible for coordinating annual physicals, worker's compensation, and reviewing safety violations. Nowhere else in the organization were we able to find a dedicated emphasis on incident scene safety and health/welfare. Changes within the industry such as OSHA standards and the emphasis on firefighter safety make this an important function in which the county should consider making investment to reduce costs let alone the obligation to reduce injuries. A

reasonable commitment is to maintain the current position and add a health/wellness professional.

Recommendation 6: Consolidate the compliance officer and wellness officer positions under a new safety and health unit managed by a health and wellness professional.

Planning and Research – HCFR is hampered by data collection and retrieval, which makes it more difficult for management to make good decisions. Over the last five years progress has been made; however, there is still room for improvement in data collection, analysis and planning.

The individual currently responsible for data (and GIS) is very knowledgeable. However, there appears to be some disagreement within the department on the manner in which data should be collected and analyzed. To improve the process a civilian analyst familiar with emergency service should be added to the staff and planning should become a focal point of their efforts. The new analyst and the present staff should form the basis of a newly created research and planning unit.

There are also problems with non-reporting by the volunteer companies who often do not complete the necessary NFIRS reports on their computer. During one of our visits, we were provided access the department's computer system where we observed numerous incident reports which had not been completed. Reports were also incomplete from several career stations as well. There is currently no process in place to track incomplete reports, or to correct those completed improperly. On the EMS side, supervisors do review incident reports as part of the ongoing QA program.

Recommendation 7: Create a planning and research unit and improve the data collection and analysis functions.

Recommendation 8: Improve the NFIRS data collection from volunteers by having the research/planning unit deal directly with volunteer companies who do not submit the required information. For repeat offenders, or those who do not complete the required reports, withholding their pay-per-call check might be one way to correct the problem.

Proposed New Organization – In light of the findings above, reorganization appears warranted. One step is to eliminate several mid-level uniformed positions to be replaced by civilians with more appropriate specialized experience and training, and lower loaded cost, too. . We also recommend adding a division of executive services which would handle the entire set of business-related functions consolidated under a single civilian executive.

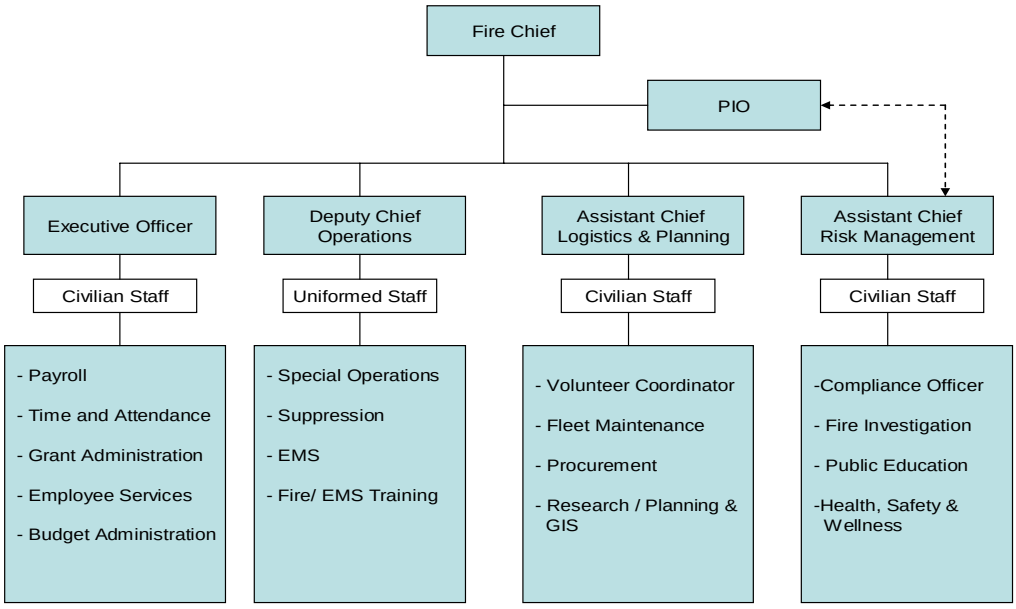
In addition to the civilian executive services director would be three uniformed chief officers who will manage Operations, Logistics/Planning, and Risk Management. With the exception of the assistant chiefs, who will be uniformed, the Risk Management and

Logistics/Planning functions would be civilianized. Three division chief positions remain in the new organization as equivalent grades to battalion chief. However, individuals holding the staff (division chief) positions should be rotated periodically between line and staff assignments; which is necessary to improve their professional development. In the long-term, HCFR will benefit when field battalion chiefs are exposed to staff responsibilities. Such a move should also eliminate or reduce significantly, the need to go outside for new chief officers to fill staff positions.

Another significant change is the merger of fire and EMS training. As it stands now, coordination of fire and EMS training is less than ideal. Because EMS comprises the majority of service provided by the HCFR, EMS and fire training should be coordinated under the same chief. Facility improvements at the training center are needed to accommodate such a merger. We discuss this later in the report along with a more in-depth discussion of training staff needs.

Figure 6 shows the proposed organization with four divisions.

Figure 6: Proposed New Organization



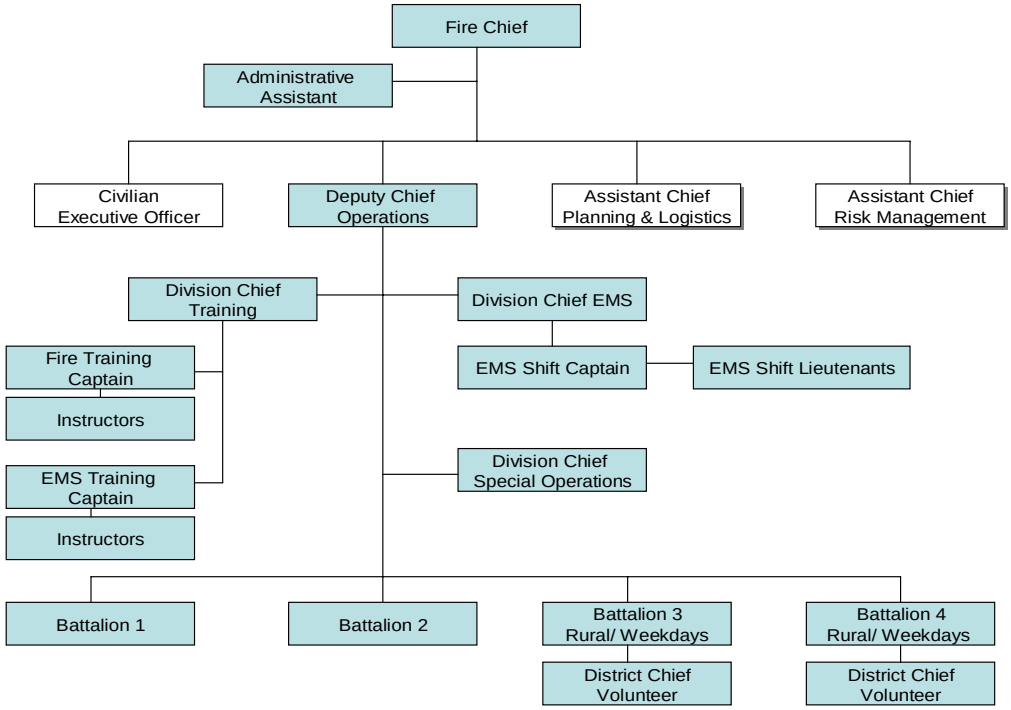
Unlike the current structure where assistant chiefs report to a deputy chief, who in turn reports to the fire chief, under the proposed structure assistant chiefs are on the same level as the deputy chief. The major difference is in pay grade, which is higher for the deputy chief who supervises more personnel.

Revamped Operations Bureau – The new structure removes a layer of management between the field and the fire chief, a major distinction of the proposed reorganization. Unlike

the current structure, the deputy chief will not supervise other assistant chiefs. In the actual day-to-day activities of the department, it is questionable whether he did anyway. The level of responsibility for the deputy chief and the total number of personnel under his authority are valid reasons to have a deputy chief in this division. It also maintains someone as second-in-command.

Another change is the addition of two field battalions, which increases the number of battalions from two to four. The present alignment is unable to adequately cover the county and the span of control for battalion chiefs is much too high. The new structure includes the possibility of involving volunteers in the operational structure by having the new (rural) battalions staffed by career personnel during weekdays and by volunteer battalion chiefs nights and weekends. Inclusion of volunteers at this level of the command structure will require them to achieve the same training standards, which are discussed later in this chapter. Figure 7 depicts the proposed structure of operations where a majority of the department's resources are located.

Figure 7: Proposed Operations Bureau



Under the proposed change, the number of field battalion chiefs will increase from six to eight, with two of the eight positions assigned to a new, rural battalion. The rural battalion is managed by volunteer district chiefs during nights and weekends. It is preferable that the volunteer district chiefs live in the response area, since they would be on-call. More than one volunteer district chief per battalion could also work. On the career side, four battalion chiefs will be on-duty weekdays, and two during nights and weekends.

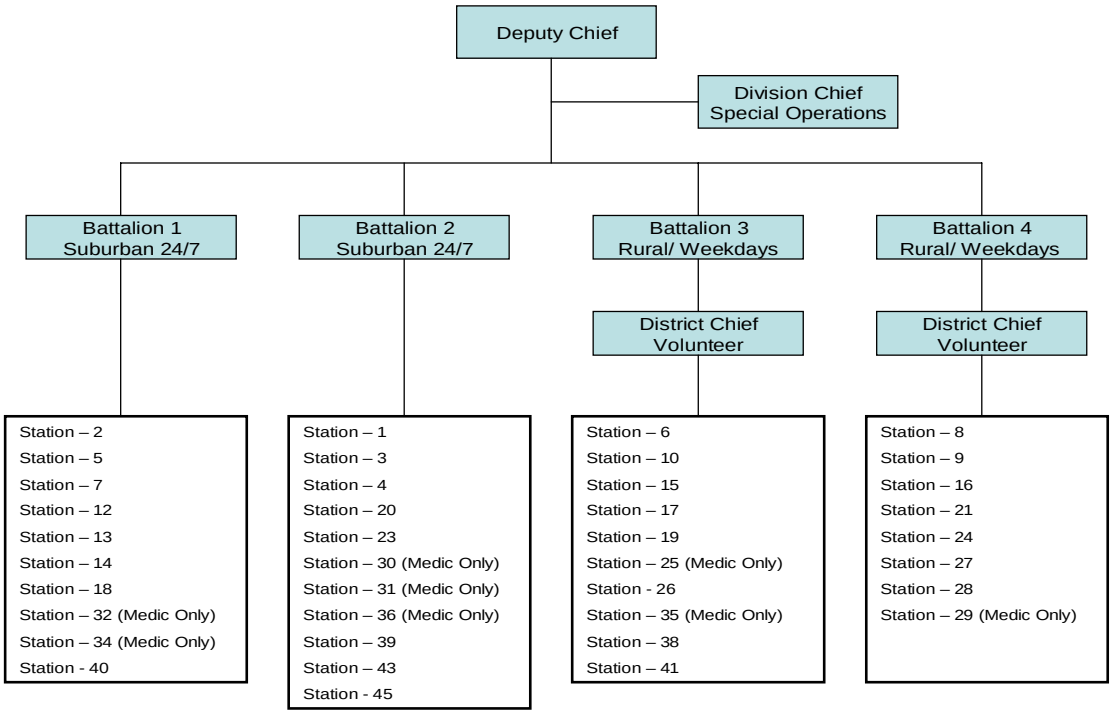
The proposed structure also adds a district chief of special operations, who will coordinate the hazmat, technical rescue, and water/dive rescue functions. This individual will also coordinate activities with emergency management. Large-scale incidents involving emergency management often require specialized services.

EMS is expanded from one shift officer to four. Although the general deployment configuration is similar to that of the field battalion chiefs, the actual location where EMS supervisors are assigned may be slightly different. Each shift is commanded by an EMS captain with lieutenants reporting to the captain. The increase in EMS supervision is necessary given the number of medic units, which are to increase from 16 to 18. The number of EMS units under each supervisor will be four to five.

In addition to strengthening the daily field supervision by having four supervisors, response times for medical calls will improve. Unlike the current staffing arrangement where EMS supervisors rarely arrive on scene early in the incident, the new plan will increase the number of times it happens since each district will have a supervisor. Because supervisors do not transport patients, they are also available more of the time, which will also decrease EMS response times.

Figure 8 shows the Level 2 detail for the stations assigned to each battalion.

Figure 8: Proposed Operations Division - Level 2 Detail



A significant improvement in span-of-control is derived from the proposed four battalions. Under the new structure, each battalion will average about 9 stations as compared to the 18 stations under the current configuration. Another improvement is the incorporation of volunteers into the formal command structure, which is not done currently.

Summary of Personnel Changes

Table 6 gives a summary of personnel changes (by division) that would occur with the new organization. Not included in this table are the operational positions below the rank of battalion chief. These are provided in a later chapter. Positions in red are new or the position title has been modified.

Table 6: Summary of Position Changes

	Current Positions	Proposed Positions	Increase/ (Decrease)
Administration			
Fire Chief	1	1	0
Deputy Chief	1	0	(1)
Division Chief, Communications/GIS/IT	1	0	(1)
GIS/IT Technician	1	0	(1)
Wellness Coordinator	1		(1)
Public Information Officer	1	1	0
Administrative Supervisor	1	0	(1)
Administrative Assistants	5	1	(4)
Compliance Officer	1	0	(1)
Sub-Total/Administration	***13***	***3***	***(10)***
Executive Services			
Executive Officer	0	1	1
Administrative Supervisor	0	1	1
Administrative Assistants	0	4	4
Scheduling Coordinator	0	1	1
Sub-Total/Executive Services	***0***	***7***	***7***
Operations			
Deputy Chief	0	1	1
Assistant Chief	1	0	(1)
Scheduling Coordinator	1	0	(1)
Division Chief/Training	0	1	1
Fire Training Officer (Captain)	0	1	1
Fire Instructors	0	3	3
EMS Training Officer (Captain)	0	1	1
EMS Instructors	3	3	0
Division Chief/EMS	0	1	1
Battalion Chief/EMS	1	0	(1)
Medical Officers (Shift)	3	0	(3)
EMS Shift Captain	0	3	3
EMS Shift Lieutenant	0	9	9
Division Chief/Special Operations	0	1	1
Battalion Chief/EMS	1	0	(1)
EMS Supervisors	3	0	(3)
EMS Training Officers	3	0	(3)
Battalion Chief	6	8	2
Sub-Total/Operations	***22***	***32***	***10***

	Current Positions	Proposed Positions	Increase/ (Decrease)
Support Services			
Assistant Chief	1	0	(1)
Division Chief/Logistics	1	0	(1)
Trades Workers	3	0	(3)
Division Chief/Apparatus Maintenance	1	0	(1)
Heavy Mechanic	2	0	(2)
Light-Duty Mechanic	1	0	(1)
Sub-Total/Support Services	***9***	***0***	***(9)***
Planning and Logistics			
Assistant Chief	0	1	1
Fleet Maintenance Supervisor	0	1	1
Heavy Mechanic	0	3	3
Light-Duty Mechanic	0	1	1
Logistics Supervisor	0	1	1
Trades Workers	0	3	3
Research & Planning Supervisor	0	1	1
GIS/IT Technician	0	1	1
Data Analyst	0	1	1
Volunteer Coordinator	0	1	1
Sub-Total/Planning & Logistics	***0***	***14***	***14***
Training & Life Safety			
Assistant Chief	1	0	(1)
Division Chief/Fire Training	1	0	(1)
Fire Training Officer	1	0	(1)
Public Education Training Officer	1	0	(1)
Volunteer Coordinator	1	0	(1)
Fire Investigator	1	0	(1)
Sub-Total/Training & Life Safety	***6***	***0***	***(6)***
Risk Management			
Assistant Chief	0	1	1
Health & Safety Specialist	0	1	1
Wellness Coordinator	0	1	1
Compliance Officer	0	1	1
Fire Investigator	0	1	1
Public Education Officer	0	1	1
Sub-Total/Risk Management	***0***	***6***	***6***
Total Positions	**50**	**62**	**12**

Nine of the new positions are EMS shift supervisors (lieutenant equivalent) and two are battalion chiefs for the new rural districts. We also recommend an additional heavy-equipment mechanic, which is discussed in a later chapter.

Recommendation 9: Revise the fire department organization to include four divisions: Operations; Executive Services; Planning & Logistics; Risk Management.

Other Findings Regarding the Organization

In this section we discuss several areas of general concern found during the study. Most notable among them is poor communication between the command staff and field personnel, particularly volunteers. Among other concerns is the high turnover rate for HCFR employees, which is believed to be a problem in other county government agencies as well. Of these areas, the internal communication issue is the most important.

Internal Communication – Periodic meetings are conducted by the career staff. There have also been quarterly chief meetings; however, these have been stopped because of concerns about overtime. On the career side, shift battalion chiefs and EMS supervisors meet each morning at headquarters to discuss the latest happenings and get direction. The large span-of-control issue we discussed earlier hinders their ability to keep employees informed, but it is better than the volunteer side. On the volunteer side, information and ideas are rarely exchanged with the administration.

Past practice is for volunteer district chiefs to meet every month. Recent changes now have them meeting every two months. Multiple sources commented that these meetings are not very effective. Outside of the district chief meetings there are few opportunities for volunteers to serve on committees or work groups. Committees are important for volunteers (and career) as they provide a valuable conduit to the chief on important matters under consideration by the department. An effective committee process is important for all departments, but it is especially important in combination departments where there are varying opinions on just about everything. Although the list is probably endless, the following are topic areas where committees work well:

- Turnout equipment
- Apparatus specifications
- Running assignments
- Recruitment and retention
- Station designs
- Pre-planning
- Rural water supply

When committees are formed it is up to the volunteers to participate and contribute. Failure to capitalize on the opportunities presented to them is likely to be received by the administration that volunteers are disinterested. A result would be that the department will transition from a combination service to an all-career organization sooner then necessary. To prevent this from happening, the fire administration should make a top priority to improve internal communication and use the committee process for volunteers to contribute their ideas. Whenever possible, the committees should represent by a cross-section of perspectives including those from career personnel, volunteers, officers, and rural and suburban stations.

Recommendation 10: Continue to hold the quarterly chief officer meetings and require all career and volunteer chief officers to attend. Meetings should include a segment for professional development and information/planning.

Policies and Procedures – Policy development and enforcement is a problem for the department. There is a wide variety of interpretation about various policies between shifts and between stations. There are also problems getting new policies implemented. Multiple individuals reported that the organization is good at discussing problems and potential solutions; however, it is not very effective at implementing new policies, or consistently enforcing ones already on the books. Though not an uncommon situation in fire departments because they are decentralized organizations, it is more of a problem for HCFR because it is a relatively new system.

As a young organization, HCFR has not yet established its own 'identity' which reinforces how things are to be done even when there is no written policy. That it is transitioning from all-volunteer to a combination system where a large segment of the organization is career also plays a part.

Another issue is that many of the department's SOPs are outdated. Many of those we reviewed were also signed by a previous fire chief. It does not appear that a regular review process for SOPs is in place. However, when this issue was discussed with the department's leadership, we learned that many SOPs are being updated, thus some progress is being made, which is good. The policy manual and the general outline used for each policy is good overall. For this project we sampled a large number of policies though we primarily focused on those germane to this study that dealt with management and operations. Following is synopsis of the SOP manual review:

Table 7: Review Synopsis of HCFR SOP's

SOP #	Title	Review
101	Organizational Chart	Written in 2003 and is outdated
205	Personnel Records Management	Excellent and appears up-to-date
206	Administrative Policy	Outdated – most were authorized and signed by a former fire chief
204	Volunteer Residency	Policy requires that volunteers become members in the station nearest their home. The policy should be changed such that volunteers in the suburban district can live anywhere since they will be scheduled or volunteer on shifts, not responding from home.
408	Volunteer Promotions[13]	Policy is outdated because it relies partially on the election of officers. The policy should be changed such that volunteer officers are selected on merit by their peers using a standardized selection process.
604	Incident Safety Officer	One of the best incident safety officer policies we have seen.
606	Career Job Descriptions[14]	Written in 2003, this SOP appears to be outdated already. There is also a need to increase the minimum requirements for promotion in most classifications. Suggested changes are provided below.
701	Incident Command Procedure	The policy is excellent and well written. It should be updated to ensure all information is current and training on the Incident Command Procedures should held in each battalion at least quarterly.
615	Physical Fitness	Excellent policy and well written
700	Operational Policies	Excellent overall but most are outdated. The pre-incident survey policy is especially good but is not followed.

Note: It should be standard practice for fire departments that when a new fire chief is appointed the first directive should be that all existing policies, written or verbal, remain in effect until they are rescinded or changed by the new fire chief. This is an important step to take as it ensures there is no grey area in policy interpretation during the transition.

Recommendation 11: Conduct a complete review of all department policies and procedures. Update those which are outdated, eliminate those which are no longer applicable, and create new ones where there are policy gaps, or where additional guidance and coordination is needed. Assign the current SOPs to specific battalion chiefs, who will coordinate the review process and write new policies.

Recommendation 12: Establish an SOP for policy development and changes to existing policies. A standardized format should be developed which all FD personnel recognize. Some departments use a "general orders' system of policy management, which can be adapted to written or electronic means.

[13] The fire department is currently revising this SOP.

[14] The department is currently awaiting recommendations from the county's HR section to make the necessary changes.

The fire department records system also relies too heavily on paper and administrative processes could be made more efficient if they were automated.

Recommendation 13: Automate as many of the administrative paperwork procedures as possible and implement a paperless report system to minimize the level of effort.

Career Personnel Responding as Volunteers – The fire department has enacted a policy that permits career firefighters to respond voluntarily when they are off duty. The program has been somewhat successful, especially where volunteers are not available in sufficient numbers. The department's guidelines require that career personnel are paid overtime according to the U.S. Department of Labor's (Title 29 553.102) guidelines. The program is innovative in light of the low volunteer participation in some areas of the county.

Recommendation 14: Continue the policy that allows career personnel to voluntarily respond during their off-duty hours. .

Personnel Leave Policy – The fire department has an unusual leave selection policy. As with other policies, it has been modified though not updated in the SOP manual. The written policy requires employees to give an advance notice of 28 days. The written policy also includes 'blackout periods' where employees are unable to take leave unless another employee is willing to work for them, typically on overtime. HCFR recently modified its leave selection policy and reduced the advance notice period from 28 to 14 days.

Requiring 14-day advance notice for leave is still out of the norm for fire departments. Most require a 24 or 48-hour notice with emergency leave and special circumstances being handled on a case-by-case basis. The current policy is limiting the ability of employees to use leave at their discretion, which is preferable. A result of the policy is that employees are using sick leave to circumvent the 14-day requirement. The blackout policy is also not a particularly good policy for the same reason—employees typically have difficulty finding someone to work for them.

Recommendation 15: Change the leave selection policy to allow a 24 or 48-hour advance notice.

Recommendation 16: Establish a maximum for the number of officers and personnel allowed off each day. A reasonable ratio is 15 percent of the FTE staff on each shift. For example, if the minimum career staff in Battalion 1 is 28 personnel on-duty, approximately four personnel can be allowed off on leave. Include a reserve in staffing to allow for injury and last minute sick leave.

Backfilling Command Positions and Rank-for Rank Overtime – The fire department experiences times when command officer positions at headquarters are vacant for extended periods for reasons of injury, sickness, or retirement. Current policy is not to backfill the vacant position with an acting chief from operations. A result of this policy is that

opportunities for professional development are missed. It is also policy that battalion chiefs are paid overtime to fill vacant slots when other battalion chiefs are off on leave, or the position is left vacant. These too are lost training opportunities.

To improve professional development it is a good idea to backfill vacant officer slots whenever possible. On those occasions when a staff position (assistant chief, deputy chief, or division chief) is vacant for only one or two days, it should be left open since changing the schedule of an officer on shift work creates its own challenges. When a vacancy of several days or longer occurs however, most departments fill the position with either overtime at the same level or personnel who will be "acting up." In addition to the enhanced training, continuity of the operation also improves.

Battalion chiefs on shift work are considered non-exempt under the department's current work rules and thus are entitled to overtime premium for hours worked over 212 within 28 days, which is the FLSA standard. HCFR tracks the time for each employee such that time off is not included in the 212 hour threshold, which is also consistent with FLSA guidelines. The department is presently using a rank-for rank staffing practice where battalion chiefs fill in for other battalion chiefs, which is more expensive than allowing captains to act as battalion chiefs and filling the open captains' slot with an acting officer and calling a firefighter back on overtime. Changing this policy will improve professional development.

Recommendation 17: Eliminate the rank for rank policy for battalion chiefs and use acting battalion chiefs whenever possible. The result will be more overtime at the firefighter rank instead of chief ranks, which will lower overtime costs.

Employee Turnover – Turnover has been a problem for HCFR and 30 employees have resigned for various reasons during the past year. Reportedly, turnover is also a problem in other county agencies as well. Causes for high turnover in the fire department vary and low salaries appear to be part of the problem; however, pay is not always the top reason, in our experience. As compared to county government overall, the turnover in HCFR is lower, but it is still very high as compared to other emergency service agencies.

Reportedly, a large percentage of new applicants for HCFR jobs are coming from outside the county. The cost to provide the initial training is a significant expense. When the incumbent leaves county service after only a short time, the county loses not only their service, but the initial training investment. Other jurisdictions have similar situations and a few now require new employees to sign contracts such that training costs are reimbursed if the employee leaves within a certain time period. Such a policy may also work for HCFR.

Although the turnover problem is not within the purview of this study, the comments and observations we received during this project suggest that it is a large issue and it should be studied in-depth.

Recommendation 18: Conduct an in-depth review of the employee turnover problem within county government. The study should include an employee satisfaction survey and designing a format for exit interviews to collect future data. TriData has performed this analysis for other clients, including a detailed employee satisfaction survey for the Arlington, TX Fire Department, and it can yield much useful information.

Position Descriptions and Officer Standards – Position descriptions have been created for career officers but not for volunteers. Going forward, the vision that volunteers may hold officer positions up to battalion chief should require that they meet similar training standards and have position descriptions for every rank.

There are currently no training standards beyond the state's 80-hour OSHA class to be a volunteer responder. Additional standards for volunteer (and career) officers are commonplace today and many combination departments are moving toward identical training standards for career and volunteer officers. In those systems where training standards exist for career officers but not volunteers, conflicts usually arise between career and volunteer personnel. This is particularly true in departments where career and volunteer personnel work at the same stations and sometimes ride the same apparatus.

Training standards should be mandated for volunteer officers such that the requirements for a volunteer or career officer of the same rank are similar. It is important that firefighters have confidence in their officer, regardless of whether they receive compensation. The notable exception to having the same requirements is education, which should be a selection component for career officers but not for volunteers. The reason to have educational standards for career personnel is to prepare them for higher levels of responsibility in the county's career path. There are multiple ways to construct the requirements. Below is one that we suggest.

Table 8: Proposed Training and Educational Standards

Rank	Minimum Training	Career Officer Education	Year
Firefighter	OSHA 80 Firefighter II within 2 years	HS or Equivalent	2010
Lieutenant	Firefighter II NFPA Fire Officer I NFPA Instructor I NFPA Inspector I	30 credits	2012
Captain	NFPA Fire Officer II NFPA Instructor II NFPA Inspector I	AA degree	2014

Rank	Minimum Training	Career Officer Education	Year
Battalion Chief	NFPA Fire Officer III NFPA Instructor III	BS or BA degree	2016
Division Chief (career only)	Same requirements for battalion chief	BS or BA degree	2016
Assistant Chief (career only)	Same requirements for battalion chief plus successful enrollment in EFOP or Masters program	BS or BA degree	2018
Deputy Chief (career only)	Same requirements for battalion chief plus completion of EFOP	Masters degree may be substituted for EFOP	2018

Recommendation 19: Establish training standards and position descriptions for career and volunteer officers. Consider a grandfather clause for the training requirements for volunteer and career officers already in the various positions and phase in the change such that education requirements are not mandated for several years. The phased-in approach also provides the department some time to enhance its training division such that it can provide new programs.

Requiring minimum training standards for career and volunteer officers and raising the education requirements for career-minded personnel are excellent ways to prepare future leaders. Without these enhancements, the fire department may have to continue recruiting leaders from outside the organization. In addition, a greater divide between volunteers and career personnel is also likely to occur, especially if volunteers are given a greater role without the requirement to meet minimum standards.

Interjurisdictional Comparisons

To put a department's performance in perspective, it is helpful to compare the department with other similar jurisdictions. In doing so, department leaders can identify benchmarks that can be used to assess their own performance. Comparisons also identify innovative ideas that are successful in other departments.

Jurisdictional comparisons can be difficult to interpret as there are many variables. No two jurisdictions are exactly alike in terms of geographic size and features, population dynamics, or governmental organization and services provided. However, many jurisdictions do share some similar qualities that are useful for comparison. While these comparisons are not direct indicators of departmental performance, they do provide a valuable function in assessing a department in relation to the performance of its peers. This direct comparison identifies organizational strengths and suggests areas for improvement.

Four jurisdictions were selected for comparison to Horry County. Each of these has a relatively large land area and the population densities are generally low. We also selected these

jurisdictions because there are areas within each of them where the population density is quite high. Table 9 shows the four comparison communities used in this study.

Table 9: Horry County Comparison Communities

Jurisdiction	Population	Area Served (Square Miles)	Density (Population /Square Miles)
Average	305,223	1,030	288.5
Polk County, FL	561,606	1,874	299.7
Charleston County, SC	331,917	919	361.2
Horry County, SC	***238,493***	***1,134***	***210.3***
Frederick County, MD	222,938	663	336.3
Sumter County, SC	104,430	665	157.0

Charleston County, SC – Fire service in Charleston County, South Carolina is provided by 14 separate organizations. Organizations in the area vary from completely volunteer to completely career. The county is comprised of several small municipalities and these municipalities may or may not provide fire service to unincorporated areas of the county. Conversely, there are areas where departments from unincorporated fire districts in the county respond into the municipalities.

Within the county, the Awendaw Fire Department is the only organization with county employees (the municipal departments with career personnel provide their own employees). These employees supplement volunteers at five of the department's six stations, where they provide both fire and EMS first response. In 2007, the Awendaw Fire Department consisted of 19 full-time career employees, who are augmented by 9 part-time personnel.

Funding for the department comes from their own tax district, not from the county's general fund. Municipal departments and the other departments each have their own tax mileage. The department also uses grants, particularly for equipment purchases. The 2007 budget for the Awendaw Fire Department was $1,691,532. However, we were not able to determine the per-capita cost for services because of the unique arrangement among the 14 departments that serve Charleston County.

Apparatus are minimally staffed by career personnel, with career staffing of engine companies at one person. There are no minimum staffing levels for any other apparatus. Career firefighters must have no less than Firefighter I certification, but there are several new employees who have yet to meet this level of training. Only three employees have their EMT certification.

Career-staffed units are supposed to have turnout times of less than 2 minutes and 22 seconds from the time the call comes into communications until the unit marks en route. Volunteer units have no response time guidelines. The volunteers generally do not respond on apparatus; rather, they respond directly to the scene of an incident, so measuring response times is not necessary. There is no scratch policy for career or volunteer staffed units.

Volunteer participation is very low. There are eight volunteer firefighters on the roster, but only six of these are active. No volunteers are involved in the command staff. The only training requirement for volunteers at any level is to complete Firefighter I within one year of becoming a volunteer. There are two incentive programs in place in order to increase volunteer participation. The first is the South Carolina Volunteer Incentive Program. Additionally, the Awendaw Fire Department divides a small cash amount (usually around $3,000 per year) between each of the volunteers based on the number of hours each spent responding, training, or working a duty shift at a station.

Sumter County, SC – Sumter County Fire Department operates 15 fire stations covering the jurisdiction's 665 square miles. Six fire stations have some level of career staffing, while nine are operated solely by volunteers. Each of the stations provides fire suppression as well as EMS first response. The total budget for both career and volunteer activities was approximately $2.2 million in FY 2005/06, which correlates to a per-capita cost of $21.

The career portion of the department consists of 10 personnel who work only weekday shifts. Four personnel are assigned to administrative responsibilities while six are assigned to different stations. Volunteers provide the majority of the fire service and there are 240 active volunteers. Minimum staffing is three personnel - career or volunteer.

Turnout times in Sumter County are significantly longer than in most jurisdictions. In stations with a career employee, the minimum standard is four minutes, and when no career personnel are at the station the minimum response time is increased to six minutes. There is no policy to address the situation when a unit is unable to respond.

Sumter County does have has minimum training standards for firefighters, company officers, and chief officers. Operational firefighters are required to obtain NFPA Firefighter II, while company and chief officers must work through a progression of leadership and incident command courses. Volunteers are compensated for training, meetings, drills, and incident responses. For each instance, firefighters receive $10, drivers receive $12, lieutenants $13, and captains earn $15.

Frederick County, MD – Fire service in Frederick County is provided by a combination of career and volunteer personnel operating out of 30 fire stations. Of these, 10 provide fire

service, 4 provide emergency medical service, and 16 provide both fire and emergency medical service. Three stations are county-owned and the remaining 27 are volunteer-owned facilities. The county has approximately 1,600 volunteers on the books; however, a large majority of these personnel are not operationally active. Volunteer personnel also augment career staffing on seven advanced life support units.

In addition to its volunteers, the county has 286 career personnel who staff 22 stations. Of these, 174 are assigned to 24-hour shifts while the remaining are scheduled to various other shift schedules to fill the gap in volunteer availability.

Funding is provided through several sources and the FY07 budget is reported at $38.1M. The county has adopted a three-tiered service delivery model with urban, suburban, and rural districts and each district pays a different fire service tax rate. General fund monies provide $12.1M of the department's budget; urban district fire tax of $20.0M; suburban/rural area fire tax of $5.8 million. The per-capita rate for service in Frederick County is approximately $171.

Apparatus staffing varies depending on whether the station is completely career, combination, or completely volunteer. The current policy is to staff stations as opposed to specific units with most stations being staffed with three personnel to cover an engine and an ambulance. When a call for the engine occurs, three personnel plus the available volunteers respond. In the event of fire call when the ambulance is already on another response, a single career person remains at the station and waits for volunteers before responding. The county's minimum staffing policy is three on suppression units and two on EMS units.

Frederick County has two volunteer incentive programs. The first is the Length of Service Award Program (LOSAP). Volunteer fire and rescue personnel in Frederick County who enroll in LOSAP are eligible to receive several benefits. After five years of qualified service in LOSAP, volunteers are covered by a life insurance policy. After completing 25 years of qualified service volunteers are eligible to receive a cash benefit upon reaching age 65. A person enrolled in LOSAP must earn a minimum of 50 points per year to qualify for benefits. Points are earned in five categories: department responses, training, special projects, meetings, and being an officer or chairperson.

Another incentive program is that up to $3,500 can be deducted from the Federal adjusted gross income on the Maryland State Income Tax return. There are minimum requirements in order to qualify for the tax break, but these requirements are relatively easy to meet for most volunteers.

Training requirements in Frederick County vary between the career and volunteer personnel, which is a source of friction. Career firefighters receive approximately 20 weeks of

training, including Firefighter I, II, and EMT. Volunteers typically have the required minimum of NFPA Firefighter I. Additionally, many of the stations are staffed with career personnel only on weekdays during business hours. As a result, there is little interaction between career and volunteer personnel at these work locations. The department recognizes this issue and is attempting to institute programs to increase interaction between career and volunteer personnel in training situations.

Polk County, FL – Polk County Fire/Rescue provides fire and EMS services from 29 county fire stations. In addition, nine municipal jurisdictions also provide their own, separate fire service. These municipal departments range in size from single-station combination departments to seven-station all career organizations. Polk County Fire/Rescue provides staffing to 26 of the County's 29 stations with a total of 265 personnel. Approximately 50 volunteers supplement staffing countywide.

Funding is provided from county tax assessments on the non-incorporated areas. The 2007 fire assessment was $148 per single family residence, which is the lowest fee in central Florida. In 2007 the department's total budget was approximately $30 million. Per capita spending data is not determined, as the County population noted earlier includes those people living in municipalities served by other fire and rescue departments.

Each of the 26 stations staffed by Polk County is staffed by one lieutenant and two firefighters, who work 24-hour shifts. Personnel respond to calls for service on the appropriate apparatus based on call type (handle first emergency). When available, volunteers supplement career staffing. Minimum turnout times for both career and volunteer units are two minutes from the time of dispatch. When the unit does not respond within two minutes, other units may be dispatched at the discretion of the first-due officer. There are no minimum staffing levels for career or volunteer apparatus.

Like Horry County, Polk County also contracts with individual volunteer stations to provide fire service. The basic contract provides each volunteer company with $334 per three month period. Small increases in funding are available if the company provides additional trained personnel. In addition to these small stipends, Polk County provides and maintains all necessary apparatus and equipment for each volunteer company. Volunteers are encouraged to run their own fundraising programs to pay for any additional equipment or other upgrades. Polk County does not track the finances of each volunteer organization.

Different training requirements are in place for volunteer and career firefighters. Career personnel are certified at the Firefighter I & II level and are required to have EMT certification. Volunteers may participate so long as they have NFPA Firefighter I; however, they are

encouraged to maintain FFII and EMT-B. Polk County does not provide any incentives for volunteers.

Volunteer Fund Accounting

As part of this project we were asked to review the volunteer funds, including those allocated by the state of South Carolina (one-percent funds), and the locally authorized Volunteer Improvement Program (VIP) money. One-percent funds are generated by insurance premiums and returned to local governments to improve fire services. VIP funds are general revenue monies dedicated in the fire department's budget to improve programs of interest to volunteers.

Overall, the fire department is doing a credible job of accounting for the various funds available to volunteers. Prior to this project there were concerns that state-provided one-percent funds were not properly disbursed according to the state's guidelines and accounting procedures were less than ideal. It was determined by our review that one-percent funds are being used for their intended purpose, and perceived accounting problems are mostly unfounded. It was also determined that Horry County is not unique in its problems with state-funded monies for volunteers. Other jurisdictions also had similar issues, it was reported.

Although the procedures for volunteer funds are generally good, there is room to improve. Chief among them is to improve the communication between the fire department administration and local volunteers.

South Carolina One-Percent Monies – In 1907, the South Carolina General Assembly passed legislation called the Fireman's Insurance and Inspection Fund. These funds are generated by a one-percent tax collected on all fire insurance premiums written in the state, thus the term 'one-percent monies'. Established for the "betterment and maintenance of skilled and efficient fire departments", participation in the program is optional, but we are not aware of any jurisdiction that does not accept the state funds.

The one-percent program is considered a privilege and fire departments must meet specific requirements to receive funds. To participate in the program departments must provide quarterly inspection reports to the state fire marshal along with an annual equipment certificate.

The South Carolina State Firefighter's Association (SCSFA) is statutorily empowered to administer and supervise the one-percent fund program. Budgets are submitted by local fire departments to the SCSFA, who is responsible to approve the budget request. Because HCFR is a consolidated department, the fire chief is responsible for the oversight of one-percent funds. Volunteers provide input to the budget through the volunteer district chiefs and the yearly budget

requires that signatures be obtained from 51 percent of the total career and volunteer membership, which is a difficult and time-consuming task.

A unique feature of the one-percent fund is that fire departments receive the entire portion of funds (based on assessed valuation) regardless of the budget amount actually approved by the SCSFA. Another unique feature is that fund balances are carried from year to year. The HCFR carry-forward fund balance in FY07 is just over $500,000.

SCSFA has developed specific guidelines for the expenditures and the guidelines are updated periodically. Due to the ever changing mission of local fire departments, these updates are necessary. Guidelines were last updated in October 2006. Funds provided by the state are transferred to the county treasurer, who then distributes them to the various county stations based on the percentage of the total assessed value within the department's coverage area. For Horry County, the funds are available to every station, whether volunteer or career.

Following are the annual one-percent expenditures and balances from FY03 through FY07.

Table 10: One-Percent Funding and Expenditures, 2003–2007

Fiscal Year	Amount Received	Amount Expended	Fund Balance
FY02	-	-	$681,956
FY03	$310,786	$312,734	$680,008
FY04	$395,070	$434,446	$640,632
FY05	$452,153	$437,135	$655,650
FY06	$413,836	$458,743	$610,743
FY07	$470,988	$560,135	$521,596
Average	**$408,567**	**$440,639**	**$631,764**

Under the program, HCFR is responsible for budget preparation and submission of the annual budget to the SCSFA. The department's public education officer is attends the district chief meetings to keep minutes and coordinate the program. From these meetings expenditures are submitted to the fire department administration, which approves the request. The process is completed when a check is issued to the station by the county treasurer.

At the time of this project, HCFR was refining its fund management procedures for one-percent monies. For example, in past years individual stations were allocated their entire fund amount and permitted to carry-forward unused funds. On the advice of the SCSFA the practice was terminated and unused funds are made available to the HCFR to be used by the entire department. Another positive change is in one-percent money used for firefighter retirements, insurance, and training. These are now managed by HCFR management, not by the stations. The

annual budget process also improved with a representative from the state's one-percent committee acknowledging that this year's budget submittal was "the best one ever submitted by HCFR".

It was found during this review that the largest portion of state funds are being allocated within the guidelines established by the SCSFA. However, some irregularities do exist within the recruitment/retention guidelines. Stations are using these funds for drill night suppers, holiday dinners, and to purchase furniture or appliances for the station. Current guidelines allow stations to spend up to $10 per attendee per dinner.

SCSFA guidelines are also specific regarding purchases for furniture and appliances. Approved categories are televisions, DVD players, day room furniture, and/or special kitchen items. However, funds have been used to purchase copiers, banquet tables and folding chairs, cameras, and even outdoor canopies. These items are not within established guidelines.

Guidelines for one-percent monies are very specific and they are being updated continually by the SCSFA. A large number of the fire personnel we met were unaware of the guidelines and they did not fully understand the one-percent program. The problem appears to be because volunteer officers did not pass the information on to their personnel, despite the department's best efforts to educate personnel. To improve management of the program more aggressive action should be taken to educate those who access and use one-percent funds.

Recommendation 20: Delegate responsibility for managing the one-percent funds to a senior-level HCFR official, who should attend all meetings and take official minutes. At same time, improve the liaison with SCSFA officials and educate local responders on the intent and guidelines of the one-percent program.

Volunteer Incentive Program (VIP) Funds – Included in HCFR's annual operating budget are funds for special projects important to volunteers. Unlike state one-percent monies that may be used to benefit career and volunteer personnel, VIP monies were created by county elected officials specifically for volunteer special projects. VIP funds are a specific line item within the operating budget paid for by general tax revenues. The funding level for VIP funds has increased from $284K in FY03 to $285K under the present budget. To be expended, VIP funds are transferred from the VIP line item to a specific line item where the item/s can be purchased.

A committee of volunteer firefighters is organized to oversee expenditures from the VIP funds. Since FY2004, a portion of the VIP budget has been used to supplement the volunteers' pay-per-call program, which accounts for 36 percent of the VIP budget. A supplemental accident/disability insurance plan has also been established for volunteers. Premiums for this program account for another 30 percent. The remaining expenditures from this line item are

typically used to purchase equipment. Past items purchased by VIP funds include portable radios, flashlights, and thermal imaging cameras.

It is difficult for the department to always transfer the exact amount for VIP purchases to the purchase line item, thus the line item sometimes has a fund balance at the end of the year. For example, during FY 2007, $51,200 was transferred from the VIP account to line item code 258, Non-Asset Equipment. As we understand it, the purpose was to pay for portable radios. However, the cost of the radios was $50,007, thus the fund transfer resulted in excess funds remaining in the account. From an accounting standpoint, having a small fund balance in the VIP account does not pose a problem in our opinion

Minutes of the meetings where volunteers discuss VIP funds are not taken. Minutes capture the essential information of a meeting—decisions and assigned actions. Proper recording of minutes ensures that the decisions and actions from the meeting are carried through. VIP meeting notes should be made available to all interested parties, not only to committee members.

Recommendation 21: Establish written guidelines on the programs that qualify for VIP funds, and ensure that the transfer of funds from the VIP account (#111) is equal to the purchase amount. Also, maintain meeting notes at every VIP committee meeting.

Volunteer Fundraising at the Local Level – Before this project started questions were raised by county officials about the local fundraising efforts by volunteers. Specifically, whether the monies raised by such efforts are being used for the right purpose. There were also questions about whether the fire department should have specific policies regarding fundraising activities. Only a few of the volunteer stations conduct private fundraising activities - most do not.

Volunteer fire companies provide a valuable service to the local community and they are often the central focus for the community. This is especially true in rural areas such as those in western Horry County. For these volunteers, only a small portion of actual time is spent on fires and other incidents as most activities involve attending meetings and training. Fundraising is also important since it links the community together in a common cause.

Although undated, departmental SOP-211 (Fundraiser Activity Policy) clearly spells out that all local fundraising activities must be approved by the fire chief. In our opinion the requirement is appropriate and justified, particularly since fund raising activities typically require that the department's equipment or logo be used. The policy is also appropriate because HCFR is a tax supported entity and such policies are standard in most public agencies. Like many SOPs, it appears the SOP on fundraising is not being followed. A copy of SOP- 211 is included as Appendix A.

We met with multiple volunteer personnel regarding local station fundraising during our initial visit. Each person had a different understanding of local station fundraising efforts. Inasmuch as the fundraising is typically performed by the independent corporations, we were not provided with any receipts or disbursements. From our discussions it appears that a majority of the private fundraising activities are done under the auspices of the local volunteer fire organization, not as HCFR. Even so, the SOP is relevant to the situation and it should be followed.

Conducted appropriately under the department's SOP, we see no logical reason to preclude volunteers from raising their own funds if the event is approved as required. Purchases made from the fundraisers should only be used for department sanctioned purposes and any equipment purchased should also be approved by the fire department.

Recommendation 22: Update the existing policy (SOP-211) to reflect the current practice and standardize the intent. At the same time, encourage the local volunteer departments to interact with their communities by participating in fundraisers and update the county code to reflect the authority of the fire chief to establish the necessary policies to ensure the effective operations of the fire department. For their part, volunteers should then be expected to follow the policy.

III. Risk and Demand Analysis

This chapter provides an overview of the risks that Horry County Fire Rescue deals with, followed by an analysis of department demand and workload. This chapter also serves as an example of a document that could be updated annually by HCFR planners to better understand and describe the risks faced and the ability to meet the demand those risks place on the department.

Data

Data was a major issue in conducting the risk and demand analysis. The County has utilized NFIRS reporting since 2002; however the reporting is spotty at best. For the years 2002 and 2003, only career staff filed NFIRS reports. Starting in 2004, all HCFR personnel began utilizing NFIRS, however reporting is not mandatory. According to HCFR, 30 to 50 percent of calls were reported in NFIRS in 2002 and 2003, and 60 to 70 percent of calls were reported for 2005 through 2007. The number of fires by incident type was extracted from the fiscal year budget documents (in place of the NFIRS data) as this correlated somewhat with CAD incident types and was determined to be the most accurate of the available datasets.

Risk Assessment

Risks that HCFR can expect to deal with on an almost daily basis include fires, hazmat incidents, traffic accidents & technical rescue, and medical emergencies.

Fires – Fire risks in Horry County are in the range normally found in other counties of similar demographics. Risks include everything from a vehicle fire to a small residential fire to a large high-rise or multi-family residence fire. In 2006, HCFR had 667 structure fires, 243 auto fires, and 1,295 alarms.[15] In comparison to the national average, Horry County has lower than average number of fires and a higher than average number of fire casualties. Spikes in population during vacation periods, mainly summer and holiday breaks, also contribute to the fire risks. In 2007, 38 percent of all structure fires and 42 percent of all false alarms occurred during the summer months of May 1st through August 31st.

Hazmat Incidents – Hazmat incidents occur in manufacturing facilities, transportation networks, and other places where hazardous materials are stored, transported, or used. In Horry County, there is a hazmat risk on the interstates, railroad system, waterways, and industrial areas.

[15] Statistics from Horry County Fire Budget for Fiscal Year 2008.

According to the Toxic Release Inventory Program report for 2005, there were ten facilities within Horry County that reported storage of chemicals.[16] The National Response Center database contains 332 reports of hazardous material incidents over the last 17 years in Horry County[17], or about 20 incidents a year. The vast majority of the NRC reports are minor in nature including small release incidents resulting from traffic and/or boating accidents. The risk of hazmat incidents is ever present and the capabilities to deal with them need to be maintained at a high level. HCFR currently has a "haz-tech" team with approximately 30 personnel and has one hazmat/technical rescue unit.

Traffic Accidents & Technical Rescue – The term "technical rescue incident" is defined as a "complex rescue incident requiring specially trained personnel and special equipment to complete the mission."[18] This includes everything from automobile accidents to building collapses to high-angle rope rescues. In 2007, HCFR responded to over 100 rescue extrication incidents.[19] Incidents included technical rescues from structures, elevators, trenches, and machinery. From February 2006 through October 2007, HCFR responded to over 1,700 traffic accidents, most of which were reported to have injuries and required medical care.[20] With the number of fires decreasing in the United States, fire departments have increasingly become first responders to other types of emergencies. Decreasing response times to motor vehicle accidents and other emergencies with the proper equipment can make significant differences in patient outcomes.

Medical Emergencies – The risks of this type of emergency are a conglomeration of the many health issues the residents and visitors of Horry County face. Time is imperative in true medical emergencies. For example, the most important factor in dealing with a patient in cardiac arrest is time to defibrillation. Because of the wide geographic area covered by HCFR and staffing structure, the rescue personnel are hard-pressed to reach all coverage areas in a short period of time. It is important to note that both fire and EMS response units play an equally important role in the chain of survival. While EMS provides patient transport, fire units often

[16] The Toxic Release Inventory Program requires businesses to report the locations and quantities of chemicals stored on-site to state and local governments in order to help communities prepare to respond to chemical spills and similar emergencies. Toxics Release Inventory (TRI) Program. www.epa.gov/tri/report/index.htm. Accessed January 2008.

[17] National Response Center. http://www.nrc.uscg.mil/foia.html. Accessed January 2008.

[18] NFPA 1670, Section 3.3.141. Standard on Operations for Technical Search and Rescue Incidents, 2004.

[19] Statistics from Horry County Fire Budget for Fiscal Year 2008.

[20] Calculated from 2006-2007 CAD data as provided by Horry County Fire Rescue.

arrive first and then provide assistance to arriving medics. Including vehicle rescue incidents, medical-related emergencies accounted for 64 percent of all calls in 2006.[21]

Other Hazards

Hazards that should be planned for, but are not daily occurrences are listed in Table 11. This table outlines the natural hazards which have significantly impacted Horry County in the past and their likelihood of occurrence as identified in the *Horry County All-Hazards Mitigation Plan* published in March 2006. These hazards fall under the emergency management analysis and are discussed further in the Organization and Management chapter of this report.

Table 11: Natural Hazards Faced by Horry County

Natural Hazards	Likelihood of Occurrence
Hurricane	Highly Likely
Flooding	Highly Likely
Tornado	Highly Likely
Severe Thunderstorm and Wind	Highly Likely
Severe Winter Storm	Highly Likely
Storm Surge	Highly Likely
Earthquake	Highly Unlikely
Wildfire	Highly Likely
Lightning	Highly Likely
Drought	Possible
Extreme Heat	Possible
Tsunami	Highly Unlikely

According to the *Horry County All-Hazards Mitigation Plan*, there are eight natural hazards of particular concern due to their high likelihood of occurrence. The Plan classifies the hazards shown in Table 11 as "highly likely" if the hazard "probably will occur in the next five years;" "possible" if the hazard will "probably occur at least once in the next ten years;" and "highly unlikely" if the hazard "has little or no probability of occurring in the next 100 years." Horry County has experienced several hurricanes and tropical storms including four hurricanes that were direct hits. According the National Climatic Data Center database, Horry County has experienced over $2.9 million in property damage over the last 56 years as a result of floods. A total of 104 tornados, including two F-3 tornadoes were reported over the last 56 years.[22] Severe

[21] Statistics from Horry County Fire Budget for Fiscal Year 2008.

[22] National Climatic Data Center. http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms. Accessed January 2008.

thunderstorms and lightning strikes have resulted in property damage and injuries and one death since 1950. According the All-Hazards Mitigation Plan, the County had two federally declared fires: Long Bay Fire (November 2001) and the Legends Fire (June 2002). Both fires occurred in areas of dense vegetation and threatened residential areas forcing evacuations. Horry County has a Mitigation Strategy section of the All-Hazards Mitigation Plan outlining the strategy to reduce the community's vulnerability to the effects of natural hazards.

Analysis of Fire Risk

The U.S. fire problem has declined on a per capita basis, but is still one of the higher rates in the Western industrial world. Thousands of Americans die each year, tens of thousands of people are injured, and property losses reach billions of dollars. There are enormous indirect costs of fire as well—temporary lodging, lost business, medical expenses, psychological damage, pets killed, and others. These indirect costs may be as much as eight to ten times higher than the direct costs of fire. To put this in context, the annual losses from floods, hurricanes, tornadoes, earthquakes, and other natural disasters combined in the United States average just a fraction of those from fires, with the exception of major disasters such as 9/11 and Hurricane Katrina. The public, the media, and local governments are generally unaware of the magnitude and seriousness of the fire problem to individuals and their families, to communities, and to the nation.

Although the national risk of structure fires and fatal fires is relatively high, Horry County is proportionally even higher. Table 12 compares Horry County's fire and death rates to the national average. There are 68 percent more fires per capita and 26 percent more fire deaths per capita. Although fire statistics are not the only measure for determining the level of fire risk in an area, they do provide an indication of what is happening.

Table 12: Structure Fires and Fire Death Rates in Structures, 2005

Loss Measure	National[23]	Horry County[24]	Percent Difference
Fires/Million Population	1,723	2,894	+ 68%
Deaths/Million Population	10.5	13.2	+ 26%

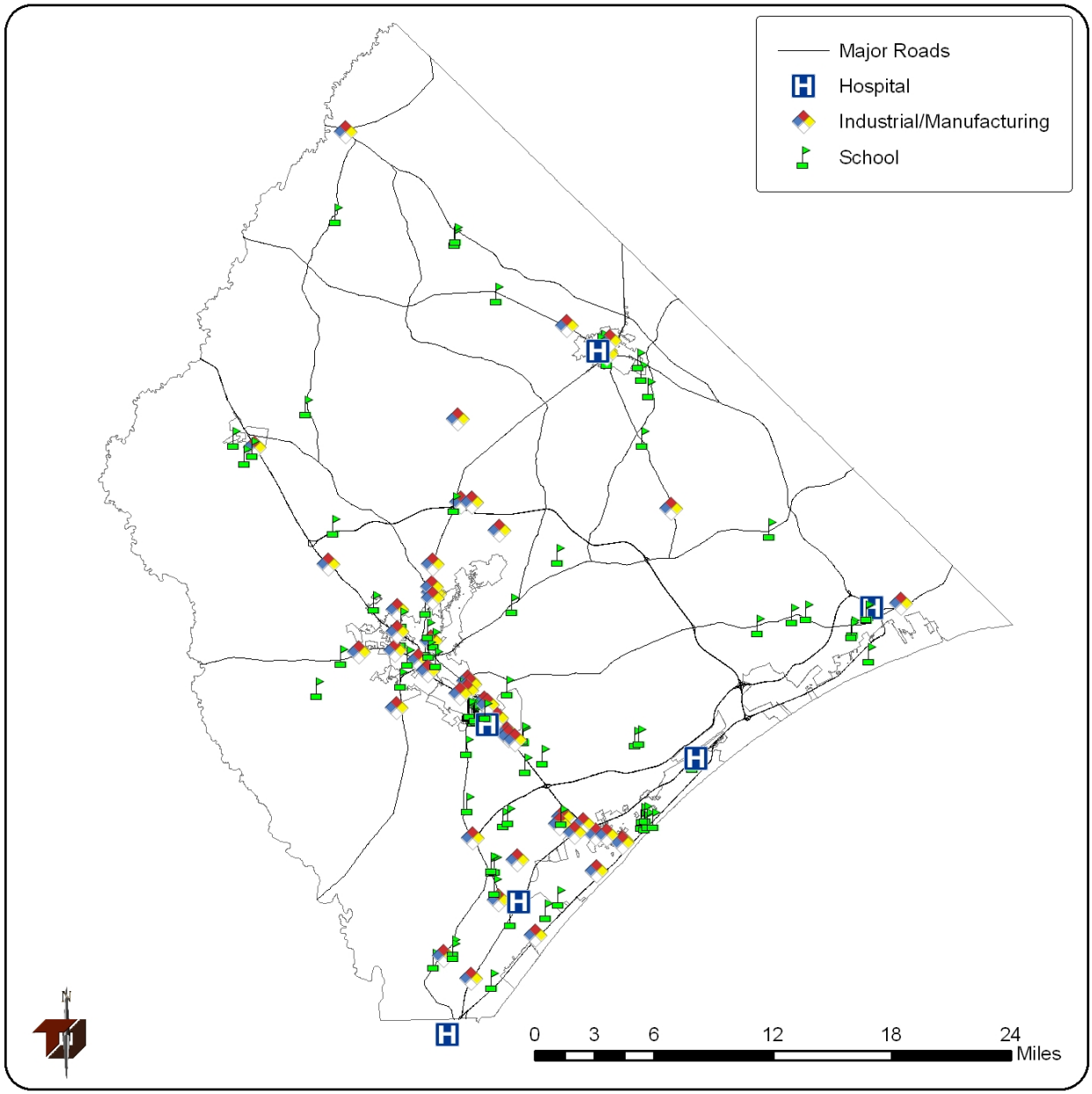
[23] Fire statistics for 2005 from www.nfpa.org

[24] Calculated from fiscal year 2005 budget documents provided by Horry County Fire Rescue

Special Areas

In addition to considering the different types of risks that might affect Horry County, this study has also considered some of the special areas including hospitals, schools, and industrial/manufacturing locations. These areas encompass segments of the population that are less able to rescue themselves from a fire, are densely populated areas, and/or are areas that contain a high concentration of hazardous materials. Map 2 shows a map of Horry County with these areas marked.

Map 2: Special Areas



As expected, these types of facilities are found throughout the County, but are especially concentrated along major roads. This map was used in the deliberations on appropriate station locations. It is also important to know the location of these facilities for planning prevention efforts and inspections.

Population Growth Analysis

Horry County is a widely-dispersed community comprised of both suburban and rural areas. The 2007 estimated population for all of Horry County was 249,925. In addition, the County experiences many visitors throughout the year, attracted to the coastal area. In 2004, there were approximately 13.2 million visitors to the Grand Strand area of Myrtle Beach.[25]

Overall, Horry County has experienced almost 300 percent growth over 56 years. The greatest increase in overall population was between 1970 and 1980 where the County experienced a 44 percent increase in population.[26] Horry County experienced a 57.5 percent growth rate between 1990 and 2005, making it the fastest growing county in the State.[27] Table 13 shows the population and percentage change for 1950 through 2007.

Table 13: Horry County Overall Population, 1950–2007

Year	Population	Increase	Percent Change
1950	59,820	-	-
1960	68,247	8,427	14.1
1970	69,992	1,745	2.5
1980	101,419	31,427	44.9
1990	144,053	42,634	42.0
2000	196,629	52,576	36.5
2005	226,992	30,363	15.4
2006	238,493	11,501	5.1
2007	249,925	11,432	4.8

Unincorporated and Incorporated Areas – Horry County is officially divided into unincorporated and incorporated areas. The incorporated areas are Atlantic Beach, Aynor, Briarcliff Acres, Conway, Loris, Myrtle Beach, North Myrtle Beach, and Surfside. The

[25] Population Element. http://www.horrycounty.org/envision/docs/Population%20Element.pdf. Accessed January 2008.
[26] U.S. Census Bureau. www.census.gov. Accessed January 2008.
[27] Population Element. http://www.horrycounty.org/envision/docs/Population%20Element.pdf. Accessed January 2008.

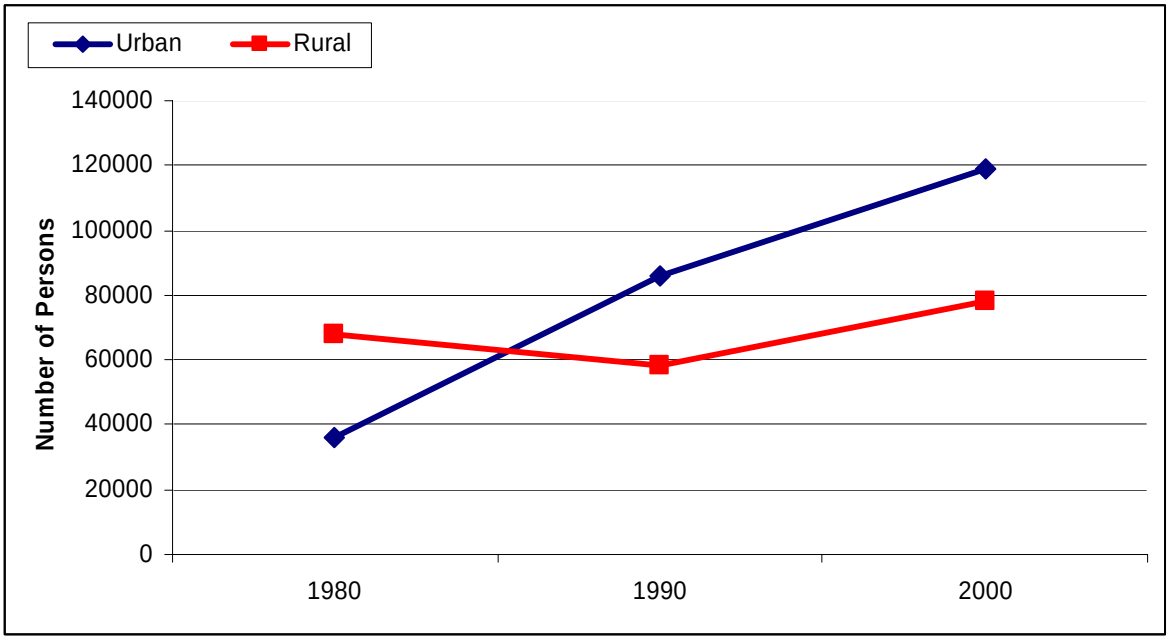
incorporated areas are mostly located near the shore and in the suburban part of the County.[28] Over the past 20 years, the population in the incorporated areas has steadily declined from 39.3 percent in 1980 to 27.2 percent in 2000. Table 14 shows the population growth in incorporated and unincorporated areas.

Table 14: Incorporated and Unincorporated Population Growth, 1970–2000[29]

Area	1970		1980		1990		2000	
	Population	% of Total	Population	% of Total	Population	% of Total	Population	% of Total
Incorporated	23,113	33.0	39,887	39.3	50,683	35.2	53,433	27.2
Unincorporated	46,879	67.0	61,542	61.7	93,370	64.8	143,196	72.8
Total	69,992		101,419		144,053		196,629	

Rural and Urban Areas – The U.S. Census Bureau defines *urban* as incorporated and unincorporated areas with populations over 2,500 people. Horry County was predominately rural in 1980, changing to predominately urban in approximately 1985. The urban growth rate has been much higher than the rural rate over the past 20 years. Figure 9 shows the urban and rural growth and Map 3 shows the population per square mile for the 2000 census.

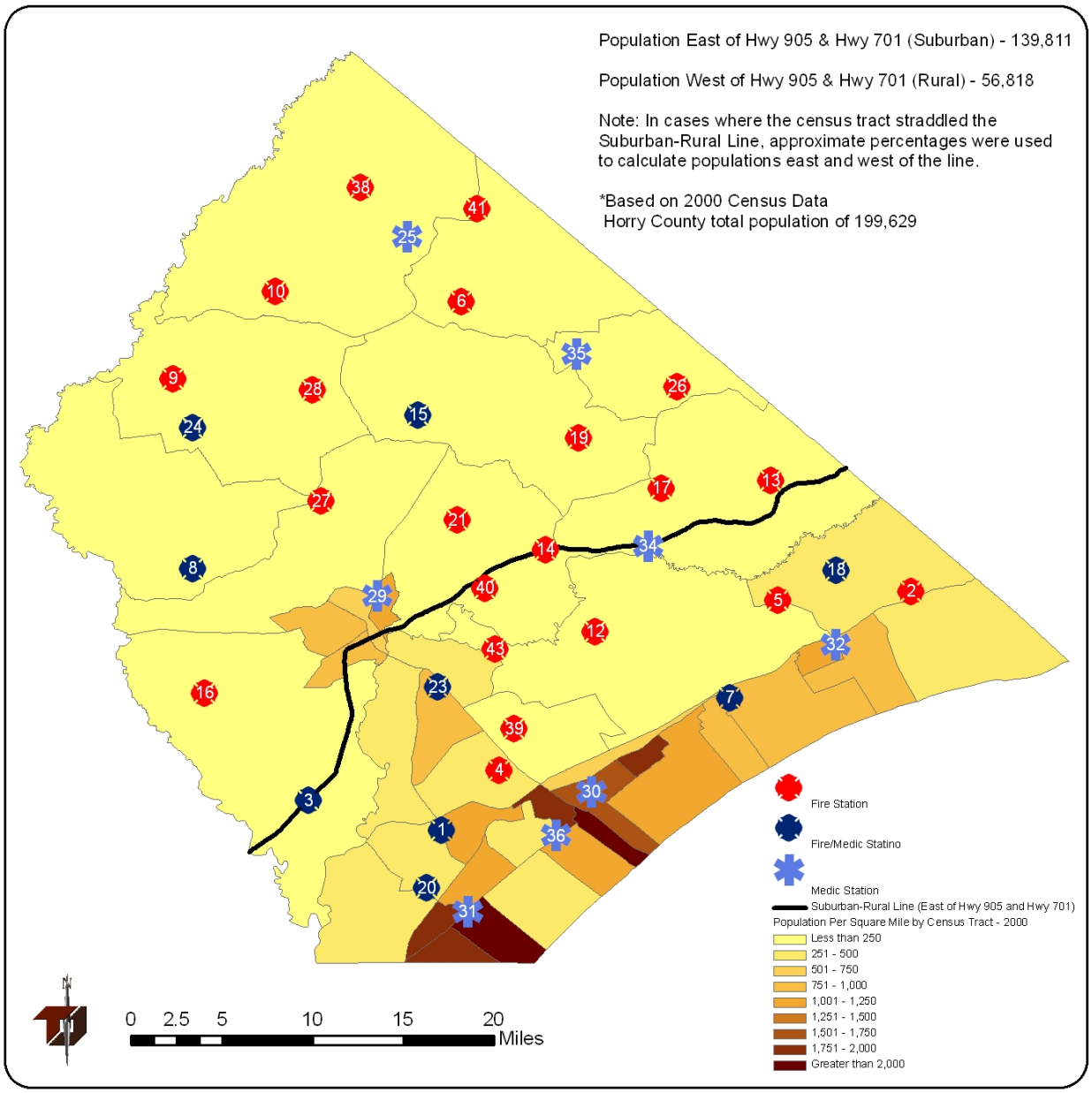
Figure 9: Urban and Rural Growth in Horry County



[28] For this study, Highway's 701 and 905 were used as the dividing line between rural and suburban – rural areas are to the west and suburban areas are to the east of this line.

[29] U.S. Census Bureau. www.census.gov. Accessed January 2008. (Note: Data beyond the year 2000 was unavailable for the population segments described in Table 3, Figure 2, and Figure 3)

Map 3: Population per Square Mile, 2000



Seasonal Population **–** The demand from seasonal population is important to consider in the planning process. The increased amount of people and concentration of visitors in season may overwhelm a fire-rescue system if not adequately planned for. The 2000 census indicated that 20.4 percent of vacant housing units were classified for seasonal, recreational, or occasional use. The estimated number of visitors to the Myrtle Beach area was 11.9 million in 2001 and has steadily increased to 13.2 million in 2004. In 2004, the average leisure length of stay was 5.3 days and 2.6 days for business travelers. 31 percent of visitors were between the ages of 18 and

34 and 51 percent were 35 to 54.[30] The vast majority (90 percent) of overnight guests visited the beach.

In addition to tourists, seasonal variations also occur with the school calendars of colleges and universities, specifically Coastal Carolina University. The academic year starts in the end of August and runs through the beginning of May. The 2004 enrollment at Coastal Carolina University was 7,021 students with over 4,700 out-of-area and foreign students requiring local housing. The expected growth of the University is five percent over the next eight years, with an expected 10,000-12,000 students by 2013.[31]

Age Demographics – Studies have shown that the elderly create a disproportionate level of demand for fire departments; mainly from EMS calls. The population of Horry County grew older steadily from the 1990 to the 2005 census. Data from the 1990, 2000, and 2005 censuses and the change in percent of the population by age range is shown in Table 15.

Table 15: Population Age Demographics for 1990, 2000, and 2005

	1990		2000			2005		
Age Group	Number	Percent	Number	Percent	Percent Change/ 1990–2000	Number	Percent	Percent Change/ 2000–2005
0-4	9,534	6.6	11,298	5.7	+19	13,392	5.9	+19
5-9	9,324	6.5	11,808	6.0	+27	12,711	5.6	+8
10-14	9,805	6.8	11,819	6.0	+21	13,392	5.9	+13
15-19	9,607	6.7	12,080	6.2	+26	12,257	5.4	+1
20-24	11,032	7.6	13,345	6.8	+21	15,663	6.9	+17
25-34	25,654	17.8	27,958	14.2	+9	33,141	14.6	+19
35-44	21,185	14.7	29,665	15.1	+40	33,368	14.7	+12
45-54	14,838	10.3	29,996	13.7	+102	30,644	13.5	+2
55-64	14,845	10.3	22,190	11.3	+49	27,013	11.9	+22
65+	18,229	12.7	29,470	15.0	+62	35,411	15.6	+20
Total	144,053	100	196,629	100	+36	226,992	100	+15

[30] Myrtle Beach Regional Economic Development Corporation. http://www.myrtlebeachdevelopment.com/business/visitordemo.html. Accessed January 2008.
[31] Population Element. http://www.horrycounty.org/envision/docs/Population%20Element.pdf. Accessed January 2008.

Expected Growth

Population estimates for 2000 to 2025 are shown in Table 16. From 2000 to 2007, Horry County had a net increase of 53,296 persons. Overall, the county experienced a rapid growth rate in the last 25 years and this is not expected to change in the coming years. The Horry County Planning Department model projects a 41.3 percent increase from the 2006 estimated population and a 71.3 percent increase from the 2000 population by 2025. New construction projects, specifically interstate 73, are expected to impact future population numbers for the County.[32]

Table 16: Horry County population, 2000–2025

Year	Population
2000	196,629
2007 (est.)	249,925
2010*	251,088
2015*	279,694
2020*	308,301
2025*	336,908

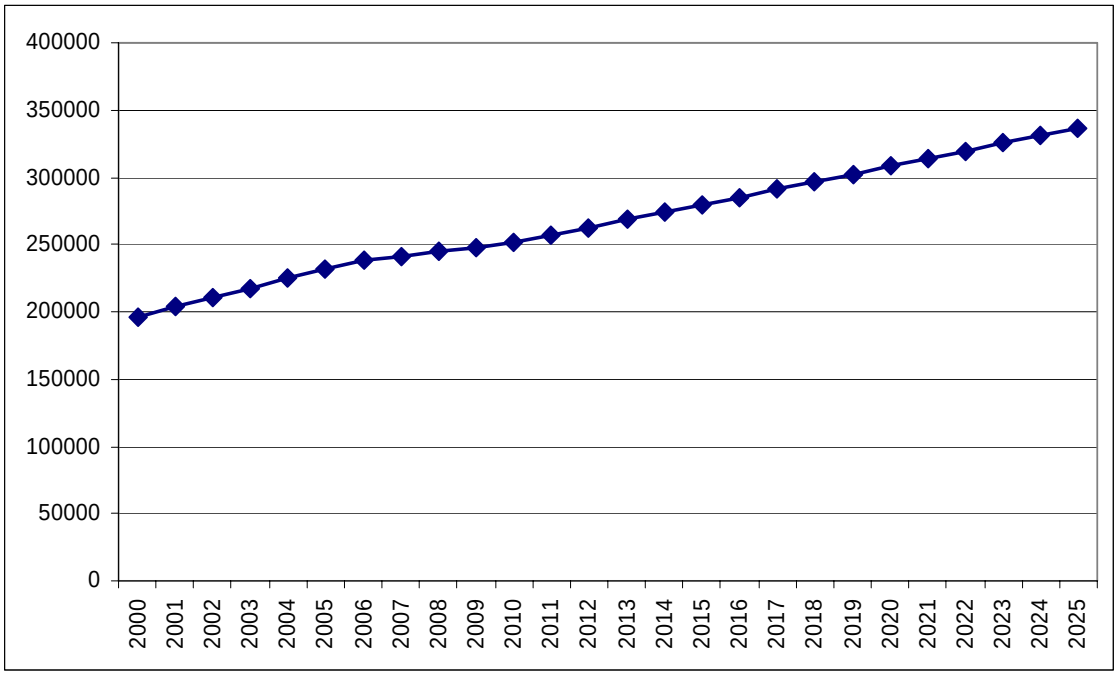
* = forecast

Figure 10 shows Horry County's projected population for the years 2000 through 2025.[33] The population is expected to exceed 300,000 persons by 2019. This is a net increase of 5,611 persons per year over the 13-year period. These population increases will undoubtedly increase the department's workload in the future.

[32] Population Element. http://www.horrycounty.org/envision/docs/Population%20Element.pdf. Accessed January 2008.

[33] Linear interpolation was used to project population for years not included in Planning Department data.

Figure 10: Projected Horry County Population, 2000–2025



Demand Analysis

This section takes the information on past history and estimates the number of fire and rescue incidents through 2020, based on trends and what is expected in population and industrial growth. Needless to say, the further one peers into the future, the less certainty there is with regard to the estimated demand for services. Due to limitations in available data, future demand is a rough look at the very best. Various local, state, and federal factors may also affect the demand for services and the nature of the fire services. Nevertheless, this section develops demand scenarios for the future as an aid in planning for services delivery. This section should not be used as a stand alone component of the overall analysis as its accuracy is limited due to a significant lack of historical data.

Current Demand

Demand is the number (and types) of calls for service – services provided by the entire Fire Rescue department. Demand for service varies between communities for a number of reasons. For example, the degree of urbanization, community income level, and overall age and health of the population impact demand. Demand is also affected by the degree that fire and EMS services are publicized and to which the public is encouraged to call for service. Citizens will typically call for 911 services disproportionately more in a city than in rural areas with suburban communities somewhere in between.

Past Demand

In 2006, HCFR responded to nearly 60,000 fire and EMS incidents. The overall fire and EMS workloads of HCFR are shown in Table 17 and Table 18, respectively. The numbers listed in the table reflect those published in the fiscal year budget documents due to a lack of accurate and complete data supplied in CAD and NFIRS data. The average for each incident type was used to produce the pie charts shown in Figure 11 (fire) and Figure 12 (EMS).

Table 17: HCFR Fire Incidents, 2004–2006

Type of Incident	2004	2005	2006
Structure Fire	657	671	667
Auto Fire	243	273	262
Alarms	1295	1345	1323
Medical Reponses	6824	4629	5691
MVA	2831	3054	3394
Brush/Woods/Smoke Investigation	824	1207	2180
Special Duty	589	646	671
Other Responses	245	1973	9726
Technical Rescue	100	79	101
Total	**13608**	**13877**	**24015**

Table 18: HCFR EMS Incidents, 2004–2006

Type of Incident	2004	2005	2006
Assault	578	717	790
Behavioral	656	732	931
Cardiac	2151	2277	2416
Environmental	115	91	145
Fall	1568	1738	1954
Fire	29	25	40
Interfacility Medical	4	1	1
MVA	2493	2951	3015
OB/GYN	213	205	236
Other Medical	6894	7849	9202
Other Trauma	742	848	948
Pediatric	42	59	62
Respiratory	1601	1822	1868
NPC/No Transport/Cancel Call	12911	12236	14139
Total	**29997**	**31551**	**35747**

Figure 11: Fire Incident Type

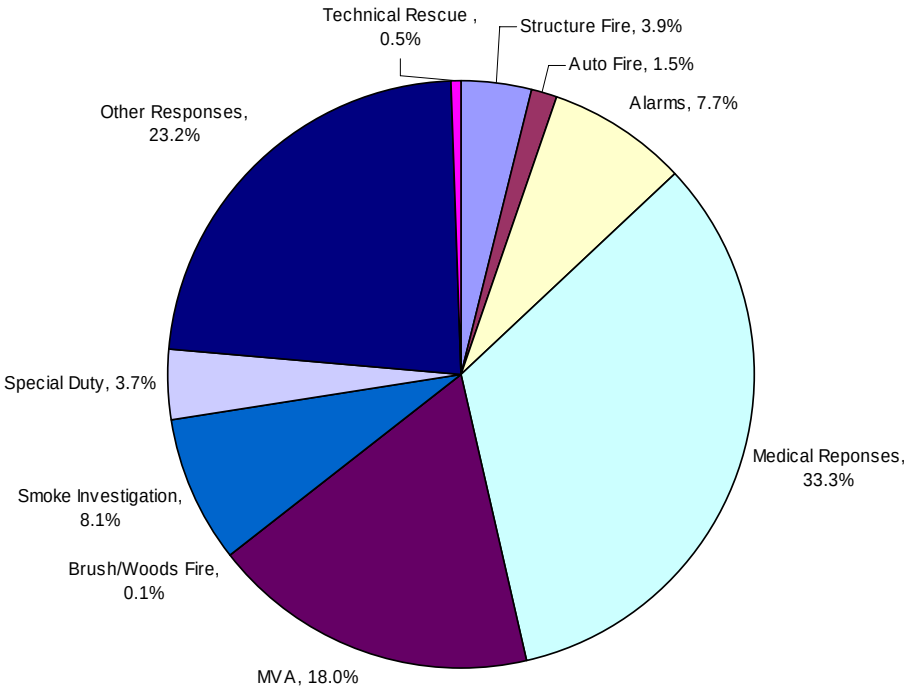
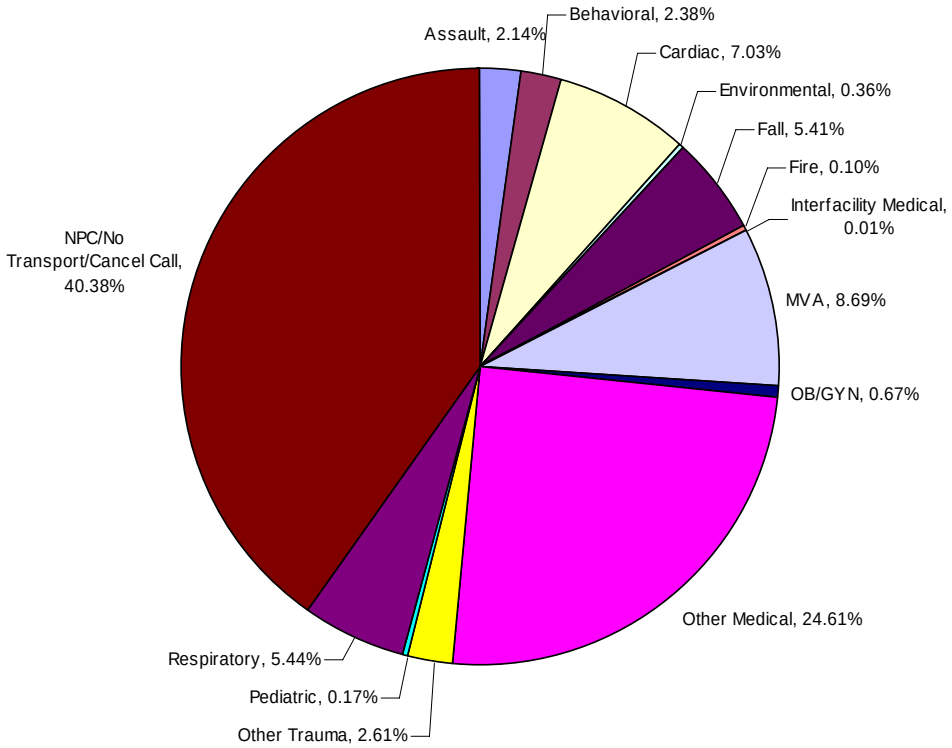


Figure 12: EMS Incident Type



As shown in Table 17 and Table 18, demand for both fire and EMS services have steadily increased from 2004 through 2006. Further, for fire incidents, the demand for services increased by 73 percent from 2005 to 2006 with a sharp increase in the number of "other responses." In addition, when examining the overall average of fire incidents, medical responses accounted for 33 percent of all fire incidents. Generally speaking, incident totals tell half the story of a department's contribution. They are an intermediate measure of workload, less detailed than responses or hours in service.

Per Capita Demand

The population of a county along with past demand are elements required to project a department's demand for services. Demand per capita – the number of incidents requiring response divided by the size of the population – was analyzed using the aforementioned data to aid in determining future demand. Per capita demand is not a static statistic and can have a major impact on the number of incidents. The trend in per capita demand is shown in Table 19. The demand is shown in terms of calls per thousand population to keep the data in integers and more understandable.

Table 19: HCFR per Capita Demand, 2004–2006

Year	Total Incidents per 1,000 Persons	Fire Incidents per 1,000 Persons	EMS Incidents per 1,000 Persons
2004	200	63	138
2005	200	61	139
2006	251	101	150

The apparent trend is toward moderate growth in calls per capita. The changes in per capita demand often are attributable to changes in public perceptions and awareness of service availability, demographic changes, and socioeconomic changes in the community's composition. For example, many localities report increasing utilization of emergency medical services as the population ages. Per capita demand may also be disproportionately affected by the many people who do not have health insurance and who may defer medical attention until it is an emergency requiring HCFR services, or not even an emergency, just a substitute for a doctor visit.

Projected Demand

The Fire Rescue Department provided fire data, EMS data, and population predictions from the Planning Department. The following steps were used to convert this data into a rough estimate of future demand:

1. The fire and EMS data was merged into one data set and adjustments made for overlapping incidents (where both fire and EMS response units were dispatched).
2. Using population figures provided by the Planning Department, a per capita rate was calculated for each incident type in years 2004 through 2006.
3. The highest per capita incident rate of the three years was multiplied by the predicted population for 2010, 2015, and 2020 to arrive at a rough estimate of future demand.

Demand Prediction

The demand predictions are shown in Table 20. Horry County is rapidly growing and it is expected that demand for emergency services will grow along with the population. Over the next twelve years, the fire department may need to respond to an additional 250 structure fires and 10,000 more EMS incidents. Although the increase in structure fires may be manageable, an additional 10,000 EMS incidents will certainly require more resources and the county should plan accordingly.

Table 20: Demand Predictions for Fire and EMS Incidents

Year	2010	2015	2020
Population	251,088	279,694	308,301
Structure Fire	735	818	902
Auto Fire	296	330	364
Alarm	1,459	1,625	1,791
EMS	34,062	37,942	41,823
MVA	3,573	3,980	4,387
Brushfire	30	34	37
Smoke Investigation	2,268	2,526	2,784
Special Duty	706	787	867
Other Responses	10,240	11,406	12,573
Technical Rescue	112	125	137
Total	**53,480**	**59,573**	**65,666**

Improved Planning Through Improved Data Collection

The analysis here was hindered by the lack of good historical data on incidents. Usually in such analyses it is possible to approximate future demand by area of the county and tailor department recommendations to those needs. The demand analysis is usually based on National Fire Incident Reporting System (NFIRS) data collected by the agency that gives a detailed report of each fire and EMS incident. Horry County has started collecting (and reporting) this data, but

the information is far from complete. For this study it was not possible to use the NFIRS data in the demand analysis. For a county that is growing so quickly, it is imperative that NFIRS data is collected for all incidents. It is difficult to make optimal fire and EMS deployment planning decisions without good data. That said, the analysis made the best of the data that was available.

Recommendation 23: Design the County NFIRS incident reporting system to require 100 percent reporting. Although this might be challenging with the large number of volunteer departments in the County, it is a requirement that must be seen through for improved deployment planning.

IV. Fire and EMS Operations

This chapter discusses the current deployment of personnel and apparatus and gives -- recommendations to improve service delivery. The recommendations on personnel and apparatus reflect the station location and demand analysis findings presented in earlier chapters.

The overall framework to deliver fire and EMS service effectively is in place. However, fire unit staffing is inadequate in most areas of the county. As a result, on-scene complements, referred to as weight of response, are lean and fire operations are being compromised as a result. In addition, there are an insufficient number of volunteer officers. Also, the rank structure and distribution of volunteer officers is inconsistent.

The county and fire department are working to improve the condition of fire apparatus. Also, new stations are being added and existing ones are being updated. However, these improvements won't mean much if enough trained personnel are not available to use them effectively. Building new station 41 without the necessary personnel (career or volunteers) to staff it is one example.

To address the staffing issue and improve service delivery to meet the county's increased demand, additional funding will be needed. If the county chooses not to improve staffing levels to meet its growing demand, a continued loss of volunteers will require a large budget increase to replace them. A large incident that results in a poor outcome or legal situation because of insufficient personnel could also result in a significant budget increase. To avoid the problem, the county should act now and gradually make staffing improvements.

Summary of Critical Findings

Staffing levels at most of the county's stations are dangerously low. There are too few career personnel on each unit and there are not enough active volunteers to make up the difference. To improve the situation additional personnel, both career and volunteer, are needed. Whether more volunteers can be recruited is questionable since volunteerism is on a downward trend in the county (and nationally as well.) Still, the county and fire department need to make the effort and initiate an aggressive recruitment program. The maintenance of the volunteer side of the system as long as possible will save a lot of money and enhance the character of the community. .

On the EMS side, the staffing situation is considerably better, but attracting enough paramedics is a problem. Fulltime EMS units are logically deployed throughout the county albeit more EMS resources are needed in the rural area. There are plans for two additional medic units,

which will help. Improving EMS delivery in the rural area can be accomplished at less cost than adding more lightly loaded paramedic units by using paramedic engines. Adding a FF/PM to engines in rural area will improve EMS response times and improve staff levels at fires.

Too few responders are on-scene initially at most structure fires and others arrive too late to make a difference. That fire units regularly respond with only one or two personnel is a real problem and a safety issue. At a minimum, crews on career engines and ladders should be increased from two to three in the suburban area and to four in the rural areas where response times are considerably longer and backup units take longer to arrive.

Staffing is also a problem for volunteer units as many of them respond with only one person (the driver). Minimum staffing on volunteer units also needs to be improved and we recommend a required minimum of three responders on a suppression unit responding to a structure fire since one or even two personnel is not an effective team. Volunteers are also responding directly to the scene in many cases and on-scene accountability is being compromised. To get enough personnel on-scene, fire commanders typically use EMS personnel, to the detriment of medical service delivery.

There are two vastly different service areas in the county. As expected, service demands are higher nearest the coast where the population density is greater. Although it is appropriate to provide the same quality of service to the suburban and rural areas under the fire tax system, lower call volumes in the rural areas make it reasonable to provide fewer resources and less redundancy there. A lower weight of response (personnel delivered to the scene) can be applied to the rural areas where structures are smaller with fewer occupants.

This study proposes significant improvements to the fire and EMS delivery system. To make the improvements will take time and money. To implement the desired changes we recommend they be implemented gradually. Following are the most important issues to address:

- Establish different service delivery standards for the rural and suburban areas. For the line where the service levels change, we recommend Highway 701 (S) through Conway to Highway 905 (N). This line of demarcation is a reasonable separation for the two service areas and it was discussed with several individuals familiar with the county, including elected officials.
- Increase staffing levels on all career suppression units such that minimum staffing is three personnel in the suburban area and four in the rural area. Due to the shortage of volunteers and high no response rates at many rural volunteer stations, begin to increase staff levels in the rural area first, so that the first arriving unit can start work on their own.

- Add a cross-trained FF/PM to units with high EMS call rates in rural areas, and increase the number of responders on these units to four personnel. Do this first for the units where the next closest EMS units have the longest response times.
- Initiate an aggressive recruitment program to increase the number of active volunteers at the all-volunteer stations or where volunteers comprise the primary response during nighttime and weekend hours.
- Identify the service level provided by each station using the suburban and rural designation. In the suburban area, fire services will be primarily career augmented by volunteers. Where volunteers have the capacity to sustain their operation fulltime or during nights and weekends, a suburban station should retain its all-volunteer or mostly volunteer status. Services in the rural area should be mostly-volunteer augmented by career staff during weekdays. The rural area should have key stations staffed entirely by career staff to supplement the volunteers. A 'wagon-wheel approach' can be used in which one career station supplements several mostly or all-volunteer stations.
- Establish a standard for officer ranks and assignments within the context of the rural and suburban areas. In mostly volunteer stations with weekday career staff, the senior officer should be a volunteer captain, with a career lieutenant in-charge during weekdays. For mostly career stations, the senior officer should be a career captain with career and volunteer lieutenants as adjuncts.
- Establish minimum staffing levels for units to respond, including volunteers. At the same time, establish minimum numbers for trained volunteers and officers for all-volunteer or mostly-volunteer stations. Although there are no concrete standards to determine these minimums, 10–15 active responders is reasonable for a mostly volunteer station with higher numbers (about 25) for stations designated as all-volunteer. When volunteer numbers go below these thresholds, career personnel are probably needed.

The remainder of this chapter discusses the various deployment needs in more depth. It concludes with a staffing and apparatus deployment matrix the county can use for longer-term planning.

Current Deployment of Apparatus and Personnel

Fire and EMS units are strategically located at 39 stations, 18 in the suburban area and 21 in rural areas. On a typical shift, 71 career personnel are on duty countywide, 32 of whom are

assigned to 16 medic units. The remaining 39 include 36 firefighters and fire officers, 2 battalion chiefs, and 1 EMS shift supervisor.

Eleven of the county's stations have career personnel augmented by a few volunteers while 21 stations are all-volunteer. Nine stations are stand-alone medic stations where a medic unit is housed by itself or in a non-county facility such as a Myrtle Beach fire station. Stand-alone medic stations include 29, 30, 31, 32, 34, 35, and 36. A new station (Iron Springs – Station 41) was just completed but no staff is provided. A modern and well-equipped facility, Station 41 is being used primarily for storage and is underutilized.

Table 21 depicts the fire and EMS units located throughout the county and the current deployment of career and volunteer personnel by station.

Table 21: HCFR Apparatus and Staffing by Station, 2007

Station	Units	Career Staffing	Number of Volunteers	Year Constructed	Number of Bays	Suburban or Rural District
1 Socastee	1 Engine 1 Rescue 1 Tower 1 Medic 1 BC	2 2 0 2 1	13	1999	4	Suburban
2 Little River	1 Engine 1 Tower 1 Brush 1 Squad	0 0 0 0	19	2002	4	Suburban
3 Bucksport	1 Engine 1 Tanker 1 Medic	2 1 2	0	1995	1	Suburban
4 Forestbrook	1 Engine 1 Ladder 1 Marine Utility 1 Boat	2 0 0 0	20	2003	2	Suburban
5 Wampee	1 Engine	0	2	1989	2	Suburban
6 Finklea	1 Engine 1 Tanker 1 Brush	3 1 0	1	2005	3	Rural
7 Lake Arrowhead	1 Engine 1 Tower 1 Medic	2 2 2	3	2003	3	Suburban
8 Juniper Bay	1 Engine 1 Medic	2 2	0	1985	2	Rural

Station	Units	Career Staffing	Number of Volunteers	Year Constructed	Number of Bays	Suburban or Rural District
	1 Brush 1 Boat	0 0				
9 Antioch	1 Engine 1 Tanker	0 0	4	1989	2	Rural
10 Ketchup Town	1 Engine	0	7	1980	2	Rural
12 Nixonville	1 Engine 1 Tanker	0 0	5	1986	2	Suburban
13 Longs	2 Engines	0	6	1981	2	Rural
14 Shell	1 Engine 1 Tanker	0 0	4	1981	2	Suburban
15 Bayboro	2 Engines	2	5	1980	3	Rural
16 Cates Bay	1 Engine 1 Tanker	0 0	10	1989	2	Rural
17 Mount Vernon	2 Engines	0	11	1993	2	Rural
18 Stephen's Crossroad	1 Engine 1 Rescue 1 Medic	2 2 2	12	1993	3	Suburban
19 Cherry Hill	1 Engine 1 Tanker	0 0	13	1993	2	Rural
20 Scipio	1 Engine 1 Medic 1 Brush	0 2 0	17	2003	3	Suburban
21 Maple	1 Engine	0	6	1991	2	Rural
23 University	1 Engine 1 Medic 1 Hazmat/Tech Unit 1 Air Unit	2 2 1	11	1993	2	Suburban
24 Aynor	1 Engine 1 Medic 1 Brush	3 2	0	1997	1	Rural
24 Aynor #2	Vacant To be renovated	-	-	1989	3	Rural
25 Mount Olive	1 Medic	2	0	1992	1	Rural

Station	Units	Career Staffing	Number of Volunteers	Year Constructed	Number of Bays	Suburban or Rural District
26 Goretown	1 Engine 1 Brush	0 0	8	1991	2	Rural
27 Allens	1 Engine	0	5	1993	2	Rural
28 Joyner Swamp	1 Engine 1 Tanker	0 0	8	1992	2	Rural
29 Conway	1 Medic	2	0	Leased from Conway (Station #2)	1	Rural
30 Myrtle Beach	1 Medic	2	0	Stationed at Myrtle Beach Fire Station	1	Suburban
31 Surfside Beach	1 Medic	2	0	Leased space from Surfside Fire Department	1	Suburban
32 North Myrtle Beach	1 Medic	2	0	Shared building with NMB Rescue Squad	3	Suburban
34 Red Bluff	1 Medic 1 BC	2 1	0	1992	1	Suburban
35 Loris	1 Medic	2	0	1977	1	Rural
36 South Myrtle Beach	1 Medic	2	0	Leased space from MBFD.	1	Suburban
38 Floyds	1 Engine 1 Tanker	0 0	4	1992	2	Rural
39 Carolina Forest	1 Engine 1 Ladder 1 Brush	2 0 0	19	2003	2	Suburban
40 Hickory Grove	1 Engine 1 Wildfire Unit 1 EMS Supervisor 1 Brush 2 ATV's	2 1 1	4	2005	2	Suburban

Station	Units	Career Staffing	Number of Volunteers	Year Constructed	Number of Bays	Suburban or Rural District
41 Iron Springs	1 Engine	0	1	2005	2	Rural
43 Lee's Landing	1 Engine 1 Squad	0 0	7	2005	2	Suburban
Total	33 - Engines 5 - Ladders/Towers 16 - Medics 4 - Rescues/Squads 9 - Tankers 9 - Brush/Wildfire Units	71	225	-	-	18 – Suburban 21 – Rural

Fire suppression resources county-wide include: 33 engines, 5 tower ladders (aerials), 4 rescue units, 9 tankers, and various support units such as brush units and boats. Medical service resources include 16 medic units. Management and supervision is provided by two battalion chiefs, who are considered shift commanders and one EMS supervisor. The EMS supervisor is responsible for the coordination of medical service. Supervision within the fire station is provided by a career or volunteer officer, typically a captain or lieutenant.

On the career side, personnel are assigned to one of three shifts (A, B, or C). Each shift works an average of 56 hours/week in a rotating 24-hours on-duty, 48-hours off-duty arrangement. The schedule is typical for career fire departments. Fire personnel on shift work are paid overtime for actual hours worked above 212 hours in a 28-day cycle. FTE personnel allocated for fire and EMS operations in FY07 are depicted in Table 22.

Table 22: FTE Positions by Rank for Operations, FY07

Position	EMS	Fire	Total
Battalion Chief	3	3	6
Supervisor (Captain Equivalent)	0	3	3
Captain	0	17	17
Lieutenant	0	23	23
Firefighter/Paramedic	58	15	73
Paramedic	12	0	12
Firefighter 1	88	45	133
Emergency Medical Technician	8	0	8
Sub-Total	***169***	***106***	***275***
Total	**-**	**-**	**275**

At the time of this study, 225 volunteers were on the rolls. However, only 80-90 of them are active and respond regularly to calls. Under the existing policy volunteers are expected to serve at the station nearest their address of residence. However, volunteers may respond to any call in the county and many keep their personal protective equipment in their privately owned vehicle just for these occasions.

Determining the Appropriate Levels of Service

HCFR is presently unable to deliver enough personnel within the first few minutes of a structure fire, especially in rural areas of the county. Staffing levels are generally sufficient to mitigate smaller incidents such as automobile fires, extrication events, and other calls when two or three responders suffice. When a larger force is needed, an excessive number of fire units are needed to muster enough personnel.

Some within county government are of the opinion that the current system is disproportionately balanced in that more career personnel, stations, and equipment are located in the eastern (suburban) half of the county. However, the demand and risk levels are highest in the suburban area where more people live (and work), and thus the allocation indeed should weight these areas more, for good risk management. Fire tax revenue derived from property assessments is also higher in the suburban region.

In addition to fire suppression, HCFR provides EMS service. Although the existing EMS units have adequate staff, there are not enough EMS units to meet response time goals countywide, and it is probably cost prohibitive to do so. Many areas have too few calls to warrant a greater expense although ultimately it is the citizens' call on whether to pay higher taxes to provide a uniform level of service even if inefficient to do so. The county's low EMS call volume in the rural area and the large geographical area make a consolidated fire/EMS system appear to be the best choice balancing efficiency and effectiveness. Cross-trained personnel on fire units can and do enhance the medical and fire response system—and at less cost than having a full set of units dedicated to each function.

Balancing the requirements of a reasonably fast EMS and fire response (a sufficient number of facilities) and having an adequate number of personnel to provide an adequate on-scene force is a challenge but it can be accomplished. To do this, the county should adopt different parameters for the suburban and rural areas. In the following section we discuss the standards the county should consider.

Where and How to Deploy Resources – Decisions about how many resources to deploy, and where, is not an exact science. There are no perfect deployment models. The ultimate decision is based on a combination of risk analysis, professional judgment, and a jurisdiction's willingness to accept more or less risk. Accepting more risk generally means that fewer resources are deployed, though deploying more resources is no guarantee that loss will be less, especially in the short term. In the fire service, risk can be considered a combination of the frequency and severity of emergency incidents. Also to be considered is the strength of the prevention program. Many nations are reducing requirements for speedy response, and increasing career and volunteer firefighter time spent on delivering prevention, especially to high risk homes. They are spending less than we do for fire protection and seeing lower casualty and losses. We feel obliged to mention that in light of the latest research on best practices in other nations, though the scope of this study is solely on operations and management. FOOTNOTE- Global Concepts in Residential Fire Safety, Part I- Best Practices from England, Scotland, Norwaty and Sweden, TriData, October 2007.

In the following section we discuss the standards that were considered during this project and their applicability to the county's situation.

Insurance Services Office (ISO) – ISO is a national insurance engineering service organization that assigns a public protection classification (PPC) to jurisdictions based on fire department services. Insurance companies typically establish insurance rates for individual occupancies or groups of occupancies based on the PPC, which uses ISO's *Fire Suppression Rating Schedule* (FSRS).

The use of FSRS is limited in that it only evaluates fire protection (not EMS, which most fire departments now provide to some degree). Also, the FSRS does not consider efficiency (e.g., how many resources are deployed in comparison to the number of actual calls). Though not as widely used now, ISO ratings are still appropriate to consider as part of a more comprehensive system performance review. Combined with other assessments, ISO standards are useful, but not by themselves.

The ISO uses a grading system of 1 to 10 with a community protection factor of one being the highest possible grade. Insurance rates are lowest for community Class 1 communities and the ratings increase by 1 class for every 10 credits, e.g., Class 1 = 90.00+ credits, Class 2 = 80.00-89.99, Class 3 = 70.00-79.99, etc.). A community with a Class 10 rating means that there essentially is no recognized fire protection system or availability of water for fire suppression. Only a very small number of communities with very effective water distribution systems and mostly career fire departments are able to achieve a rating of one.

At the time of this study, most areas of the county had an ISO rating of 6-9. Murrells Inlet-Garden City currently has the best rating at Class 4, which is very good. To lower insurance rates for residential property owners, the county is using the ISO rating almost exclusively, which is best approach if only insurance rates are considered. However, ISO does not consider efficiency and there are other tools available such as Geographic Information Systems (GIS), which is an improvement on the prescriptive methodology used by ISO. ISO also does not consider medical service, which is a large portion of the county's demand.

According to a report issued by the ICMA in 2002:

> In its practical application, the (ISO) rating schedule is a tool used for assessing the insurance rate charged in a specific community on a specific property. Generally, the better the rating schedule classification, the lower the insurance premium charged. Although one cannot say with certainty what the effect of an improved rating schedule classification might be in a specific community, improvements in the classification in communities with between 10 and 5 tend to result in lower insurance premiums for residential properties. Improvements when the community has ratings better than five can result in lower premiums on commercial and industrial properties but will usually have a negligible effect on premiums for residential properties.[34]

ISO ratings are limited in their application because they are heavily weighted to the performance of the water system and water pressure to deal with a large-scale fire. Forty percent of the rating is based on water availability for fire suppression. The three components evaluated by ISO in making a final determination of rates are:

1. Fire department: number of engines, training, personnel, procedures, etc. (50 percent). Equipment accounts for 26 percent, personnel for 15 percent, and training for the remaining 9 percent.
2. Water supply (40 percent).
3. Emergency dispatching and communications (10 percent).

As noted in the ISO's *Fire Suppression Rating Schedule*, "The Schedule is a fire insurance rating tool, and is not intended to analyze all aspects of a comprehensive public fire protection program. It should not be used for purposes other than insurance rating"[35] A

[34] International City/County Management Association, *Managing Fire and Rescue Services*, 777 N. Capitol Street, N.E., Washington, DC, 2002, p. 293.
[35] Fire Suppression Rating Schedule, Edition 02-03, ISO Properties, Inc., 2003

community may have an excellent fire department and communications system, but it may have a higher (worse) ISO rating if the water distribution system is not constructed to ISO standards

Recommendation 24: Evaluate fire and EMS service using other measures such as 90th percentile response times and fire/EMS incident outcome data.

Workloads – Determining how busy units are is important for establishing their availability for the next call and because it provides insight on how much capacity various units have to handle more work, or whether additional units are needed.

One needs to consider both the number of calls (demand) and the time spent per call in determining workload. Unit workload is the number of calls x its average time per call. (Workload here is emergency workload only, not all the training and other tasks undertaken at the station, nor the paperwork for calls.) Fire and EMS data on times of call and time of returning are needed to determine the availability of a specific unit or station. Only recently did the fire department begin to collect the necessary incident data to assess workload.

Workloads for HCFR units are not high when considered with those of similar units in metropolitan areas. Workloads of the EMS units are considerably higher than fire units, as is common and expected. On the fire side, there is ample capacity to handle more responses at every station. In EMS, several units have 'high' workloads but still have capacity before their workload becomes too high. The demand analysis shows that EMS calls are expected to increase significantly over the next 10 years and the county will need to make adjustments to the system in years to come. This picture is shared by many other growing counties.

The concept of workload is not merely a count of how many calls to which a unit was dispatched. For example, one unit can have fewer responses than another but remains on the scene longer on average (e.g. more working incidents), and so has a greater workload. Evaluating workload is important when looking at the overlaps in coverage to an area that may be required to achieve the response time goals. An analysis of workload also can indicate whether a new station should be built or new apparatus purchased, or if current stations should be closed or

Below are guidelines developed by TriData that outline the overlap of response areas (level of mutual support) necessary to reliably meet response time goals. These guidelines are based on how various call volume levels affect availability.

1. **Very Low (<500 responses/yr)** – Simultaneous calls are infrequent and unit availability usually is assured. Stations/units can be spaced at the maximum distance possible to achieve stated travel time objectives established by the community.

2. **Low (500-999 responses/yr)** – Few calls will overlap and unit availability usually is assured. Stations/units can be spaced at the maximum distance possible to achieve stated travel time objectives established by the community.
3. **Moderate (1,000-1,999 responses/yr)** – Some overlap of calls will occur, usually at peak demand periods; however, stations/units are usually available. Stations/units must be located with marginal overlap to achieve stated travel time objectives established by the community.
4. **High (2,000-2,999 responses/yr)** – Additional overlap of calls will likely occur; however, stations/units will probably be available for emergency response. Stations/units must be located with significant overlap to achieve stated travel time objectives established by the community. This footprint usually achieves the best results in terms of cost efficiency and effectiveness of service delivery. (Overlap can be achieved with additional stations or additional units in existing stations.)
5. **Very High (3,000-3,999 responses/yr)** – Overlapping calls occur daily, usually during peak demand periods, and working incidents are frequent. The closest station/unit may not be available, thus requiring the response of adjacent stations/units. Stations must be located with sufficient overlap to achieve the stated travel time objectives, or additional units offering the same service must be located within the same station (e.g. two medic units or one medic unit and one paramedic engine).
6. **Extremely High (>4,000 responses/yr)** – Overlapping calls may occur hourly, regardless of the time of day. The closest station/unit is likely to be unavailable thus requiring the response of adjacent stations/units. Frequent transfers or move-ups are required for the delivery system to meet demand. Stations/units must be located with redundancy (back-up units) to achieve stated travel time objectives, or additional units added. This footprint is usually found in very densely populated urban areas and is especially evident in EMS services located in urban areas with very high demand for service.

The 3,000–3,200 response level (*very high* category above) is the point at which units are often considered "busy" and their availability needs to be evaluated. This is a rough rule of thumb, not a fixed standard. At this point, response times often will begin getting longer from frequent call overlap (calls to the same first-due area arriving back-to-back).[36] As units become busier, the chances for overlap or simultaneous alarms increase, and second-due units begin to answer more calls. This causes a domino effect where unit B is dispatched to a call in unit A's area because unit A is already engaged, causing unit B to be unavailable for the next call in its own area. Unit C must then respond to unit B or unit A's area, and so forth.

Again, the 3,000-response threshold is just a rule of thumb. How much time a unit is unavailable due to being involved with another incident is a better assessment of the impact of workloads on availability and response times than just the number of calls. This is the second factor in workload, known as unit hour utilization (UHU).

Unit Hour Utilization – For Horry County, the workload of fire and EMS units is such that coverage overlap is not a major factor; most units will be available when the next call occurs, especially fire units. UHU is used more in relation to EMS units than fire suppression units. However, an evaluation of UHU is useful to in both cases. During the summer season when tourism is highest and special events such as 'Bike Week' occur, the fire department is already adding extra medic units to address peak-demand periods of the day, which is appropriate.

UHU is the fraction of time a unit is occupied on emergency calls, expressed as a percentage of the number of hours a unit is staffed and available for response. A unit staffed full-time is available 8,760 hours per year. A high UHU means lower availability for calls. Poor availability negatively impacts response times.

The formula used to calculate the UHU for each unit is:

$$\text{UHU} = \frac{(\text{number of calls}) \; x \; (\text{average call duration in hours})}{8{,}760 \text{ hours per year}}$$

UHU measures the percent of a unit's time in service that is spent running calls. Other productive time is not included, such as time for training, maintenance, and other preparedness-functions. Public education and inspection efforts also are not included in the UHU calculation.

[36] A "first-due" 'area is a certain geographic area of the overall fire department response jurisdiction that is assigned to a particular fire station and the units that are assigned to them. Generally, it is best to dispatch the closest unit or company to any particular type of incident. Companies may be assigned to incidents outside of their first-due area, such as a second-due area, as the need arises because of the normal first-due unit being out-of-service or other circumstances.

In other words, when units are not engaged in emergency response, it does not mean they are not working.

While there is consensus within the industry on the importance of utilization rates and how to measure them, the interpretation of how indicative utilization rates are of overall system efficiency is debatable. Most believe that a UHU between 35 and 45 percent for EMS is good for economic efficiency. (This is commonly a goal for private ambulance providers.) If a UHU is greater than 45 percent, units often are not available and response times suffer. If a unit has a UHU of 40 percent, it will not be available for the next call 40 percent of the time. This is, of course, an average over the course of the day. If a UHU is below 35 percent, units may not be well utilized, but response times still may be high too often. Many communities choose to aim for a UHU in the 15 to 25 percent range to improve or maintain good response times.

There are no guidelines on UHU levels for fire units; many large departments evaluated by TriData experience engine and truck UHUs between 5 and 15 percent. If a unit is out of its station on a call more than 10 percent of the time, then it is unlikely to meet response time goals of 90 percent of calls in 4 minute travel times, since a second, further away station will have to respond. A UHU of 5 to 15 percent is consistent with a goal of being there about 90 percent of the time.

Recommendation 25: Analyze the workload and UHU for all fire and EMS units. This can be a task of the planning unit, whose establishment was recommended earlier in this report.

Unit Staffing and On-Scene Complements – A major finding of this study is the low staffing levels on fire units in every area of the county. Although the minimum number of fire personnel needed per engine or aerial truck company is not in total agreement in the fire service, the total response complement (weight of response) is generally agreed on.

With its current number of career and volunteer personnel, HCFR is unable to assemble a sufficient first alarm fire suppression force for structure fires. To get the personnel it needs, additional equipment are typically called by incident commanders, which depletes the available resources that may be needed elsewhere. Another concern is that the number of volunteers who will respond is virtually unknown until after the fact. That incident staffing is uncertain seriously hampers the battalion chiefs who command an incident. From an incident planning perspective, it is difficult to develop an effective strategy if the number of responders is unknown. For volunteer units in busier areas, the concept of scheduling people has been successfully used elsewhere.

NFPA Standard 1500, *Fire Department Occupational Safety and Health Program* says that "…a minimum acceptable fire company staffing level should be four members responding or arriving with each engine and each ladder company responding to any type of fire." NFPA 1710 also recommends that fire suppression units be staffed with a minimum of four personnel. While NFPA 1720 does not specify minimum staffing by piece of apparatus for volunteer departments, it does identify minimum staffing levels on scene of an emergency incident. Regardless of the pay status of the people involved, the aforementioned staffing issues *must* be recognized as a significant safety consideration.

As they stand, unit staffing levels usually are too low to deliver the required number of personnel on-scene to begin interior fire suppression operations with the first unit. It is common that HCFR fire units respond with two or even one person. The incident commander must wait until other units arrive on the scene to begin interior operations, while the fire burns. To amass the necessary personnel, at least two and sometimes three units must arrive before operations can begin—if national and state safety standards are followed.

In the heavier populated suburban area, backup units arrive more quickly because the stations are closer together. In the rural area, it is not uncommon that 15 to 20 minutes lapse before other units arrive. Although we did not have the opportunity to observe an actual operation, experience tells us that firefighters are probably initiating interior operations before the required backups arrive.

The most common fire risk in Horry County is the residential structure. Although many structure fires are quickly extinguished by two or even three personnel, NFPA recommends a first-alarm force of 13 personnel. When units do arrive on-scene quickly, as it is likely to happen in the suburban area, fewer personnel may be needed because of getting to the scene before the fire spreads much. In rural areas where response times are longer, structure fires burn for a longer period before the first units arrive, and hence are larger and require more personnel. However, the current method of personnel staffing, especially for career units, does not consider the longer response times in rural areas. It also does not deliver the minimum number of personnel for the most prevalent risk, which is the single-family residential structure fire.

While the staffing of the unit determines its effectiveness, a more important criterion is how fast the total team can be assembled for a given incident regardless of the number of vehicles on which they ride. The *National Fire Protection Handbook, 18th Edition, Typical Initial Attack Response Capability Assuming Interior Attack and Operations Response Capability* (Table 10-2A), makes staffing recommendations based on the number of firefighters arriving on the scene of a fire depending upon the type of occupancy (low-, medium-, and high-hazard occupancy). The NFPA staffing recommendations by the type of hazard areas follows:

- **High-Hazard Occupancies** (schools, hospitals, nursing homes, explosive plants, refineries, high-rise buildings, and other high-risk or large fire potential occupancies):

  At least four pumpers, two ladder trucks (or combination apparatus with equivalent capabilities), two chief officers, and other specialized apparatus as may be needed to cope with the combustible involved; not fewer than 24 firefighters and two chief officers.

- **Medium-Hazard Occupancies** (apartments, offices, mercantile and industrial occupancies not normally requiring extensive rescue or firefighting forces):

  At least three pumpers, one ladder truck (or combination apparatus with equivalent capabilities), one chief officer, and other specialized apparatus as may be needed or available; not fewer than 16 firefighters and one chief officer.

- **Low-Hazard Occupancies** (one-, two-, or three-family dwellings and scattered small businesses and industrial occupancies):

  At least two pumpers, one ladder truck (or combination apparatus with equivalent capabilities), one chief officer, and other specialized apparatus as may be needed or available; not fewer than 12 firefighters and one chief officer.

NFPA 1710 Response Time Standards – The most widely recognized standard used in response time analysis for career or substantially career fire departments is outlined in NFPA 1710, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments*. NFPA 1710 was updated in 2004 and addresses benchmarks to be used by career organizations in the delivery of their services, including specific recommendations regarding unit staffing and response times. Response times for each of these objectives are to be achieved in 90 percent of a jurisdiction's responses.

Unlike many NFPA standards, NFPA 1710 is not based on much of a research foundation, but rather is the majority vote reflecting experience and opinion of a committee, within which there was much disagreement. There is no published information on the expected reductions in losses or injuries as a function of increased staffing and only a little on the effect of increased response times. Nevertheless, despite having been formulated largely on the basis of expert opinions and task sequencing (what must be done and how many it takes to do it) rather than research, NFPA 1710 has become the *de facto* benchmark for the emergency response community. However, NFPA 1710 has not been embraced by all groups, including the ICMA.

Response Time Standards for Emergency Medical Services – One method of measuring and evaluating response times is to count the number of patients who survive to the point of being released from a hospital. Although survival is not solely a function of the timeliness of care, time is crucial to a critically injured or seriously ill patient. Guidelines

published by Basic Trauma Life Support International (a widely known training institute) suggest that a trauma patient's odds of survival are directly linked to the amount of time that elapses between the injury and definitive surgical treatment.[37]

Prevention of death and disability secondary to acute coronary syndromes is also an issue of time. The American Heart Association 2005 guidelines for CPR and Emergency Cardiac Care emphasize the importance of shortening response time to suspected cardiac arrest patients.[38]

If brain tissues are deprived of oxygen, they will begin to die within four to six minutes. For that reason it is imperative to begin resuscitation measures as soon as possible. A recent study in Ottawa, Ontario, found that defibrillation was most effective if it was provided within six minutes of the patient's initial collapse.[39, 40]

The study also found the following:

1. Effectiveness decreased significantly as the interval between cardiac arrest and defibrillation increased between six and 11 minutes.
2. After 11 minutes, the odds of patient survival were extremely poor.
3. The odds of patient survival were doubled if ALS (paramedic) care was provided alongside BLS (layperson/police officer/EMT) defibrillation at all points prior to 11 minutes.[41]

The American College of Emergency Physicians noted that for every minute of cardiac arrest the chance of survival decreases up to 10 percent. EMS systems should attempt to achieve travel times of 3–4 minutes for medical first response and 6–8 minutes for advanced life support ambulance transport.[42]

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[37] Campell JE. (Ed.). 2000. Basic Trauma Life Support for Paramedics and Other Advanced Providers (4th ed). Englewood Cliffs, NJ: Prentice-Hall. pp. 24-26.

[38] AHA. 2005. Highlights of the 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Currents in Emergency Cardiovascular Care, 16(4), 1-25.

[39] Defibrillation is a critical intervention that can be provided by paramedics using manual defibrillators, or by laypersons, police officers, or EMTs using automatic external defibrillators.

[40] *USA Today* ran a series of investigative reporting articles on EMS services across the country (July 28-30, 2003). The title of one article was "Six Minutes To Live or Die." In this article, new research was cited from the Mayo Clinic that suggested the six-minute mark is when lives are saved or lost.

[41] Nichol G, Stiell IG, Laupacis A, Pham B, De Maio VJ, and Wells GA. 1999. "A Cumulative Meta-Analysis of the Effectiveness of Defibrillator-Capable Emergency Medical Services for Victims of Out-of-Hospital Cardiac Arrest." Annals of Emergency Medicine, 34 (4 pt. 1): 517-25.

[42] Pratt, F. D. & Overton, J. (2005). Ground Transport Ambulances. In Brennan, J.A. & Krohmer, J.R. [Eds.]. American *College of Emergency Physicians Principles of Emergency Medical Services Systems*, [3rd Ed.]. Boston: Jones and Bartlett Publishers.

Nationally, the closest thing to a response time standard for paramedic (ALS) transport units in an urban/suburban EMS system with automatic defibrillation-capable first responders is 8 minutes in 90 percent of the critical (i.e., life-threatening) calls. This *de facto* standard is an amalgamation of generally accepted criteria or rules-of-thumb. No standards-making consensus group has ever formally defined a standard for ambulance response times. Generally, various EMS systems interpret the idea of a standard in two ways. Some jurisdictions view the 8-minute standard to mean 8 minutes and all of the 59 seconds that follow; other jurisdictions view it as 8 minutes exactly. The latter, more stringent definition is suggested and is more consistent with the medical principles on which it is based.

Response Time Standards for Mostly Volunteer Services – The most widely recognized response time standard for volunteer and mostly-volunteer fire departments is outlined in NFPA 1720, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Volunteer Fire Departments*. NFPA 1720 was updated in 2004 and addresses benchmarks to be used by volunteer organizations in the delivery of their services, including specific recommendations regarding staffing and response times.

Table 23: Volunteer Staffing and Response Time Standards

Demand Zone	Demographics	Staffing and Response Times	Percentage
Special Risks	Authority Having Jurisdiction (AHJ)	AHJ	90
Urban	>1000 people/mi^2	15/9	90
Suburban	500-1000 people/mi^2	10/10	80
Rural	<500 people/mi^2	6/14	80
Remote*	Travel dist ≥8 mi.	4	90

* Upon assembling the necessary resources at the emergency scene, the fire department should have the capability to safely commence an initial attack within 2 minutes 90 percent of the time.

Source: NFPA 1720, 2004 Edition

Recommendation 26: Establish level of service standards for the suburban and rural districts based on their risks. Include response time goals as well as the weight of response and assess how well the goals are being met by collecting and analyzing incident data. As the dividing line, we recommend Highway 701 (S) on the south and Highway 905 on the north. Under the proposed plan, those areas west of HWY 701 and 905 will be primarily volunteer while those areas east of this line be primarily career.

Table 24 depicts the NFPA standard with four-person crews. Horry County should develop a similar standard using the three and four-person crews we recommend for various units.

Recommendation 27: Establish a three-person crew as the department's minimum staffing for volunteer engines (and ladders) county-wide and career units in the suburban area. A four-person minimum should be established for career units in the rural area where response times are considerably longer. In these areas career crews will also augment the volunteers, who operate with a limited number of personnel.

Table 24: HCFR Structure Fire Response Complement vs. NFPA Guidelines

Hazard of Occupancy	NFPA Guidelines	HCFR
High-Hazard	4 Engines 2 Ladder Trucks 24 Firefighters 2 Chief Officers	5 Engines 1 Ladder 2 Tankers 1 Heavy Rescue 1 Medic 1 EMS Supervisor 2 Battalion Chiefs No Minimum Staffing Standard
Total	**26**	
Medium-Hazard	3 Engines 1 Ladder Truck 16 Firefighters 1 Chief Officer	5 Engines 1 Ladder 2 Tankers 1 Heavy Rescue 1 Medic 1 EMS Supervisor 2 battalion Chiefs No Minimum Staffing Standard
Total	**17**	
Low-Hazard	2 Engines 1 Ladder Truck 2 Firefighters 1 Chief Officer	3 Engines 3 Tankers 1 Heavy Rescue 1 Medic 1 EMS Supervisor 1 Battalion Chief No Minimum Staffing Standard
Total	**13**	

Recommendation 28: Improve the weight of response such that a minimum of 13 personnel (12 firefighters/officers and 1 battalion chief) can be delivered anywhere in the county on a first-alarm structure fire. As a general rule, EMS crews should not be considered part of the minimum since their primary responsibility is medical care.

Recommendation 29: In busier stations where volunteers are the sole responders, or responsible for at least one major unit, establish duty schedules for volunteers. Volunteers often prefer the duty schedule because it allows them to manage their time more effectively. For commanders and planners, the duty schedule allows them to know how many personnel are available and when. Scheduling volunteers also lets administrators know where service gaps are and where additional recruitment efforts are needed.

Automatic Residential Sprinklers as an Alternative – Unless the county takes a different tack, additional fire suppression resources will be needed as it continues to grow. The cost to provide these resources, which are already expensive, will be more so in the future. If volunteer participation continues to decline and more career personnel are added, the cost will be even higher. To counteract higher costs, communities are beginning to recognize benefits of requiring residential sprinklers, stronger prevention programs, and "Make the Right Call" programs, the latter to make sure that the calls for service as appropriated. Though prevention was outside the scope of this study, some points about sprinklers should be considered as part of station planning.

At the time of this study the county did not have a residential sprinkler ordinance. South Carolina code does not require sprinklers except in new high-rise buildings, places of public assembly and certain high-risk occupancies. Reportedly, there are many high-rise residential structures in the Grand Stand region that are still without automatic sprinklers since they were built prior to existing codes and have not been upgraded voluntarily by building owners. For high-rise buildings, the county should work hard to get them retrofitted and bring them up to the latest standards. Tax breaks and other incentives are a good way to get owners to voluntarily comply and the county could offer a grace period.

Unless something unforeseen occurs such as a major economic downturn, the county will continue to grow and new development will move westward. Without a residential sprinkler ordinance for new residential construction, the county will have to expand its fire service to meet the growth. Expanding water treatment facilities to meet the additional need as well as ISO and AMW requirements will also be expensive.

Efforts at the state level to require residential sprinklers have met severe resistance and it is unlikely that a state residential sprinkler law will be enacted anytime soon. To improve public safety and contain its costs, the county should attempt to pass a local sprinkler ordinance.[43] At last count there were over 160 local governments in the U.S. which have instituted such requirements. Frederick and Carroll County, MD have enacted such legislation and both are

[43] We did not investigate the legality of such a move. However, as a home-rule charter form of government, Horry County likely has some authority not afforded to other municipalities in the state.

similar to Horry County with their large contingent of volunteer firefighters and adequate staffing is a perennial issue. In addition to the obvious advantages that residential sprinklers provide for life safety, a recent study showed that residential sprinklers also provide long-term monetary advantages to the homeowner:

> "Over the 2002 to 2005 study period, houses equipped with smoke alarms and a fire sprinkler system experienced 100 percent fewer civilian fatalities, 57 percent fewer civilian injuries, and 32 percent less direct property losses and indirect costs resulting from fire than houses equipped only with smoke alarms. In addition, homeowners of dwellings with fire sprinkler systems received an added bonus of an 8 percent reduction in their homeowner insurance premium per year, according to the ISO. This report finds the monetized value of a residential fire sprinkler system, over a 30-year analysis period, to yield homeowners $4994 in present value benefits."[44]

We highly recommend that the county review the current literature on residential sprinklers and consider them as an alternative to expanding the level of protection in new growth areas. Residential sprinklers are especially attractive when large developments are constructed in areas that are sparsely populated, and that might require adding a new fire station. At a minimum the county should put together a task force of community leaders, elected officials, and fire personnel to study the issue and report its findings to the county Council.

Recommendation 30: Consider legislation to require automatic sprinklers in all newly constructed residential properties, including single-family homes. An alternative is to require them only where there is a major development in an area not served by fire stations at present.

Career and Volunteer Operations

The transition of the county from independent volunteer fire companies to a combination department has progressed fairly well considering the county's tremendous growth. There are still issues with command and control and there are not enough volunteer officers. The rank structure on the volunteer side is also not consistent and there are too few battalion chiefs and company officers on the career side. The fire department also has a policy where career stations are staffed 24/7. The entire system could be more effective (and efficient) if some stations were staffed by career staff on weekdays. Personnel accountability at an incident is also a problem because volunteers often respond directly to the scene, and they are issued personal radios.

The company officer rank structure varies across the county. On the career side, a captain is designated as the station commander and also manages one shift while lieutenants reporting to

[44] *Benefit-Cost Analysis of Residential Fire Sprinkler Systems*; U.S. Department of Commerce Office of Applied Economics, National Institute of Standards and Technology Building and Fire Research Laboratory, Gaithersburg, Maryland. 2007

him manage the remaining two shifts. Two battalion chiefs on each shift are responsible for the overall operation of all stations, and a shift EMS captain coordinates the stand-alone EMS units. Where double companies (engine and ladder) are located, only one officer is assigned to the station and two firefighters are assigned to the aerial ladder without a supervisor. Having only one officer to supervise two units at an incident is not a considered good practice.

On the volunteer side, not every station staffed by volunteers has an officer (volunteer or career). The department does have a policy on the ratio of volunteer officers to volunteers but the standard is not followed in practice and decisions about how many volunteer officers to appoint and where, appear to be arbitrary. Also, there are no department standards to be a volunteer officer beyond the minimum state-level standard for a volunteer firefighter and there are no guidelines for volunteer officers to be considered active. One volunteer officer is a lieutenant, 5 are captains, and the remaining 11 are district chiefs.

Table 25 shows the HCFR stations where volunteer officers are assigned. Also depicted is whether the station is mostly-career, mostly-volunteer, all-career or all-volunteer.

Table 25: Service Levels and Volunteer Officer Positions by Station

Station	Service Level	Volunteer District Chief	Assistant District Chief	Volunteer Captain	Volunteer Lieutenant
1	Mostly Career	1[45]			2
2	All Volunteer		1	1	2
3	Mostly Career				
4	Mostly Career			1	2
5	All Volunteer			1	
6	Mostly Career				
7	Mostly Career	1			
8	Mostly Career				
9	All Volunteer	1			
10	All Volunteer	1[46]			1
12	All Volunteer				
13	All Volunteer	1		1	
14	All Volunteer			1	
15	Mostly Career				
16	All Volunteer			1	
17	All Volunteer	1	1	1	
18	Mostly Career			1	2

[45] The district chief depicted for Stations 1, 4, 20, and 39 is the same individual. These stations are mostly career or all-career stations.

[46] The district chief depicted for Stations 10 and 28 is the same individual. Both stations are all-volunteer.

Station	Service Level	Volunteer District Chief	Assistant District Chief	Volunteer Captain	Volunteer Lieutenant
19	All Volunteer	1	1	2	
20	Volunteer with an all-career medic unit				1
21	All Volunteer	1	1		
23	Mostly Career				
24	Mostly Career				
25	Career medic only station				
26	All Volunteer			1	1
27	All Volunteer			1	
28	All Volunteer	1	1	1	
29	Career medic only housed in Conway Station 2				
30	Career medic only station which is housed at Myrtle Beach S-1				
31	Career medic only in Surfside fire station				
32	Career medic only stationed in N. Myrtle Beach				
34	Career medic only in Red Bluff				
35	Career only medic in City of Loris				
36	Career medic only in Myrtle Beach Fire Station 3				
38	All Volunteer	1	1	1	
39	Mostly Career				2
40	Mostly Career				
41	Vacant station at Iron Springs				
43	All Volunteer			1	1
45	Under construction in Carolina Forrest				
	Total	**10**	**6**	**15**	**14**

Although the HCFR has 45 volunteer officers in the system, not all of them are active.

To improve the level of supervision for career and volunteer personnel, and to reduce friction between career and volunteer personnel, the rank structure should be consistent. It should

also make sense organizationally. For example, a career captain should be the station commander at all-career or mostly-career stations and a volunteer captain should be the person in-charge at all-volunteer or mostly-volunteer stations. Every suppression unit that responds should also have an officer or acting officer.

Recommendation 31: Standardize the career and volunteer rank structure. The deployment schedule provided at the end of this chapter shows the proposed officer staff for each station.

Where volunteers are concerned, the system in Horry County is totally dependent on the time it takes volunteers to acknowledge the call and respond, not whether they have a minimum number of personnel on the apparatus. When a volunteer unit is dispatched to a call, it is given two minutes to respond. If the unit does not respond, its station tones are re-activated again and another two minutes is given. If the station still does not respond following the second alert, the next closest station is alerted and the same process begins anew. Response times can be significantly delayed, and even more soothe arrival of adequate forces on the scene when their staffing is not tracked as part of the dispatching process.

In times past the county assigned career personnel to volunteer stations during weekday hours when volunteers are least likely to be available. The practice was stopped although no one could remember why. To enhance the overall system and to make the best use of the available volunteers, the county should reinstitute weekday career staffing at volunteer stations. In several stations there are sufficient volunteers to provide night and weekend response but not 24-hour coverage. Assigning career personnel during weekdays is less expensive than 24/7 coverage. .

Recommendation 32: Consider weekday career staffing at several HCFR stations. Currently all career staff are assigned to 24-hour shifts. The proposed deployment schedule includes weekday-only career staffing at several stations while others remain covered by career staff 24/7.

Incident Command and Control – There are several problems in incident command that could affect effectiveness and safety of firefighters at incidents.

There are reported to be significant differences in the manner in which incident command and personnel accountability is conducted on the various shifts. That officers are not required to attend some type of command school is a contributing factor as is the absence of up-to-date policies. A larger than recommended span of control for the battalion chiefs is also a contributing factor.

Career battalion chiefs in command of each shift are the incident commanders for structure fires and other incidents where multiple companies respond. Career assistant chiefs rotate on-call responsibility and respond to second alarms, or when requested by the incident

commander. The system works well with several exceptions: there are not enough battalion chiefs to cover the county; volunteer district chiefs do not have command vehicles. However, the fire department does use a 'Textcaster' system with cell phones to notify off-duty chief officers of important happenings.

A serious (working) fire in a multiple dwelling/apartment or commercial occupancy routinely gets a second alarm assignment, mostly to get additional personnel. Even before a fire is dispatched as a second alarm the second on-duty battalion chief is responding to assist the first battalion chief, either as the safety officer or the operations chief. This approach is a common one used by other departments. However, the county is over 1100 square miles and the entire county is left uncovered for a second incident when the two chiefs are on one incident.

In the early 1980's a volunteer position of district chief was created. District chiefs are considered the senior officer at the stations, a majority of which were almost entirely comprised of volunteers. New district chiefs are not being appointed by the department and only 11 remain; one of these is considered acting. A while back a trial concept of a 'super district' was created where a volunteer district chief is to coordinate the activities of volunteers at more then one station. Included in the 'super district' trial program are Stations 1, 4, 20, and 39. Reportedly, the program has had some success. However, the program did not alter the overall management structure of HCFR, and it did not change how volunteer commanders are integrated into the department's command structure—which is really needed.

Simultaneously occurring structure fires, although not a daily occurrence, do happen with some regularity. This is especially true during the summer months when thunder storms frequent the county. HCFR should have adequate commanders available to handle two simultaneously working fires, one of which may be a second alarm or greater. As it is organized and staffed now, these resources are not available. There should also be a system in place to recall off-duty battalion chiefs, albeit they do not need take-home vehicles, which at one time was the department's policy.

To improve daily management and cover the entire county, a minimum of four battalion chiefs should be on duty at all times. Four battalion chiefs will also improve the management span of control issue discussed in chapter 2, Management and Organization. Under this scenario there is an opportunity to elevate the contribution of volunteer chief officers by promoting several to battalion chief and have them equal in rank to a career battalion chief.

During nighttime hours in the rural district, two volunteer battalion chiefs will be the primary incident commanders, with four career battalion chiefs' on-duty during weekdays. To make the system work, volunteer battalion chiefs should be issued command vehicles, or they

should use the vehicle assigned to the district they are covering. When qualified, a volunteer battalion chief should also be permitted to cover for career battalion chief when they are on leave, which would reduce overtime costs. As stated earlier in the report, a requirement should be that volunteer officers must meet the same training standard as their career counterparts of the same rank.

Recommendation 33: Increase the number of battalions from two to four and staff the two new battalions with a career chief weekdays and volunteers at night and on weekends. Working cooperatively with the volunteer battalion chief, the career battalion chief will coordinate the training and operations of the battalion and be the battalion commander (establish) policy). A career captain or volunteer battalion chief could then act as battalion chief when the career battalion chief is scheduled off. At a minimum, at least two of the four battalion chiefs on duty should be career officers.

Volunteer Responses From Home – Currently volunteers (and off duty career personnel if they choose) are permitted to respond directly to the incident scene in their personal vehicle. Likewise the district chiefs also respond in their own vehicle. Although the county has changed and become more populated, volunteers often respond directly to the scene, not to the station.

Allowing volunteers to respond directly to the incident scene from their home or other location is a common practice in very small communities. It is less common in larger organizations and those in communities with high traffic volumes. South Carolina laws permit volunteers to use red lights and sirens in their POV. However, the practice increases the risk of accidents, especially in populated areas of the county. Personnel accountability, which is important for firefighters, is also being affected by this practice.

Even when volunteers arrive in sufficient numbers in their POV, problems are created for the incident commander, who must decide how to safely use individual firefighters instead of cohesive, adequately staffed units. Reportedly, volunteers are also leaving the incident without notifying the incident commander, a practice that raises issues about whether the existing accountability system is actually working.

Recommendation 34: Reevaluate the policy where volunteers are permitted to respond directly to the scene in their personal vehicle. At a minimum, consider eliminating the practice in the suburban area. At the same time, eliminate the use of red lights and sirens on POVs, particularly in suburban areas where traffic volumes are heavier.

Accountability is also an issue at the volunteer stations where security systems are somewhat outdated. Using new technology, the county can improve security at fire stations and use the same technology to improve incident accountability.

Recommendation 35: Evaluate the technology for swipe-card security and personnel accountability using computer technology. Personnel should be able to log-in using their swipe card, which would then automatically be loaded to the incident information in the CAD. Testing of different products should be performed before deciding on a vendor. The same technology should be adopted for station security systems.

Portable radios are currently issued to volunteers on a case-by-case basis at each volunteer station. In career stations, portable radios are available to each person with the portable radios assigned to positions on the apparatus, which is the most common method. However, county volunteers believe they should be issued their own radio (for safety reasons) and VIP funds are used to purchase the extra radios requested by volunteers.

Numerous individuals reported that portable radios were not always available on-scene when volunteer apparatus arrived since the individuals who responded may not have been issued a radio. In our opinion, there is a significant safety issue with the current volunteer radio policy since personnel do not always have a portable radio inside the structure. In our opinion, the concern expressed by volunteers who believe they should have a personal radio (for safety reasons) is significantly less than our concern that personnel are operating in a hazardous environment without a portable radio. Under the current policy, the county is spending unnecessary money to buy extra portable radios it does not need.[47] There are also accountability issues when portable radios are issued to individual firefighters.

Reportedly, volunteers often advise the dispatch center by portable radio that the station is responding to the incident when, in fact, they are only responding to the station to get the apparatus. If this is true, it is serious legal issue for the county. It also creates problems of incident reporting since response time data, which is needed for analyses, is tainted. If the practice is occurring, it should be stopped immediately and those who improperly report that a unit is responding should be counseled.

Recommendation 36: Discontinue the practice of issuing portable radios to individual firefighters. Instead, make sure every first line unit has at least four portable radios. The current process is inefficient and it is unsafe. The exception should be volunteer and career chief officers, who may be required to respond to the incident from home.

Mutual Aid – The mutual aid system is working well and Horry County is fortunate to have a number of good departments to rely on. The county has also adopted a policy of contracting for mutual aid such with communities such as Loris and a number of other

[47] The analysis of volunteer no response rates later in this section shows that portable radios are being issued but not used in most instances.

municipalities. This is a good approach and it reduces the county's cost of delivering service. Terms of the current mutual aid contracts and their expiration dates are depicted in Table 26.

Table 26: Horry County Mutual Aid Contracts

Agency	General Terms	Cost	Contract Expires
City of Conway	Fire suppression to areas within the corroborate limits and a previous response area adjacent to the city limits; the initial response is limited to one engine company and manpower	$165,000	May 2008
North Myrtle Beach	Fire suppression to area to the corporate limits south, Intra-coastal Waterway on the west, and the Little River Inlet on the north	$58,308 annual plus	August 2007
Myrtle Beach	Fire suppression; one engine and one ladder on first response	$200,000 annual	July 2008
Surfside Beach	Automatic aid to closest fire boxes	$0	No contract
Georgetown-Murrell's Inlet	Fire service tax district that provides EMS and fire service to southeastern Horry County	$150,000 annual plus one-time $500,000 for a new station	July 2017
Loris	Fire suppression; five miles+/- from the station	$74,509 increased by 5 percent annually	March 2011
Tabor City, NC	Fire suppression automatic aid to northern portions of the County west of Loris to Iron Springs Road	$13,00 annual (2008)	June 2011
Fair Bluff, NC	Fire suppression and hazmat	$10,000 annual	March 2008

As we understand it, there are ongoing discussions between various agencies to merge the centers into one; however, nothing concrete is in the works. Operating a single dispatch system will benefit not only the county but the various subdivisions as well.

Recommendation 37: Continue the discussions with the other local governments to merge the multiple dispatch centers into one, county-operated center.

Emergency Medical Services

The county's EMS system is working well and the leadership is excellent. However, the county only has sixteen medic units to cover 1100 square miles. Unlike fire services, which are provided only to the unincorporated areas, EMS is provided county-wide. HCFR personnel are required to be cross-trained as firefighters and medical providers. The transition to a cross-trained force has progressed well since EMS and fire were first merged; however, the organizational culture is still biased toward fire.

Considerable improvement has already been made to the EMS system as the fire department worked to institute an air medical transport system. The air transport system delivers severely injured patients to a Level I Trauma Centers. Previously, patients were transported by land to the closest county medical facility and then to a trauma center later. Omni Flight now has a helicopter stationed at MB airport fulltime, which is excellent. Level I trauma centers are available in New Hanover, NC; Medical Univ. of SC (Charleston), and; McCloud Hospital in Florence, SC.

Seven of the county's 16 EMS units are located independently from fire stations. Facilities that are EMS only include: Stations 25, 30, 31, 32, 34, 35, and 36. Minimum staffing for EMS units is one paramedic and one EMT. One or both of the personnel may be cross-trained as a firefighter. . Each EMS shift is commanded by an EMS supervisor. EMS supervisors are equivalent to fire captains under the current pay schedule.

The requirement to be a firefighter and an EMT or paramedic is a point of contention in the department and a number of personnel have resigned because they do not want to be firefighters. In addition, EMS responders who are not cross-trained are compensated for hours worked over 40-hours each week; consequently their annual salary is considerably higher. Less than a dozen EMS-only personnel remain from the merger who desire not to be firefighters. It is to the county's financial benefit to have cross-trained EMS providers and firefighters because the U.S. Department of Labor, Wage and Hour guidelines allow firefighters to work up 212 hours in a 28-day period before premium overtime is paid.

Recommendation 38: Continue to require personnel to be cross-trained as firefighters and medical responders.

During peak-load tourist season additional EMS units are added to handle the increased demand. The additional units are staffed by HCFR personnel working overtime. To add the units at less cost and vary the hours of operation to meet the actual increase of demand, the county should consider hiring paramedics (and EMTs) as part-time employees. A number of departments in the area have qualified personnel who could be available and the cost per hour will be less than paying overtime. Such a program could also provide an opportunity to recruit individuals who are considering a career with HCFR.

Recommendation 39: Hire part-time paramedics and EMTs to staff the extra EMS units needed during peak-demand periods.

At the time of this study, two additional units are being added to improve response times. However, the county's very large rural area has low demand while the suburban area is more populated; demand is considerably higher in the suburban area as well. Adding enough medic units to cover the entire county would be inefficient; therefore, alternative solutions are needed.

To meet the desired response time goal of 8-minutes for ALS, the 18 EMS units currently authorized are still not enough to cover the entire county. To improve the system and do it efficiently, the county should consider paramedic engines as an alternative to more transport units.

Adding a cross-trained firefighter/paramedic to selected fire units has been effective elsewhere and it can work in Horry County. The fire department has Life-Pak 12 cardiac monitors and ALS equipment bags on many of its units. We discussed the idea with the medical director and fire chief and they were generally supportive of the idea. The added person that would increase minimum staffing from two to three will also improve the weight of response on fire calls mentioned earlier.

Recommendation 40: Introduce the paramedic-engine concept and select several units for a pilot program. The priority for paramedic engines should be those rural stations where EMS units are not located. The deployment schedule provided at the end of this chapter includes a recommendation for paramedic engines at several stations.

As a matter of policy, the county should deploy some type of medical service in every new facility it brings on line. EMS calls will continue to increase and they will be the area of highest demand in the future. For these reasons medical service should be available to the public from every HCFR facility. For all-volunteer stations where a medic unit or paramedic engine is not available, a light-duty vehicle with medical equipment should be located. Two volunteer personnel responding on a light-duty vehicle is less expensive. Volunteers are also more apt to get two persons for EMS calls rather than the three that we recommend for fire responses.

Recommendation 41: Provide EMS service from each new station the county builds. At the same time, consider adding light-duty EMS response vehicles to the all-volunteer stations.

Shift Supervision – The quality of EMS supervision overall is excellent. There are no reported issues regarding EMS delivery and the medical director reported that he is very pleased with the quality of care delivered by paramedics. Three EMS supervisors (captains) are responsible to oversee daily operations. Organizationally, EMS supervisors report to the EMS battalion chief. Only one EMS supervisor is on-duty. Supervisors work the same 24/48 rotating schedule as other shift personnel.

In addition to their activity of responding on the more serious EMS calls, supervisors investigate possible protocol violations and they resolve other QA problems. They also respond to structure fires, vehicle accidents with entrapments, and they investigate exposure cases. Combined, these activities take considerable time and supervisors have a very high workload. The size of the county and long travel times make it difficult to manage the system and the span-of control is too high. Although EMS supervisors are assigned to Station 40, they spend a

majority of time on the road. Shift changes occur at headquarters where the off-going and on-coming shift supervisors exchange important information.

A problem with the current system is that EMS supervisors rarely arrive early enough in the incident to supervise paramedics, or make a difference in the operation. To cover the entire county adequately, four supervisors are needed. Even then response times will be long but they will be greatly improved over the current times.

Training is an important part of EMS. Currently, EMS supervisors have little time to provide training to personnel on their shift. Instead, most training is provided by EMS instructors on day work, which typically requires overtime for paramedics to attend. If the system were improved to include four EMS supervisors, more of the training can be conducted during work hours, which will save overtime. Organized similar to the four battalions we recommend for fire operations, one supervisor will be the EMS shift commander and three will be lieutenants.

Recommendation 42: Increase the number of on-duty EMS supervisors from one to four. One of the four should be a captain with the remaining three as lieutenants. Deployment of the EMS supervisors should mirror a similar geography to that of four battalions.

Other Issues Involving EMS

During this study the following issues were also raised. Although they are not significant, they merit reporting.

EMS Training Documentation – HCFR maintains good records on the medical training and continuing education for its career staff. Despite repeated attempts however, it does not have the same information for volunteers, despite the administration's repeated attempts to get the information

Training Level Identification – There is not a system in place to identify personnel and their 'level of medical training' at the scene of an incident. A response by personnel from home to an incident scene may result in them not being immediately recognized by others. This could result in a liability situation for the county if the individual performs a skill they are not trained for. One way to address the situation is to include a decal on helmets to signify the level of EMS training completed.

Medic Unit Alerting Procedures – Numerous individuals commented about the alerting system for medic units that also alerts volunteers. All of the county's medic units are currently staffed by career personnel and the continual tones for medic calls are making volunteers turn off their pagers and monitors, especially at night. The EMS alerting system should be updated to activate only in the station where the medic unit is located.

Volunteer Concerns, Participation and No Responses

Volunteer participation has dwindled in recent years, not only in Horry County but nationally as well. For the county to maintain a reliable volunteer component, recruiting and maintaining qualified volunteers must be a high priority going into the future.

In 1984, the HCFR was established by an ordinance of the Horry County Council to provide fire protection to the unincorporated areas of Horry County. Prior to that time, various communities had established volunteer fire departments to provide fire protection to their communities. It is common across the country for volunteer fire departments to be independent corporations where they govern by way of their own by-laws and elect board members.

Have Horry County Volunteers Been Forgotten? – Although the volunteers have been merged into HCFR, several volunteer corporations still exist. In most stations there is not a formal organization or rank structure for the volunteer company, which we addressed with an earlier recommendation. Where volunteer officers have been appointed by the administration, they are too few in numbers. Likewise, 12 volunteer stations have five members or less, making it difficult for them to provide consistent service.

Volunteers in Horry County believe they are a 'forgotten lot' and many of the issues they presented to us supported this contention. Intentional or not, input by the county's volunteers is not being considered to the extent necessary for them to feel included. Regular communication between the volunteers and the current fire administration is poor overall; in many instances it is non-existent.

There is a disjoint in the fire administration's future vision of the organization and that of the volunteers represented at the meeting. The exact reason is unclear but in most cases it is because an administration is not articulating its ideas and vision to the volunteers effectively. Other causes are probably the limited interaction between the two groups or managers (battalion chiefs and captains mostly) subverting the administration's vision. In our experience it is not unusual that mid-level officers keep the pot stirred to create disharmony.

That volunteer numbers have dwindled is not unique to HCFR. To be a successful volunteer system, recruitment and retention must be a priority, especially for the department's administration.

> "There is no single reason for the decline in volunteers in most departments. However, there is a universal consensus that skilled department leadership is a key to resolving the problems. Retention and recruitment problems usually can be traced to several underlying factors: more demands on people's time in a hectic modern society; more stringent training requirements; population shifts from

> smaller towns to urban centers; changes in the nature of small town industry and farming; internal leadership problems; and a decline in the sense of civic responsibility, among other factors. Although some regions are more affected than others, and the problems and solutions vary across regions, even within States and counties, volunteer retention and recruitment is a problem nationwide. Specifically, it is a local issue and must be dealt with locally."[48]

Although the volunteer system includes over 200 personnel, few are officers and only 80 are considered to be active responders. The fire department does not have a standard definition for an 'active volunteer', thus there is likely to be disagreement on how many active volunteers there are and the pay-per-call system does not require a minimum number of responses.

There are no standards for selecting volunteer officers. Officers are appointed by the HCFR administration based on the recommendation of the volunteers at the station. The selection process is questionable and decisions mostly arbitrary as they are most often predicated on the personal attributes of the individual, not on their professional qualifications. This is not an uncommon problem in volunteer systems albeit most of the more progressive departments are moving to a selection process that incorporates a specific criteria and applies standards. The volunteers we met with recognized the need for these standards and they generally embraced requiring them, especially for promotions. Going forward, the implementation of officer standards is likely to be a two-edged sword: fewer, but better trained volunteer officers. A major report echoed similar sentiments:

> "Many departments report that the requirements of today's training standards are too demanding and cause members to quit. At the same time, many volunteers feel that the higher standards have increased the professionalism and pride of the volunteer fire service. The great dilemma is that while the standards have increased professionalism and safety (which help retention), they have created a major barrier for recruitment and retention because the requirements are very time demanding."[49]

During the project we participated in a three-hour discussion with volunteers. The purpose was to solicit opinions about the most important issues facing volunteers (and HCFR). The meeting was conducted at the M.L. Brown Public Safety Complex during evening hours when most volunteers can attend. Attendance was excellent as 28 volunteers, most of whom are active responders, showed up. A cross-section of ranks and experience (time as a volunteer) was represented in the group. Many of the concerns and ideas expressed by the volunteers were on target and they were essential to this project.

[48] Retention and Recruitment for the Volunteer Emergency Services: Challenges and Solutions; U.S. Fire Administration; FA-310/May 2007; pg. 2

[49] Ibid. pg. 79.

Considerations to improve the volunteers and their capacity to serve the county should include the following:

- Email should be made available to volunteers as a way to improve communication
- Encourage the volunteers to create a formal organization to represent their particular interests
- The volunteer rank structure should be consistent with the career structure
- Training requirements for volunteer officers should mirror those of career officers of the same rank
- Training opportunities for volunteers should be expanded by adding staff to the fire training division; for their part, volunteers must take advantage of the training afforded to them
- An apprenticeship program developed by the volunteers should be fully explored and implemented
- The intake process for volunteers is too restrictive; while we understand the requirement for state-mandated training such as the OSHA 80-hour class, some volunteers who may not be able to fight fires should be allowed to participate in non-operational functions
- The fire chief should meet on a regular basis with groups of volunteers, and the senior command staff should do likewise
- A primary tenet of the HCFR system should be that it is a 'combination service'; any volunteer or career member who is unable to operate within such a system, or who undermines the relationship between these two important groups should suffer the consequences!
- Volunteers need to cooperate with the administration by providing and updating personnel training records and information when it is requested
- The county should review the state's workers compensation policy to make sure volunteers are not adversely affected if they are injured while volunteering
- The fire department should enhance the recognition programs for volunteers; things to consider are annual awards programs, Class A uniforms for volunteers and ID cards.[50]
- More emphasis is needed on volunteer recruitment and retention, including whether the current pay-per call system to decide if it is an appropriate retention tool

[50] Up-to-date identification cards should be mandatory for every member of the department.

- The volunteer coordinator's position should assume more responsibility for recruiting new personnel and getting volunteers into the system
- The county should take the lead in volunteer recruiting efforts

If additional opportunities are provided and improvements are made to attract and retain volunteers, those in the volunteer system need to step up to the plate and become more active, especially in officer positions. Solving problems together and working for the greater good of the organization will be paramount in this endeavor. Unfortunately, there are a few who discredit any programs offered by the fire administration and work against change. To be a successful group that is considered relevant, volunteers must establish themselves under the direction of insightful and forward-looking leaders working to solve problems.

Recommendation 43: Convene a working group of active volunteers to work with the HCFR administration and county officials on matters considered important to volunteers.

Volunteer Station 'No Responses' – No responses by volunteers is a serious issue. In studies of other volunteer departments, the project team is not aware of any with such high percentages of 'no responses'. The impact of no responses on service levels in the rural sections of the county is particularly troubling since it is this area that relies most on volunteers. Table 27 shows the breakout of no responses in all-volunteer companies by time of day. The yellow-shaded (bold) segment shows the highest percentage of no responses for each volunteer station.

Table 27: Percentage of No-Responses by All -Volunteer Stations

Station	8am-5pm	5pm-12am	12am-8am	Average
2 Little River	46	40	**50**	45
5 Wampee	**78**	59	50	62
9 Antioch	**71**	62	62	65
10 Ketchup Town	79	76	**82**	79
12 Nixonville	43	**56**	52	50
13 Longs	**59**	33	52	48
14 Shell	73	75	**87**	78
16 Cates Bay	57	42	**62**	54
17 Mount Vernon	64	41	**71**	59
19 Cherry Hill	**48**	42	28	39
20 Scipo	**43**	38	42	41
21 Maple	59	77	**92**	76
26 Goretown	**55**	35	48	46
27 Allens	89	74	**94**	86
28 Joyner Swamp	62	41	**69**	57
38 Floyds	**46**	36	**46**	43
41 Iron Springs	95	89	**97**	94
43 Lee's Landing	64	43	**65**	57

Station	8am-5pm	5pm-12am	12am-8am	Average
System-Wide Average	56	46	57	53
System-Wide Median	63	42	64	56
Number of Calls Sampled	**7486**	**5621**	**2935**	**5347**

In 10 stations the highest no response percentage occurred during the nighttime hours of 12-8am while in 7 stations no responses were higher during the daylight hours of 8am to 5pm. Only Station 12 (Nixonville) had a higher no response during evening hours (5pm to 12am). Station 38 (Floyds) had the same no response percentage for daylight and nighttime hours. It is very unusual in volunteer systems for no responses to be higher during nighttime hours, since volunteers are most available during non-work hours. Information was not available to determine the reason for this anomaly.

There is a correlation between the number of volunteers at a station and the no response rate, not surprisingly. Stations with 10 or more members had a no response rate average of 48 percent while stations with fewer than 10 members increased to 66 percent. In those stations with fewer than five volunteers, the no response percentage increased to 68 percent.

There are no standards to stipulate the number of active volunteers for a station to be effective. Our experience is that when fewer than 15 active volunteers are on the rolls, it is difficult to sustain operations. Where the number is less than 10, career personnel are often necessary to augment volunteers. As it stands, the county has too many stations with less than 10 active responders and immediate action is needed to improve the situation. Standards for the minimum number of active volunteers (and officers) for a station to remain all-volunteer are needed. There is also need for a minimum staffing standard for a fire unit to respond.

Recommendation 44: Establish a definition for an active volunteer and increase the level of participation at the all-volunteer and mostly volunteer stations. The resource deployment schedule provided later in this chapter provides an estimate on the number of active personnel necessary to staff each station where volunteers are assigned.

Volunteer Recruitment/Retention and Incentives – Efforts to attract and retain volunteers have not been fruitful. Elected officials and the fire administration both recognize the importance of a strong contingent of active volunteers and they expressed concern over the volunteer staff available at many of the county's stations. However, very little money and time is spent to recruit new volunteers and there is very little coordination between the volunteer community and the fire administration on recruiting new members.

A county-paid volunteer coordinator is in place, but most of his effort is directed at coordinating medical exams and physical agility testing required by the state. The primary

responsibility of the coordinator is to oversee the intake process for new volunteers, which includes the application process and coordinating the entrance physical and agility test.

Prior to his assignment as the volunteer coordinator, the incumbent was a career battalion chief. Volunteers are also required to pass a physical ability test (PAT), which is pass/fail. Career personnel must pass the PAT within a minimum time. The volunteer coordinator's position is currently a career uniformed position; however, under the organizational structure recommended in chapter 2, the position can be civilianized.

Recommendation 45: When the incumbent volunteer coordinator retires, civilianize the position.

A major complaint of the volunteers is the long time required to get processed into the system to become an active responder. There are also concerns about the limited number of applicants who pass the required tests. We reviewed data for the past two years on the number of applicants and those who actually made it into the system. It is not clear why so many applicants are being disqualified and the numbers suggest there are problems either in the intake process or the requirements to be a volunteer.

HCFR has an excellent matrix that depicts the application process and the requirements to become a volunteer. The application process, medical and physical requirements are also posted on the department's web site, which is excellent. The procedure is a good one and it is well thought out. However, the process is clearly working too slowly and a conscious effort must be made to speed it up. Data should be routinely reviewed on the number of applicants and the reasons they were disqualified. Analysis of the data will help the fire department in its recruitment campaigns.

The fire department does not have volunteers in any support capacities so every volunteer must be cleared to be an active responder. There are many opportunities for individuals to support the department's mission and HCFR is missing a golden opportunity to use qualified individuals who want to volunteer but are not be physically or medically qualified or desirous of being a firefighter.

Recommendation 46: Convene a working group of volunteers and fire officials to evaluate and speed up the intake process for volunteers. At the same, develop a position description for volunteer support staff and actively recruit individuals to work in support functions.

A novel idea for the department to consider under the proposed reorganization with four battalions is for the career and volunteer battalion chiefs in the rural area (where response is heavily dependent on volunteers) to have chief officers assume the lead in recruitment and develop recruitment programs for their battalion.

Like most jurisdictions, retaining qualified volunteers is also a problem for the county. To its credit the county has implemented a number of incentive programs for volunteers. They include:

- $10 pay-per-call stipend
- $120/year for training ($10/month)
- $3k annual reduction in State income taxes
- One-year health insurance subsidy for out-of-pocket expenses
- $1,250 annual contribution to a retirement fund

The annual pension contribution fund is tiered such that individuals are fully vested after five years; zero to three years, 50 percent; three to five years, 75 percent. Volunteers are also eligible to attend the community college at no cost for their EMT-B training at a value of approximately $800. Volunteers we met believe the incentives are reasonable. They were also of the opinion that a significant number of new volunteers would not be added if incentives were increased. However, there was concern that worker's compensation (WC) protection is weak. Volunteers felt that the current programs do not offer enough protection in the event of an injury suffered while they volunteer. Concerns about WC are frequently expressed by volunteers nationwide.

Overall, while the incentives are good, they may not be enough to stave off a future decline of volunteers.

Recommendation 47: Review the current worker compensation benefits and consider an additional policy on top of WC for volunteers.

One problem with the $10 pay-per-call stipend is that all volunteers are paid the same rate regardless of rank. A better approach is to provide higher stipends for officers depending on their rank. Under the proposed restructuring in this report, in which volunteer officers are afforded more leadership roles, it is important that the incentive program recognize their additional training and responsibility..

Recommendation 48: Review the pay-per-call stipend and consider revising it to include higher rates for officers.

Deployment Schedule Summary

The following schedule summarizes the entire set of personnel and apparatus deployment changes recommended in this chapter.

Table 28: Recommended Apparatus and Staffing Changes

Station	Deployed Units	Current Career Staffing	Current Volunteer Staffing	Proposed Service Level	Proposed Career Complement[51]	Proposed Volunteer Complement
1 Socastee	1 Engine 1 Rescue 1 Ladder/Tower 1 Medic 1 BC	3 – (24/7) 3 - (24/7) 3 - (M/F) 2 - (24/7) 1 – (24/7) M/F = 12 24/7 = 9	13	24/7 staffing of 9 personnel and 13 personnel weekdays. Station officer-in-charge is a career captain. Engine and ladder are cross-staffed at night and on weekends; volunteers provide the additional personnel nights and weekends.	2 captain 5 lieutenant 3 FF/PM 15 FF 3 FF or EMT 3 battalion chief	3 lieutenants 10 firefighters
2 Little River	1 PM Engine 1 Ladder/Tower 1 Brush 1 Squad	3 – (M/F) 3 – (M/F) 0 M/F = 6 24/7 = 0	19	Volunteer station augmented by career M/F. Paramedic engine Station officer-in-charge in a volunteer captain	2 lieutenant 1 FF/PM 3 FF	1 captain 3 lieutenants 16 firefighters
3 Bucksport	1 Engine 1 Tanker 1 Medic	3 – (24/7) 1 – (24/7) 2 – 24/7) M/F = 6 24/7 = 6	0	All-career station	1 captain 2 lieutenants 3 FF/PM 12 FF	

[51] Career complements are based on the total personnel needed to staff the units. A staffing factor to account for leave and other absences is not included in the complement total.

Station	Deployed Units	Current Career Staffing	Current Volunteer Staffing	Proposed Service Level	Proposed Career Complement[51]	Proposed Volunteer Complement
4 Forestbrook	1 PM Engine 1 Ladder/Tower 1 EMS lieutenant 1 Marine Utility 1 Boat	3 – (M/F) 0 1 – (24/7) 0 M/F = 3 24/7 = 1	20	All-career station augmented by volunteers. EMS lieutenant is a new service	1 lieutenant 1 FF/PM 1FF 3 EMS lieutenant	1 captain 4 lieutenant 15 FF
5 Wampee	1 PM Engine	3 – (24/7) M/F = 0 24/7 = 3	2	All-career station 24/7. PM engine	1 captain 2 lieutenant 3 PM/FF 3 FF	2 FF
6 Finklea	1 PM Engine 1 Tanker 1 Brush 1 EMS lieutenant 1 Battalion Chief	3 – (24/7) 1 – (24/7) 0 1 – (24/7) 1 – (MF) M/F = 6 24/7 = 5	1	All-career station 24/7 PM Engine EMS lieutenant is a new service Career BC M/F with volunteer BC nights and weekends	1 captain 2 lieutenant 3 FF/PM 3 FF 3 EMS lieutenants 1 battalion chief	1 battalion chief Note: The volunteer BC could be located at any of several stations including Stations 10, 28, or 38.
7 Lake Arrowhead	1 Engine 1 Tower 1 Medic	3 – (24/7) 3 – (24/7) 2 – (24/7) M/F = 0 24/7 = 8	3	All-career station 24/7	2 captains 4 lieutenants 3 FF/PM 19 FF	3 FF

Station	Deployed Units	Current Career Staffing	Current Volunteer Staffing	Proposed Service Level	Proposed Career Complement[51]	Proposed Volunteer Complement
8 Juniper Bay	1 PM Engine 1 Medic 1 EMS lieutenant 1 Brush 1 Boat 1 BC	4 – (24/7) 2 – (24/7) 1 – (24/7) 0 0 1 – (M/F) M/F = 8 24/7 = 7	0	All-career station 24/7 PM engine EMS lieutenant is a new service	1 captain 2 lieutenant 3 FF/PM 9 FF 3 EMS lieutenants 1 battalion chief	1 battalion chief Note: The volunteer BC could be located at any of several stations including Stations 16 or 27.
9 Antioch	1 Tanker	0 M/F = 0 24/7 = 0	4	All-volunteer station with tanker only	0	1 captain or lieutenant 3 FF
10 Ketchup Town	1 Engine 1 Medic	4 – (M/F) 2 – (24/7) M/F = 6 24/7 = 2	7	Volunteer station augmented by career personnel M/F. Medic unit is a new service. Station officer-in-charge is a volunteer captain	1 lieutenant 3 FF/PM 3 FF or EMT 3 FF	1 captain 1 lieutenant 5 FF
12 Nixonville	1 Pumper/Tanker	4 – (24/7) M/F = 4 24/7 = 4	5	All-career station 24/7 augmented by volunteers PM engine	1 captain 2 lieutenant 3 FF/PM 6 FF	1 lieutenant 4 FF

Station	Deployed Units	Current Career Staffing	Current Volunteer Staffing	Proposed Service Level	Proposed Career Complement[51]	Proposed Volunteer Complement
13 Longs	1 Engine	4 – (M-F) M/F = 4 24/7 = 0	6	Volunteer station augmented by career personnel M/F. Station officer-in-charge is a volunteer captain	1 lieutenant 3 FF	1 captain 1 lieutenant 4 FF
14 Shell	1 Quint	4 – (24/7) M/F = 4 24/7 = 4	4	All-career station 24/7 augmented by volunteers	1 captain 2 lieutenants 9 FF	1 lieutenant 3 FF
15 Bayboro	1 Engine 1 Medic	4 – (24/7) 2 – (24/7) M/F = 6 24/7 = 6	5	All-career station 24/7	1 captain 2 lieutenant 3 FF/PM 12 FF	5 FF Recommend these volunteers be transferred to surrounding stations of 21, 27, or 28 to improve their staffing
16 Cates Bay	1 Engine 1 Tanker	0 0 M/F = 0 24/7 = 0	10	All-volunteer	0	1 captain 2 lieutenants 7 FF
17 Mount Vernon	1 Engine	0 M/F = 0 24/7 = 0	11	All-volunteer	0	1 captain 2 lieutenant 8 FF

Station	Deployed Units	Current Career Staffing	Current Volunteer Staffing	Proposed Service Level	Proposed Career Complement[51]	Proposed Volunteer Complement
18 Stephen's Crossroad	1 Engine 1 Rescue 1 Medic	3 – (24/7) 3 – (24/7) 2 – (24/7) M/F = 8 24/7 = 8	12	Mostly career supplemented by volunteers Note: Weeknights and weekends, engine and rescue are cross-staffed (handle first emergency) and volunteers staff the remaining unit.	2 captain 4 lieutenants 12 FF 3 FF or EMT 3 FF/PM	3 lieutenants 9 FF
19 Cherry Hill	1 Engine 1 Tanker	0 0 M/F = 0 24/7 = 0	13	All-volunteer	0	1 captain 2 lieutenant 10 FF
20 Scipio	1 Engine 1 Medic 1 Brush	3 – (M/F) 2 – (24/7) 0 M/F = 5 24/7 = 2	17	Volunteer augmented by career M/F	1 lieutenant 5 FF 3 FF/PM	1 captain 2 lieutenant 14 FF
21 Maple	1 Engine	0 M/F = 0 24/7 = 0	6	All-volunteer	0	1 captain 1 lieutenant 4 FF

Station	Deployed Units	Current Career Staffing	Current Volunteer Staffing	Proposed Service Level	Proposed Career Complement[51]	Proposed Volunteer Complement
23 University	1 Quint 1 Medic 1 Hazmat/Tech Unit 1 Air Unit	3 – (M/F) 2 – (24/7) 3 – (24/7) 0 M/F = 8 24/7 = 5	11	Mostly career supplemented by volunteers Note: Weeknights and weekends, quint and haz-tech units are cross-staffed (handle first emergency) and volunteers staff the remaining unit.	1 captain 2 lieutenant 3 FF/PM 8 FF	2 lieutenants 8 FF
24 Aynor	1 Engine 1 Medic 1 Brush	4 – (24/7) 2 – (24/7) 0 M/F = 6 24/7 = 6	0	All-career station 24/7	1 captain 2 lieutenant 3 FF/PM 4 FF	0
24 Aynor #2	Vacant To be renovated	N/A	0	N/A	0	0
25 Mount Olive	1 Medic	2 – (24/7) M/F = 2 24/7 = 2	0	All-career medic station 24/7	3 FF/PM 3 FF or EMT	0
26 Goretown	1 PM Engine 1 Brush	4 – (M/F) 0 M/F = 4 24/7 = 0	8	Volunteer augmented by career (M/F) PM engine capable (M/F)	1 lieutenant 1 FF/PM 2 FF	1 captain 1 lieutenant 6 FF

Station	Deployed Units	Current Career Staffing	Current Volunteer Staffing	Proposed Service Level	Proposed Career Complement[51]	Proposed Volunteer Complement
27 Allens	1 Engine	4 – (M/F) M/F = 4 24/7 = 0	5	Volunteer augmented by career (M/F)	1 lieutenant 3 FF	1 captain 4 FF
28 Joyner Swamp	1 Engine 1 Tanker	0 0 M/F = 0 24/7 = 0	8	All-volunteer station	0	1 captain 1 lieutenant 6 FF
29 Conway	1 Medic	2 – (24/7) M/F = 2 24/7 = 2	0	All-career medic unit Leased from Conway (Station #2)	3 FF/PM 3 FF or EMT	0
30 Myrtle Beach	1 Medic	2 – (24/7) M/F = 2 24/7 = 2	0	All-career medic unit Stationed at Myrtle Beach Fire Station	3 FF/PM 3 FF or EMT	0
31 Surfside Beach	1 Medic	2 – (24/7) M/F = 2 24/7 = 2	0	All-career medic unit Leased space from Surfside Fire Department	3 FF/PM 3 FF or EMT	0
32 North Myrtle Beach	1 Medic	2 – (24/7) M/F = 2 24/7 = 2	0	All-career medic unit Shared building with NMB Rescue Squad	3 FF/PM 3 FF or EMT	0
34 Red Bluff	1 Engine 1 Medic 1 EMS captain	3 – (24/7) 2 – 24/7 1 – 24/7	0	All-career station (24/7) Note: Engine is a new	1 captain 2 lieutenant 6 FF	0

Station	Deployed Units	Current Career Staffing	Current Volunteer Staffing	Proposed Service Level	Proposed Career Complement[51]	Proposed Volunteer Complement
	1 BC	1 – 24/7 M/F = 7 24/7 = 7		service.	3 FF/PM 3 EMS captain 3 battalion chief	
35 Loris	1 Medic	2 – (24/7) M/F = 2 24/7 = 2	0	All-career medic unit	3 FF/PM 3 FF or EMT	0
36 South Myrtle Beach	1 Medic	2 – (24/7) M/F = 2 24/7 = 2	0	All-career medic unit Leased space from MBFD.	3 FF/PM 3 FF or EMT	0
38 Floyds	1 Engine 1 Tanker	0 0 M/F = 0 24/7 = 0	4	All-volunteer station	0	1 captain 3 FF
39 Carolina Forest	1 PM Quint 1 Brush	3 – (24/7) 0 M/F = 6 24/7 = 3	19	Mostly career supplemented by volunteers	1 captain 3 lieutenant 3 FF/PM 5 FF	3 lieutenant 16 FF Note: Several of these volunteers are expected to transfer to Station 45 when it is completed.
40 Hickory Grove	1 Engine 1 Wildfire Unit 1 Brush 2 ATV's	3 – (M/F) 1 – (M/F) 0 0 M/F = 4	4	Volunteer supplemented by career (M/F)	1 lieutenant 2 FF	1 captain 3 FF

Station	Deployed Units	Current Career Staffing	Current Volunteer Staffing	Proposed Service Level	Proposed Career Complement[51]	Proposed Volunteer Complement
		24/7 = 0				
41 Iron Springs	1 PM Engine	4 – (24/7) M/F = 4 24/7 = 4	1	All-career station 24/7 This is a new service in an existing station.	1 captain 2 lieutenants 3 FF/PM 3 FF	1 FF
43 Lee's Landing	1 Engine 1 Squad	0 0 M/F = 0 24/7 = 0	7	All-volunteer station		1 Captain 1 lieutenant 5 FF
45 Carolina Bays	1 Engine 1 Medic	3 – (24/7) 2 – (24/7) M/F = 5 24/7 = 5	0	All-career station supplemented by volunteers transferred from Station 39.	1 captain 2 lieutenants 6 FF/PM 3 FF 3 FF or EMT	Unknown number of volunteers from Station 39.
46 Pitch Landing	1 Engine	3 – (24/7) M/F = 3 24/7 = 3	0	All career station supplemented by volunteers transferred from Station 16.	1 captain 2 lieutenants 6 FF	
Totals 40 Stations 34 county-owned stations	21 – Engines 7 – PM Engines 1 - Pumper/Tankers 4 - Ladders/Towers 2 – Quints 1 – PM Quint 18 – Medic Units 2 – Rescues 2 - Squads 7 - Tankers	M/F = 143 24/7 = 112	225	-		19 – Suburban 21 – Rural

Station	Deployed Units	Current Career Staffing	Current Volunteer Staffing	Proposed Service Level	Proposed Career Complement[51]	Proposed Volunteer Complement
	9 - Brush/Wildfire Units 1 – EMS captain 3 – EMS lieutenants 4 – Battalion Chiefs					

Note: All volunteer or mostly volunteer stations with crew complements highlighted in orange are designated as priorities for additional personnel and aggressive recruitment efforts.

Weekday staffing under the proposed plan is 143 positions, an increase of 71 positions over the current authorized level. At nights and weekends when volunteers are likely to be more available, career staffing is decreased to 112 positions.

In the new deployment plan, EMS capabilities at the advanced life support (ALS) will be available in 20 of the 34 county-operated stations. The plan also requires that 12 all or mostly volunteer stations increase their volunteer participation. If additional volunteers are not recruited and those that are active begin to participate less, the plan would need to be modified and more career staff will have to be added.

A breakout of the career and volunteer positions necessary for the proposed plan include:

Table 29: Operational Positions Required for the Proposed Deployment Schedule vs. Existing Authorizations [52]

Rank/	Required Career Positions/Currently Authorized	Required Volunteer Positions/Currently Authorized	Total Required
Battalion Chief	8/6	0	8
Volunteer District Chief	0	2/14	2
Captain	20/12	16/7	36
Captain (EMS)	3/3	0/0	3
Lieutenant	49/23	34/1	83
Lieutenant (EMS)	9/0	0/0	9
Firefighter/Paramedic	78/65	0/0	78
EMT or Firefighter/EMT	36/9	0/0	36
Firefighter 1	154/127	250 /200	404
Total/s	**357/259**	**302/222**	**659**

Note: To estimate the required number of volunteer firefighters, we considered the service level for each all- volunteer or mostly-volunteer station and estimated the number of active members necessary to sustain their operation.

For the county to add 98 new fire and EMS positions is an expensive consideration and it is unrealistic that such a large increase can be implemented in one or even two years. Likewise, the fire department will need to plan for the changes. Therefore, we recommend a phased-in approach with a five-year implementation schedule being the most realistic.

Recommendation 49: Begin a five-year phase-in of new positions beginning with the most critical rural areas. At the same time, identify the volunteer stations with critical staffing shortages and increase the number of active volunteers at those stations.

[52] Career positions do not include the positions necessary to cover vacation leave, sick/accident, or leave for training.

V. Response Time Analysis, Station Location, and Apparatus Deployment

This chapter discusses the deployment of fire stations and emergency response apparatus in the county. As discussed in the previous chapters, there are many factors that should be taken into account when determining the appropriate number of stations, including demand for services, population density, size of the jurisdiction, and desired response times. This chapter considers these factors for the current and future situation of the Horry County Fire Rescue (HCFR).

Data

Before the analysis took place, project team members gathered and reviewed information related to properly locating fire stations, including:

- Station locations and building ages
- Apparatus deployment
- Current risk areas
- National response time standards
- Current and projected population
- Current and projected demand

Response data from the Computer Aided Dispatch (CAD) system for 21 months (February 2006 through October 2007) was provided by HCFR. The data included addresses for geocoding, responding units, and response time segments.[53] Geographic Information System (GIS) files were also provided by the city.

Data Limitations & Assumptions – Data was not provided for previous years as the previous software used to store CAD data made it difficult to procure. In addition, the time segments (call received, dispatch, en route, on scene, and unit clear) were provided by incident number rather than by responding unit, which meant that actual response times could not be analyzed by first dispatched unit and first arriving unit. (As noted elsewhere, this is another reason why it is important to have complete, accurate incident data.)

[53] Geocoding is a process by which the street address of an emergency incident is translated into latitude/longitude coordinates by address matching to a GIS road centerline file, allowing for tabular address data to be plotted on a map.

Several different approaches were taken to work around the data limitations, in consultation with HCFR. The first approach regarded call type. The type of call as understood by the dispatcher could not be obtained from the CAD data. HCFR classifies all of its incoming calls in the CAD system as "fire/EMS" and does not distinguish between the two. For every structure fire, a cross trained a medic unit is dispatched. In addition, a fire unit is called as a fire responder to a majority of calls since the county's medic coverage area is so large and has a limited number of medic units. There are times when a medic unit is first on scene to a structure fire call/alarm due to no volunteers getting out, and since the medic units are cross-trained, they can assess the situation.

Call types were assigned for emergency calls using the assigned nature code descriptions and the responding units, as provided in the CAD data. For example, incidents with a nature code of "heart problem" with a medic as a responding unit was classified as "EMS" while incidents with a nature code of "fire alarm" with an engine as a responding unit was classified as "fire." Incidents such as trench rescue, high-angle rescue, and search and rescue were classified as "technical/rescue." An "other" classification was included to capture incidents that did not fit one of the aforementioned classifications.

The second approach to be decided was how to identify mutual aid calls. The CAD data did not contain a field tracking which calls were for mutual aid, in or out of Horry County. In consultation with HCFR, the responding unit ID and beat/jurisdiction fields were chosen to classify mutual aid calls. Medic units are first due to all beat/jurisdictions. To determine fire unit mutual aid calls, a complete list of all responding unit IDs in the CAD data was provided to HCFR who then completed the list showing which units were HCFR units and which were mutual aid units.

To determine fire unit mutual aid calls out of the county, a complete list of all beat/jurisdiction codes from the CAD data was provided to HCFR who then completed the list showing which jurisdictions were within the limits of the county and which were mutual aid outside the limits of Horry County or to a separate jurisdiction.

Finally, calls were classified as emergency or non-emergency based on the nature code in the CAD data. The vast majority of non-emergency incidents were labeled as "test" incidents in the CAD data provided and not included in the analysis.

Response Time Analysis

The first step in the deployment analysis was a review of department-wide response times. Response time is the total elapsed time between an individual calling 911 and emergency

service personnel arriving at the scene. Response time can be broken down into multiple segments for analysis: call processing, dispatch, turnout, and travel times.

In some cases, there were invalid entries in incident files (e.g. no time was recorded) or obvious errors (e.g. the unit arrived before the call came in). These were excluded from the dataset used in the analysis. Also eliminated were outliers that were more than three standard deviations from the mean. If response times have an approximately normal distribution, 99.7 percent of incidents are expected to fall within three standard deviations of the mean, and the 0.3 percent of incidents that were excluded from the response time analysis likely contains errors.

Call Processing and Dispatch Time – Call processing time includes the time to get information from the caller and enter it into a new dispatch system record. This is measured from the time the call is received to the time the call is transferred to a dispatcher. Dispatch time begins when the call is transferred from the call-taker to a dispatcher and continues until units are alerted to respond. Horry County, like many other jurisdictions, considers call processing and dispatch together as a single time segment. As a result, call processing time is measured from the time the call is received until the time the unit is dispatched.

For February 2006 through October 2007, call processing times for HCFR averaged 59 seconds and had a 90th percentile time of 1 minute 59 seconds. Overall, call processing times are nearly double the NFPA 1710 recommended 90th percentile goal of one minute. As shown in Table 30, the 90th percentile for call processing and dispatch times decreased from 2 minutes 9 seconds in 2006 to 1 minute 48 seconds at the 90th percentile in 2007; however this time segment is still above the recommended goal. On the other hand, the average dispatch time, a weaker standard formerly used nationally, is under one minute, which is good.

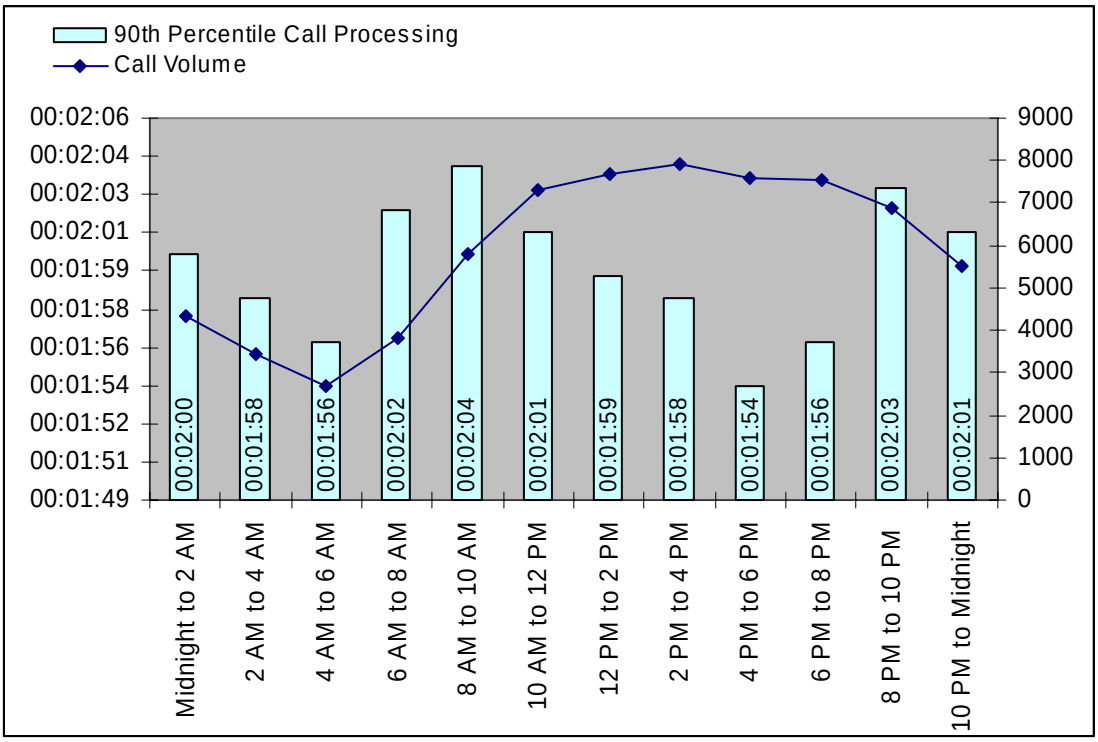
Table 30: Call Processing Times by Year

	2006	2007	Overall
Mean	01:04	00:55	00:59
70th Percentile	01:20	01:07	01:14
90th Percentile	02:09	01:48	01:59

The type of call, fire or EMS, had little variation for 90th percentile call processing times. Fire calls had a 90th percentile time of 2 minutes 1 second and EMS calls had a 90th percentile time of 1 minute 59 seconds. Interestingly, when examined by time of day, call processing times were lowest at times with the highest call volume. As shown in Figure 13, call processing times were lowest from 12 PM through 8PM, the part of the day with the highest call volume. Call

processing times were highest in the morning hours of 6 AM to 12 PM as well as in the late night hours between 8 PM and 2 AM.

Figure 13: 90th Percentile Call Processing Times and Incident Volumes by Time of Day



Turnout Time – Turnout is the time segment that begins when the alarm is received by operations personnel and extends until the apparatus begins driving to the incident scene. National standards for career agencies suggest a turnout time of one minute at the 90th percentile; no nationally-accepted turnout time goal exists for volunteer agencies.

The average turnout time for HCFR units responding to emergency incidents for 2006-2007 was 43 seconds with a 90th percentile time of 1 minute 29 seconds. Unlike call processing times, turnout times increased from 2006 to 2007. Table 31 shows the average and 50th, 70th, and 90th percentile turnout times by year. The one minute goal is being met for 70 percent of calls.

Table 31: Turnout Time by Year, 2006–2007

Year	Average	50th Percentile	70th Percentile	90th Percentile
2006	00:37	00:27	00:43	01:20
2007	00:49	00:41	01:01	01:36

Turnout for EMS calls was slightly lower than for other calls. Turnout was slightly higher for technical/rescue and fire calls, as might be expected. Turnout at the 90th percentile was 1 minute 28 seconds for EMS incidents, 1 minute 31 seconds for fire incidents, and 1 minute 42 seconds for technical/rescue incidents. This pattern is common because fire and technical/rescue

calls require the donning of protective gear, effectively increasing time usage before going en-route to the incident. Table 32 shows the 50th, 70th, and 90th percentile times for turnout by call type.

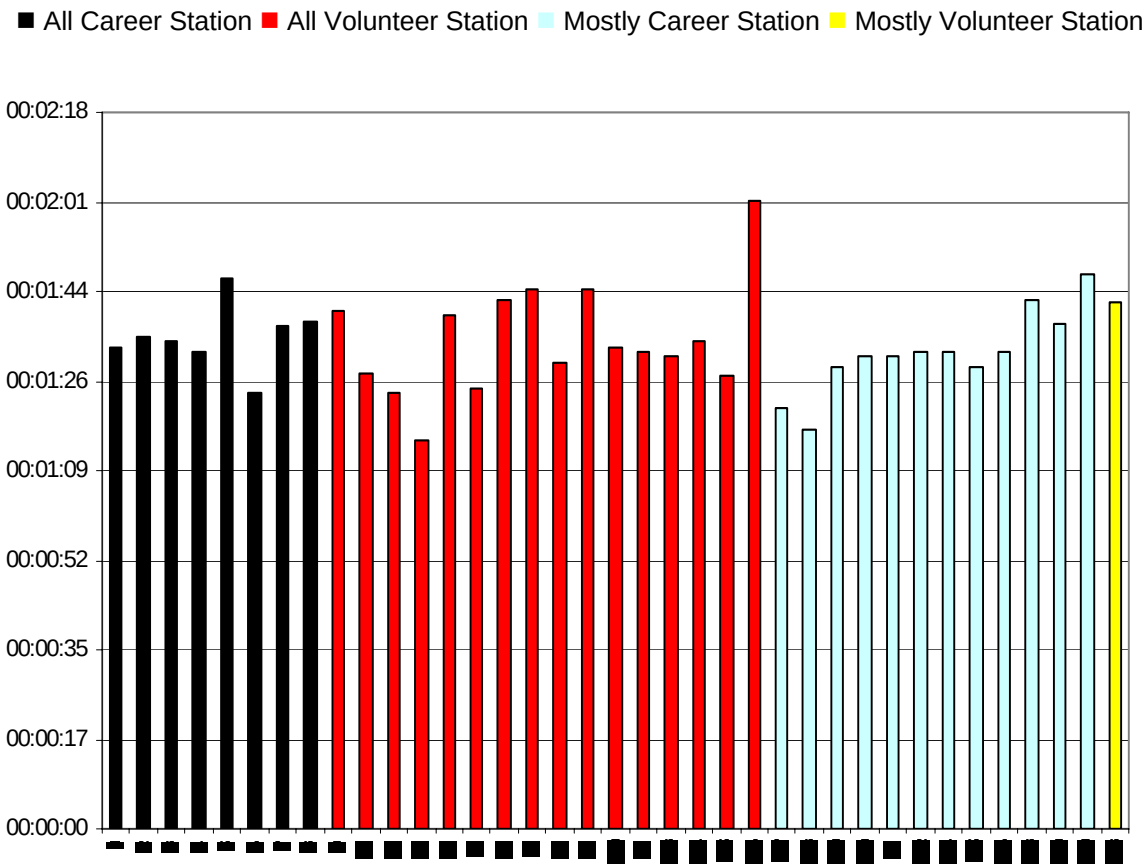
Table 32: Turnout Time by Call Type

Incident Type	50th Percentile	70th Percentile	90th Percentile
EMS	00:33	00:53	01:28
Fire	00:32	00:53	01:31
Technical/Rescue	00:33	00:57	01:42

Turnout times in Horry County varied by station, specifically the type of staffing at each station—all career, all volunteer, mostly career, or mostly volunteer. In general, all volunteer stations had somewhat higher turnout times, and stations with at least some career staffing were somewhat lower.

Delays in turnout time for all volunteer stations can be expected considering there are volunteer personnel who respond from home or another location. Figure 14 shows the 90th percentile turnout times by station with color bars representing the type of staffing. The differences are not as great as one might expect, and in fact some volunteer stations appear to have faster turnout than some career stations.

Figure 14: 90th Percentile Turnout by Station and Staffing Type



Although the graph shows the turnout times for volunteer units to be similar to that of career stations, the department is not tracking the turnout times for each unit; therefore, turnout times for volunteers stations is probably much higher than shown.

Variations in turnout time were not as apparent when comparing average and 90th percentile times by station location (suburban or rural). Table 33 shows the average and 90th percentile turnout times by suburban and rural areas.

Table 33: Average and 90th Percentile Turnout Time by Station Location

Station Location	Average	90th Percentile
Suburban	00:00:46	00:01:33
Rural	00:00:45	00:01:32

Travel Time **–** Travel or drive time is the time required to drive from the station or wherever the unit is located to the scene of the incident. The geographical location of stations and apparatus has the biggest impact on travel time, although apparatus are not always in the station when dispatched to an incident. Additional factors influencing travel time include traffic, weather, traffic limiting devices (stop lights, speed bumps, etc.), and driver familiarity with the

area. Traffic congestion, weather and traffic limiting devices are beyond the department's control; however driver knowledge is not.

From 2006-2007, the average travel time for HCFR units was 7 minutes 14 seconds with a 90th percentile time of 12 minutes 15 seconds. When examined by year, the average and 90th percentile time increased from 2006 to 2007 by 20 seconds and 26 seconds, respectively. Overall travel time and by year are shown in Table 34.

Table 34: Travel Time by Year

Year	Average	90th Percentile
2006	07:05	12:02
2007	07:25	12:28
Overall (2006 & 2007)	07:04	12:15

Segmented by call type, the averages were similar but the 90th percentile travel time for EMS calls was almost a full minute less than for fire calls. EMS calls had an average travel time of 7 minutes 13 seconds and 90th percentile travel time of 12 minutes 12 seconds. Fire calls had an average travel time of 7 minutes 25 seconds and 90th percentile 13 minutes 3 seconds. A possible explanation for this variation is that the HCFR medic units are staffed by career personnel who are on duty at the station. Much of the fire apparatus is staffed by volunteers who may not be located at the station during their assigned on-duty hours. For both fire and EMS calls, the 90th percentile travel times exceed those recommended by national standards.

Similar to turnout times, travel times varied by station as shown in Figure 15. Table 35 shows the average and 90th percentile travel time by Responding Unit ID. In general, all volunteer stations had higher travel times than all career and mostly career stations. All career and mostly career stations have personnel at the station during their assigned duty shift. All volunteer stations may rely on personnel to respond from home to the station, or in some cases in Horry County respond directly to an incident, creating delays in apparatus departure and subsequent travel times.

Figure 15: 90th Percentile Travel Time by Station and Staffing Type

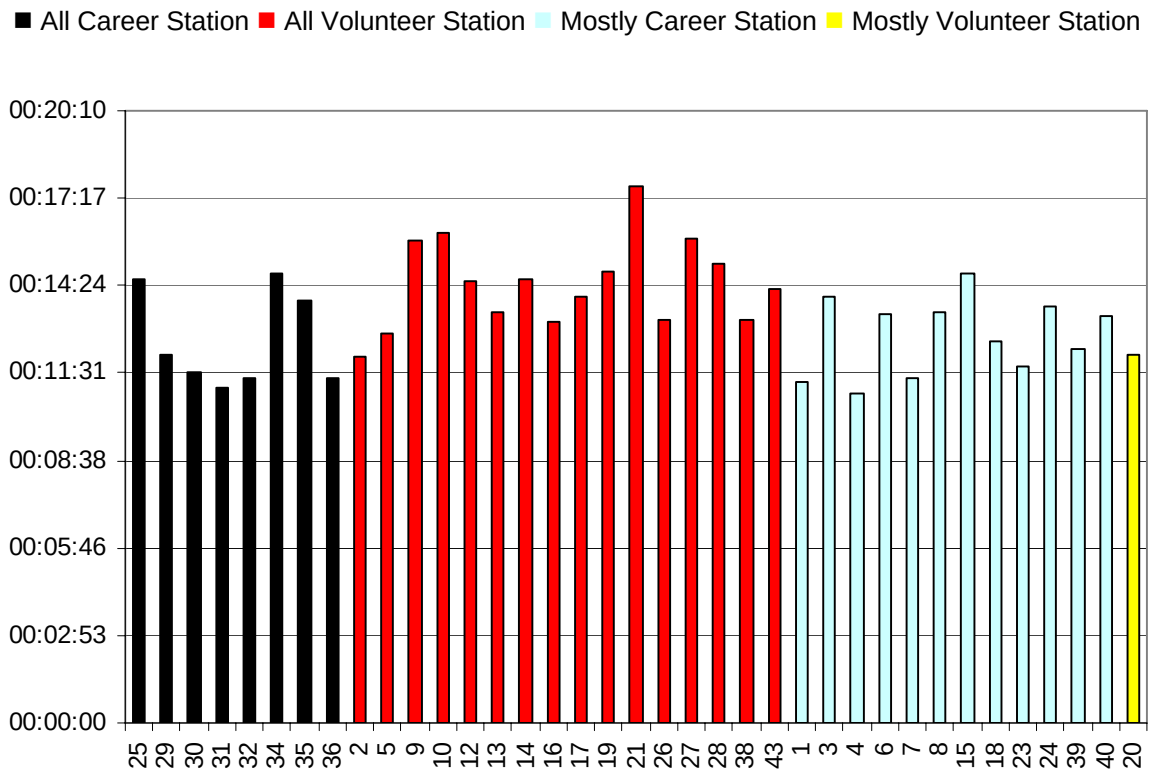


Table 35: Average and 90th Percentile Travel Time by Responding Unit ID

Responding Unit	Average	90th Percentile	Responding Unit	Average	90th Percentile
Engine 1	06:43	11:05	Brush 1	08:07	09:54
Engine 10	10:16	16:10	Brush 140	08:49	11:26
Engine 101	07:40	10:40	Brush 2	10:38	14:41
Engine 106	09:05	12:41	Brush 20	08:03	14:08
Engine 113	09:04	15:38	Brush 24	09:59	15:21
Engine 115	09:27	16:54	Brush 26	08:30	13:10
Engine 117	08:12	15:04	Brush 39	07:50	13:43
Engine 12	08:36	14:29	Brush 4	05:50	06:19
Engine 120	02:36	02:36	Brush 40	10:59	17:54
Engine 13	08:54	13:30	Brush 5	08:31	14:28
Engine 14	08:13	14:35	Brush 6	08:58	16:36
Engine 140	12:59	12:59	Brush 8	09:37	15:27
Engine 15	08:45	14:30	Ladder 39	06:40	11:18
Engine 16	08:46	13:25	Ladder 4	06:49	11:02
Engine 17	09:02	14:02	Medic 1	07:02	11:22
Engine 18	07:27	13:12	Medic 107	05:10	07:55
Engine 19	08:49	14:07	Medic 118	06:59	13:11
Engine 2	07:32	11:56	Medic 120	05:40	11:56
Engine 20	07:19	11:52	Medic 130	05:34	00:04

Responding Unit	Average	90th Percentile	Responding Unit	Average	90th Percentile
Engine 21	09:41	17:40	Medic 131	05:16	08:37
Engine 23	06:36	10:51	Medic 132	07:07	13:09
Engine 24	07:46	13:29	Medic 139	06:21	13:10
Engine 26	08:49	16:02	Medic 18	07:31	12:22
Engine 27	09:23	15:56	Medic 20	07:39	12:06
Engine 28	09:43	15:07	Medic 23	07:14	12:01
Engine 3	07:15	11:35	Medic 24	07:43	13:42
Engine 38	08:11	13:15	Medic 25	08:51	14:36
Engine 39	06:45	11:50	Medic 29	07:27	12:07
Engine 4	06:33	10:32	Medic 3	08:11	14:34
Engine 40	07:11	11:54	Medic 30	06:52	11:37
Engine 41	09:27	13:44	Medic 31	06:49	11:03
Engine 43	08:32	14:17	Medic 32	06:50	11:20
Engine 5	08:44	12:48	Medic 34	08:44	14:47
Engine 6	07:39	12:46	Medic 35	08:16	13:56
Engine 7	06:13	10:25	Medic 36	06:43	11:22
Engine 8	07:58	12:53	Medic 39	05:46	09:24
Engine 9	09:30	16:49	Medic 7	06:49	11:36
Rescue 1	06:22	10:43	Medic 8	08:12	13:46
Rescue 18	07:03	10:54	Tanker 12	17:28	17:28
Squad 14	10:23	17:45	Tanker 16	08:26	11:44
Squad 2	07:22	12:01	Tanker 19	09:46	15:57
Squad 23	13:13	16:03	Tanker 28	08:39	14:27
Squad 43	08:22	08:22	Tanker 3	08:09	13:13
Tower Truck 1	06:25	10:06	Tanker 38	08:02	14:26
Tower Truck 2	07:07	15:24	Tanker 6	05:44	10:53
Tower Truck 7	06:12	11:03	Tanker 9	08:27	11:24

The largest variation in travel times was between stations located in suburban/urban and rural areas. Rural areas had an average travel time of 8 minutes and 6 seconds with a 90th percentile travel time of 13 minutes 36 seconds. Suburban areas had travel times almost a full minute less for the average, and over a minute less for 90th percentile travel time. This finding is not surprising. The rural areas tend to have more volunteer-only stations and serve larger areas than the suburban stations. Table 36 shows the travel times by area.

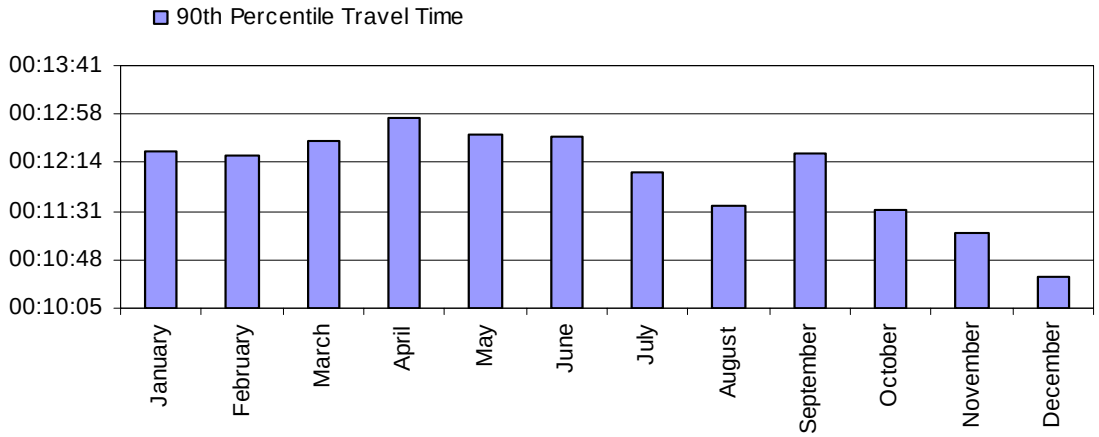
Table 36: Average and 90th Percentile Travel Time by Area

Station Location	Average	90th Percentile
Suburban	00:07:08	00:11:58
Rural	00:08:07	00:13:36

When the data was broken out by month, variations existed in travel time. Travel times were highest during the first six months of the year. Figure 16 shows the 90th percentile travel time by month for HCFR. There is an almost three minute difference between the travel times in

April (highest) verses December (lowest). This variation is not what was expected with typical tourist seasons; however, in general, the warmer months had higher travel times when there tend to be more visitors to the beach areas.

Figure 16: 90th Percentile Travel Time by Month



Total Response Time – Total response time is the time elapsing between receipt of the emergency call and arrival of the responding unit to the scene of the incident. From a citizen's point of view, this is the amount of time elapsing from their initial request for services until that request is fulfilled by a fire or EMS unit arriving at the incident location. For mathematical reasons, one cannot simply add the 90th percentile call processing, turnout, and travel time segments to reach the total 90th percentile response time.

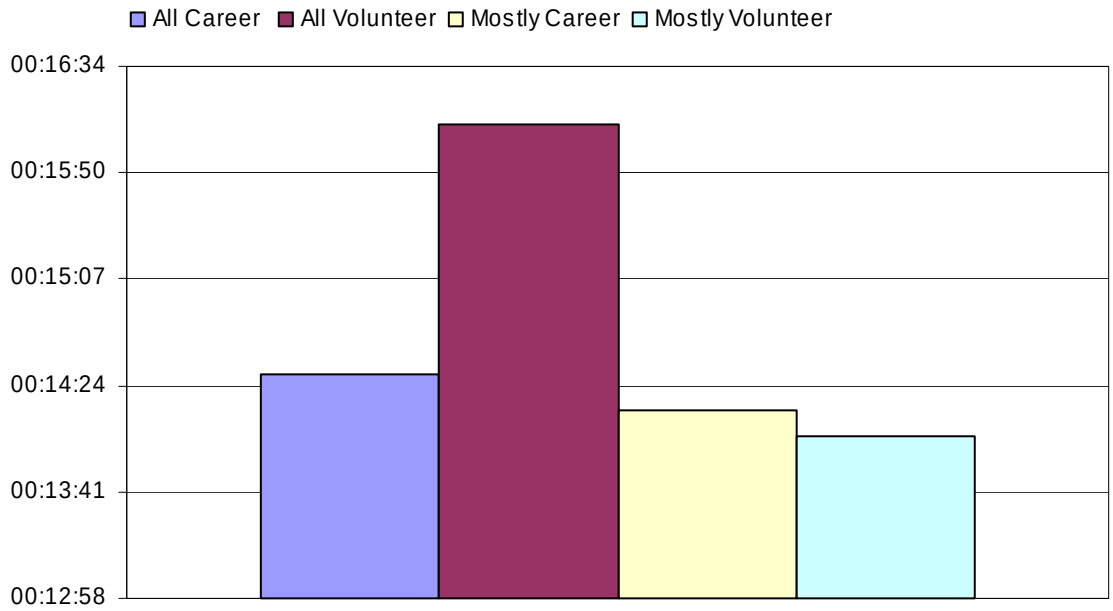
The largest and most varied portion of response time is the travel time, so the variation in the total response time is generally similar to variations in the travel time. Total response times averaged 9 minutes 20 seconds with a 90th percentile time of 14 minutes 42 seconds. Both average and 90th percentile total response times have decreased from 2006 to 2007. In 2006, the average total response time was 9 minutes 18 seconds decreasing to 9 minutes 10 seconds in 2007; 90th percentile travel times decreased from 14 minutes 40 seconds in 2006 to 14 minutes 24 seconds in 2007.

A variation in total response time is also apparent based on call type, with fire calls almost a full minute higher than EMS calls. Fire calls had a total response time of 15 minutes 35 seconds at the 90th percentile while EMS calls had a total response time of 14 minutes 36 seconds at the 90th percentile. As noted earlier, this variation is expected since career personnel staff the medic units.

Also as expected, all-career staffed stations had lower total response times than those stations staffed by all volunteers. Stations staffed by all career personnel had an average total response time of 9 minutes 8 seconds with a 90th percentile time of 14 minutes 28 seconds.

Stations staffed by all volunteers had an average total response time of 10 minutes 52 seconds with a 90th percentile time of 16 minutes 10 seconds. Figure 17 shows the 90th percentile total response time by type of staffing. To reiterate, the higher volunteer response times are largely due to the greater areas they cover, not the fact they are volunteer, though longer volunteer turnout will affect the total time.

Figure 17: 90th Percentile Total Response Time by Staffing Type



Standards and Compliance

NFPA Standards – National standards established by the National Fire Protection Agency (NFPA) are one means for assessing response times. Different standards have been established by NFPA committees for career and volunteer service. Since Horry County uses a combination of career and volunteer personnel, there is no single set of applicable response time standards. NFPA 1710 for career agencies and NFPA 1720 for volunteer departments should both be considered as guidelines. NFPA 1720 standards are based on the population density of the service area. In addition, as Horry County is essentially divided into two areas, one suburban (more career) and the other rural (more volunteer), a combination of these standards was used for this study. For this analysis Highways 701 and 905 are used as the division between the two areas. Table 37, Table 38, and Table 39 summarize the response time goals established in each standard

Table 37: NFPA 1710 Response Time Objectives for Career Departments

Time Segment	Response Time
All Calls: Turnout	00:01:00
Fire Suppression	
First Arriving Engine	00:04:00
Full First Alarm	00:08:00
EMS	
First Responder	00:04:00
ALS Unit	00:08:00

Table 38: NFPA 1720 Staffing and Response Time Guidelines for Volunteer Departments

Type of Demand Zone	Criteria	Staffing/Response Time	Percentile
Special Risks	Set by jurisdiction	Set by jurisdiction	90
Urban	Greater than 1,000 persons per square mile	15 /00:09:00	90
Suburban	500 to 1,000 persons per square mile	10 /00:10:00	80
Rural	Less than 500 persons per square mile	6 /00:14:00	80
Remote	Travel distance 8 miles or greater	4	90

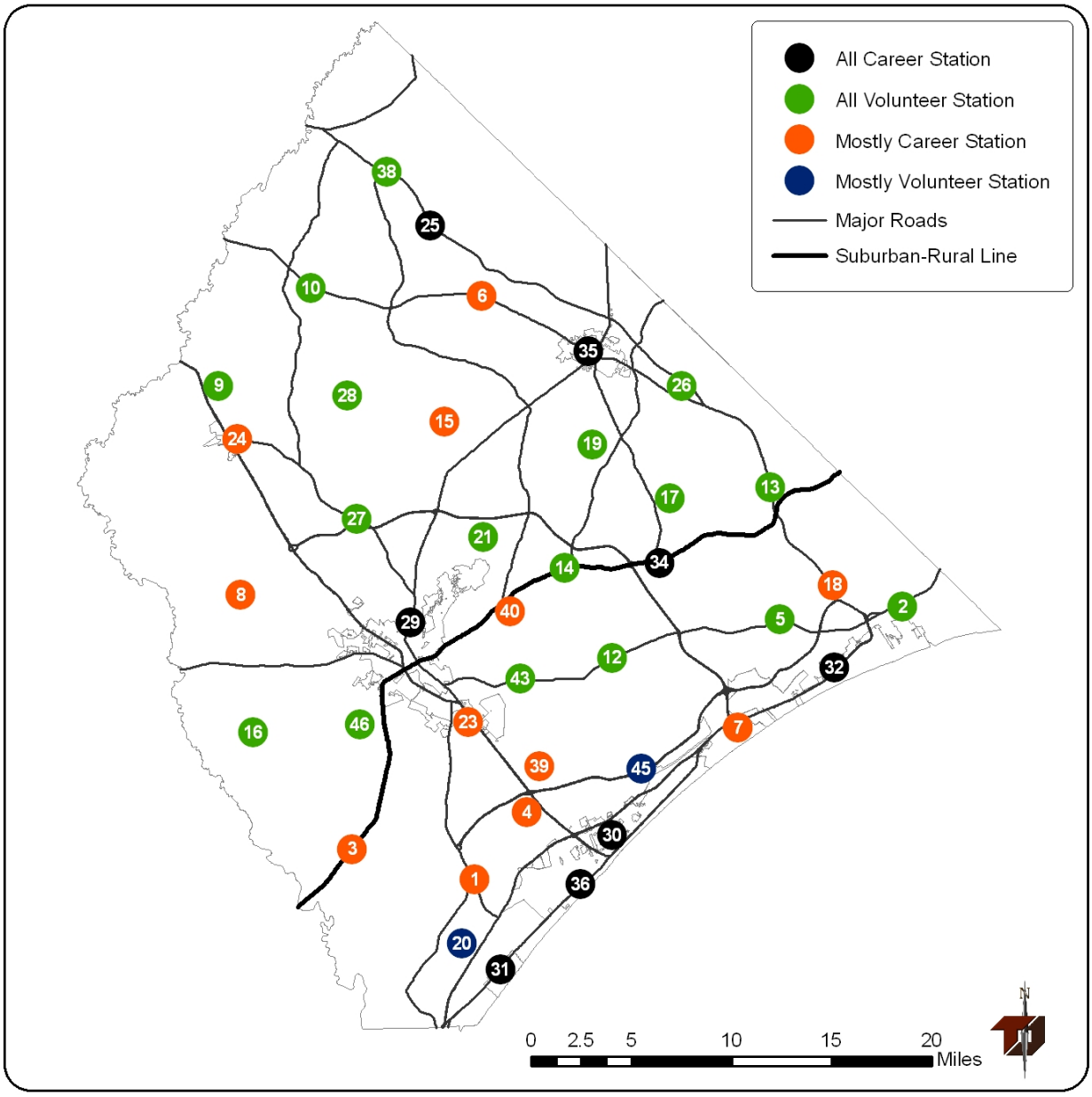
Table 39: Horry County Response Time Objectives for Suburban and Rural Areas

Time Segment	Response Time	
	Urban/Suburban	Rural
All Calls: Turnout	00:01:00	
Fire Suppression		
First Arriving Engine : Travel Time	00:04:00	00:08:00
Full First Alarm: Travel Time	00:08:00	00:14:00
EMS		
First Medic or ALS Engine: Travel Time	00:08:00	00:10:00

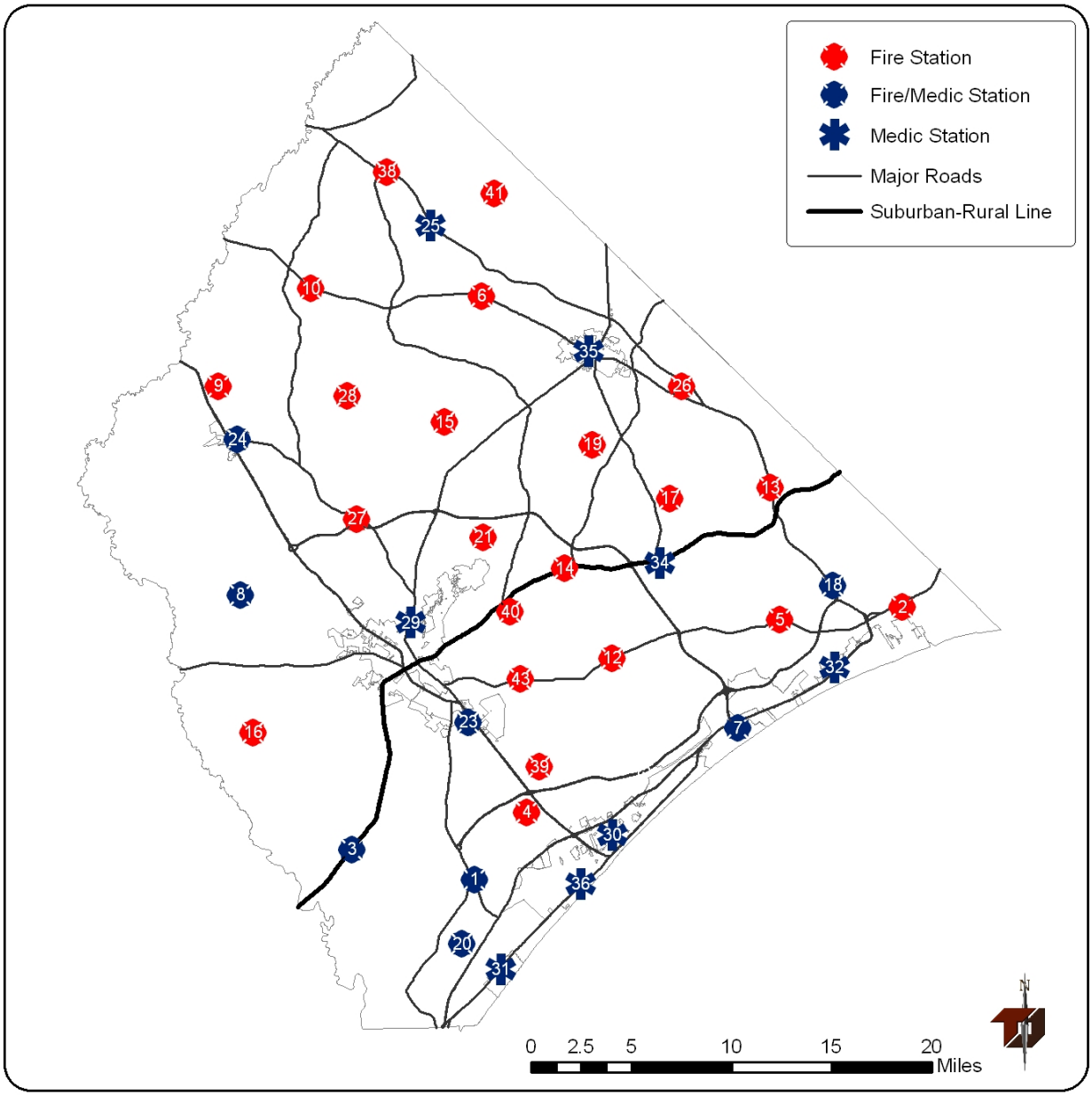
Staffing

Horry County is a combination system where stations are staffed by all career personnel, all volunteers, or a combination of the two. Map 4 shows the location of each station and the makeup of the personnel staffing each station. In addition to personnel staffing differences, stations are identified by the apparatus stored there. Stations are either fire response only stations, medic response only stations, or a combination. Map 5 shows the location of each station and each station's type.

Map 4: Current Station Location by Personnel



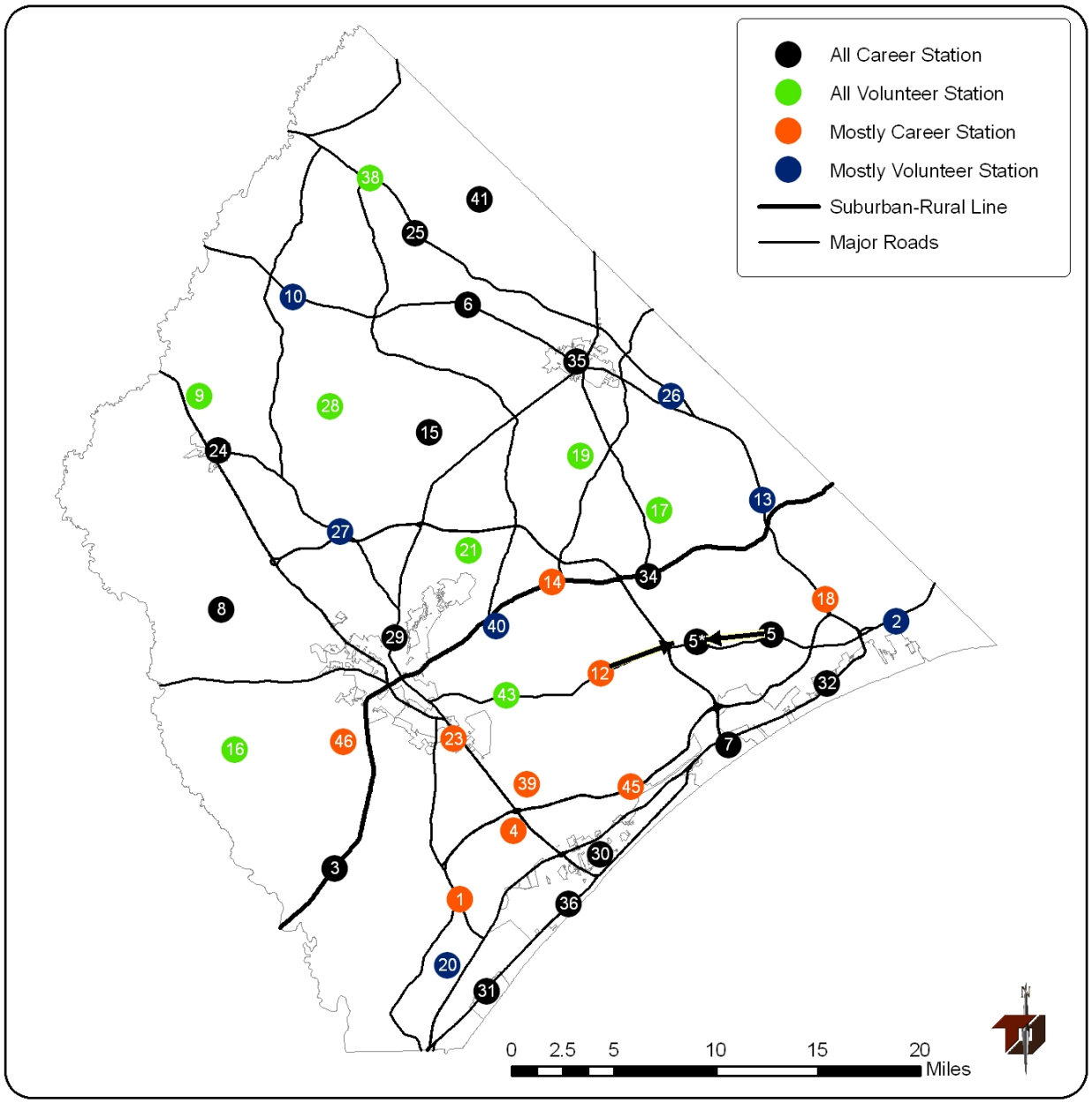
Map 5: Current Station Location by Station Type



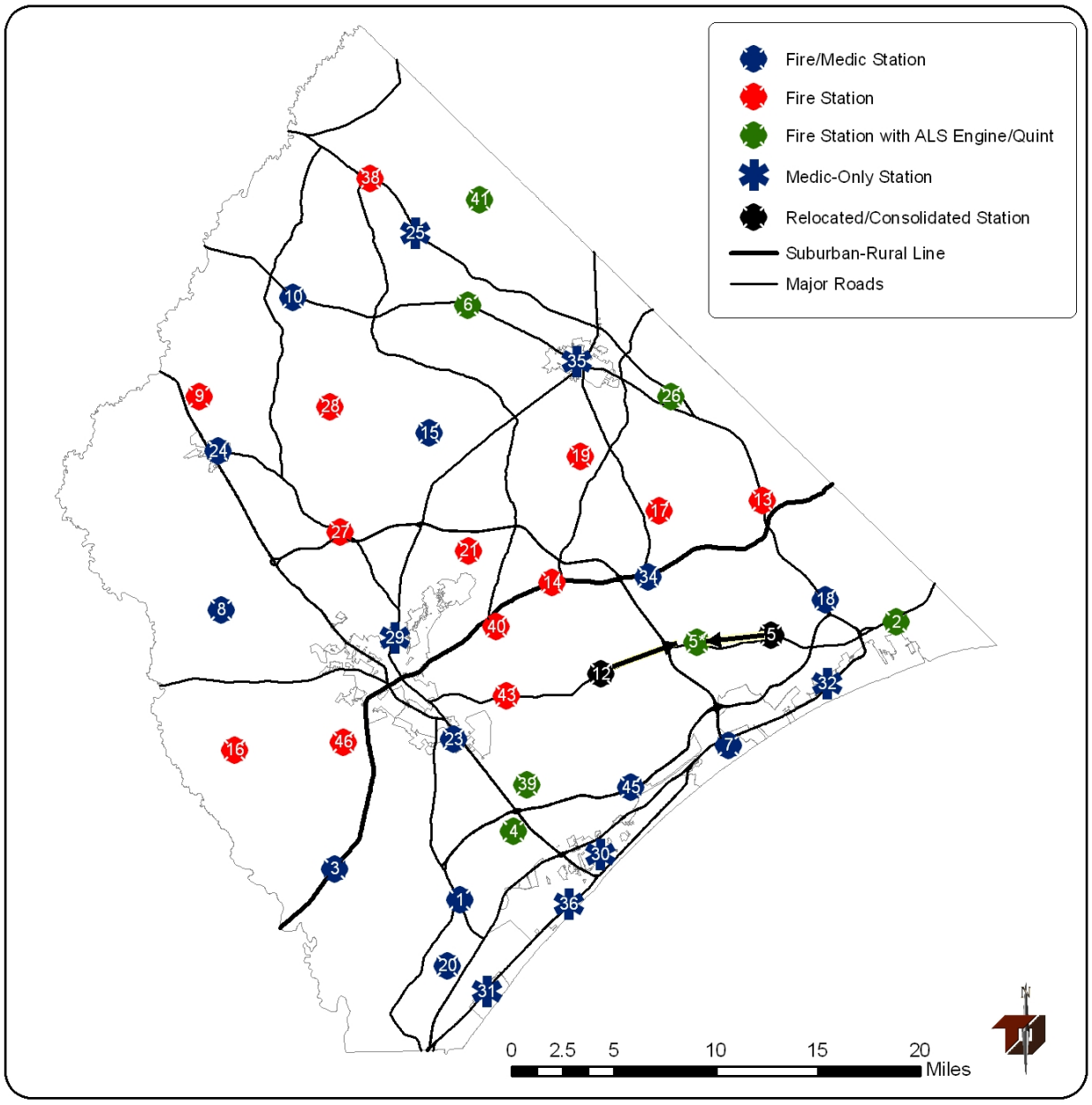
Adding additional career personnel to certain stations may help to decrease response time for calls. In addition, adding additional medic units and other apparatus to existing and proposed new stations will contribute to better overall coverage. The combination of these recommendations will provide a more efficient system overall.

Map 6 and Map 7 show the proposed station location by personnel and station location by station type, respectively. A more detailed analysis of these changes is discussed in the next section.

Map 6: Proposed Station Location by Personnel



Map 7: Proposed Station Location by Station Type



Station Location Analysis

This section provides an in-depth look at station location and apparatus placement. The primary objective is to determine what areas, if any, are in need of additional resources and how resources can be distributed to serve the county more efficiently. Travel time coverage for fire suppression units (engines, ladders/towers, quints) and EMS units (medics) is examined. The placement of special services apparatus (rescue) is also discussed.

Maps are included to show theoretical travel time reaches for the current station and apparatus locations as well as the proposed changes. An accurate representation of the travel time reach is generally calculated based on the length of GIS road centerline segments and the posted speed limits. However, because of the unique geography and associated variation in population density in Horry County, travel speeds were not assumed to be the posted speed limit, which is a common assumption in such analyses, often with a decrease of 5-10 miles per hour. Instead, actual travel time from the CAD data was used to calculate average travel speeds, which includes accounting for topography, narrow roads, congestion, and other limiting factors.

Response time averages were calculated for EMS and fire incidents from the 2006 CAD data. An attempt was made to geocode each EMS and fire incident. The main obstacle in geocoding the data was inconsistent formatting of addresses yielding lower match percentages. EMS calls were matched at 65 percent while fire calls were matched at 54 percent.

Distance along the road network was calculated between each geocoded incident location and the station housing the responding unit. This distance and the travel time from the CAD unit record were used to compute the mean travel speed for each response. Travel speeds were then averaged for each station and applied to the road segments within the corresponding first due area. The computed average travel speeds for each station are shown in Table 40. To maintain a conservative estimate of the coverage area from each station, no road segment was assigned a travel speed higher than the posted speed limit.

The results show that the average speed generally varies from 22–32 miles per hour, with a few exceptions. Interestingly, this range of speeds tends to be found in most jurisdictions, urban and suburban.

Table 40: Average Calculated Travel Speeds by Station

Station	Fire Incidents	EMS Incidents	Station	Fire Incidents	EMS Incidents
1	29	25	21	40	N/A
2	25	N/A	23	26	27
3	26	30	24	25	27
4	25	N/A	25	N/A	32
5	29	N/A	26	26	N/A
6	16	N/A	27	28	N/A
7	23	22	28	31	N/A
8	30	29	29	N/A	27
9	22	N/A	30	N/A	30
10	23	N/A	31	N/A	24
12	22	N/A	32	N/A	26
13	26	N/A	34	N/A	34
14	23	N/A	35	N/A	32

Station	Fire Incidents	EMS Incidents	Station	Fire Incidents	EMS Incidents
15	28	N/A	36	N/A	22
16	28	N/A	38	28	N/A
17	29	N/A	39	26	N/A
18	26	28	40	28	N/A
19	25	N/A	41	22	N/A
20	27	26	43	26	N/A

Background

Horry County frontline apparatus includes 29 engine companies, 16 medic units, 6 ladder/tower companies, 9 tankers, 7 brush units, 1 hazmat/tech unit, 4 rescue units, 2 marine units, 1 air unit, and a wildfire unit. Table 41 shows the frontline apparatus housed at each station, as depicted earlier in Map 5. A fire station is characterized by one that has at least one piece of fire apparatus - an engine, ladder, tower, rescue, brush, tanker, or quint. A fire/medic station is characterized as having at least one piece of fire apparatus and a medic unit. A medic-only station has only a medic unit and no fire apparatus. Overall, the medic-only stations are concentrated along the cost and in the jurisdictions where there is a high density of EMS calls and fire only stations are generally located in the more rural areas.

Table 41: Frontline Apparatus by Station

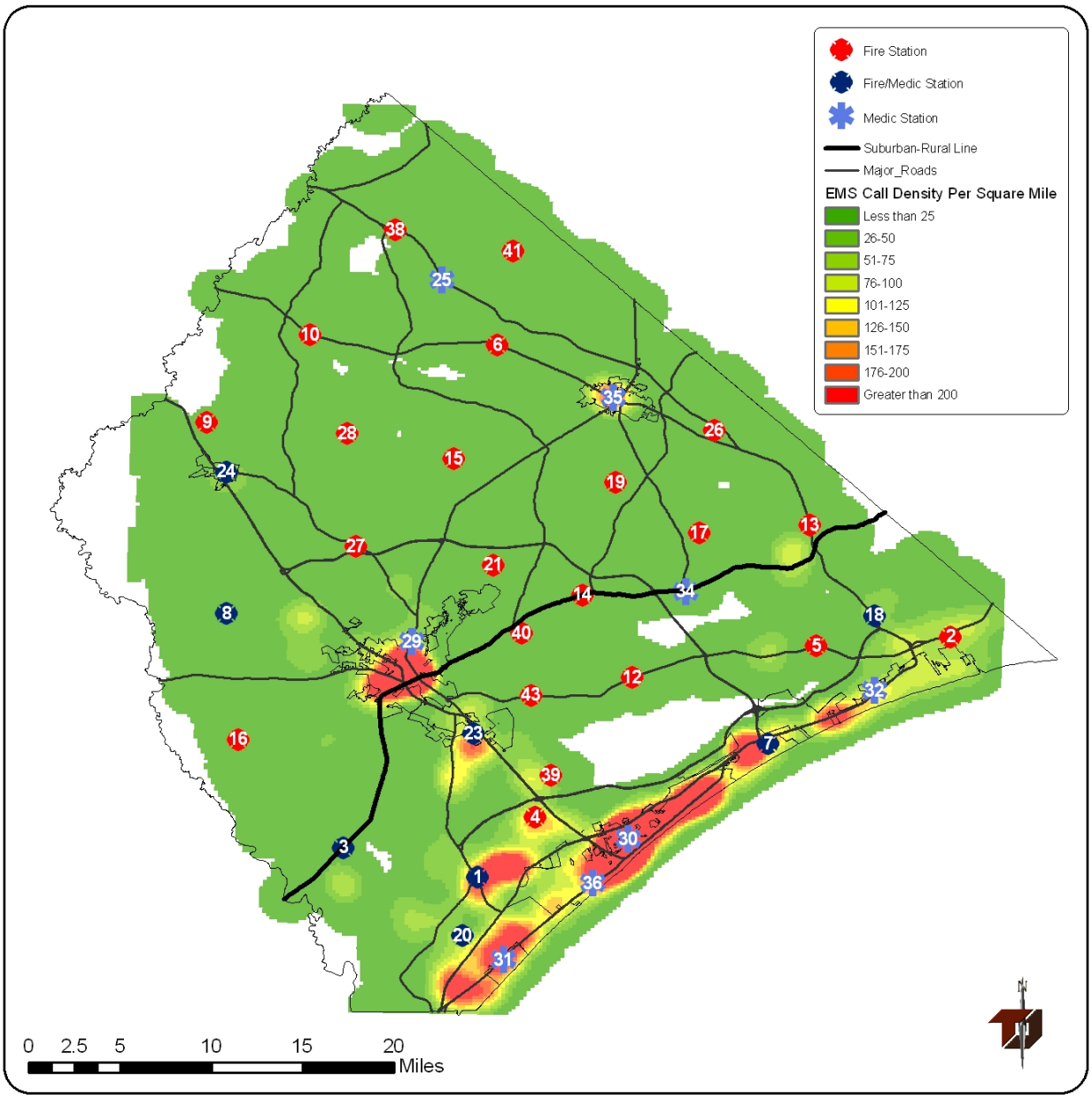
Station	Engine	Medic	Ladder /Tower	Rescue /Squad	Brush	Tanker	Wildfire Unit	Marine Utility/Boat	HazMat /Tech	Air Unit
1	✓	✓	✓	✓						
2	✓		✓	✓	✓					
3	✓	✓				✓				
4	✓		✓					✓✓		
5	✓									
6	✓				✓	✓				
7	✓	✓	✓							
8	✓	✓			✓			✓		
9	✓					✓				
10	✓									
12	✓					✓				
13	✓✓									
14	✓					✓				
15	✓✓									
16	✓					✓				
17	✓✓									
18	✓	✓		✓						
19	✓					✓				
20	✓	✓			✓					
21	✓									
23	✓	✓							✓	✓

Station	Engine	Medic	Ladder /Tower	Rescue /Squad	Brush	Tanker	Wildfire Unit	Marine Utility/Boat	HazMat /Tech	Air Unit
24	✓	✓			✓					
25		✓								
26	✓				✓					
27	✓									
28	✓					✓				
29		✓								
30		✓								
31		✓								
32		✓								
34		✓								
35		✓								
36		✓								
38	✓					✓				
39	✓		✓		✓					
40	✓				✓		✓			
41	✓									
43	✓			✓						
Total	***33***	***16***	***5***	***4***	***8***	***9***	***1***	***3***	***1***	***1***

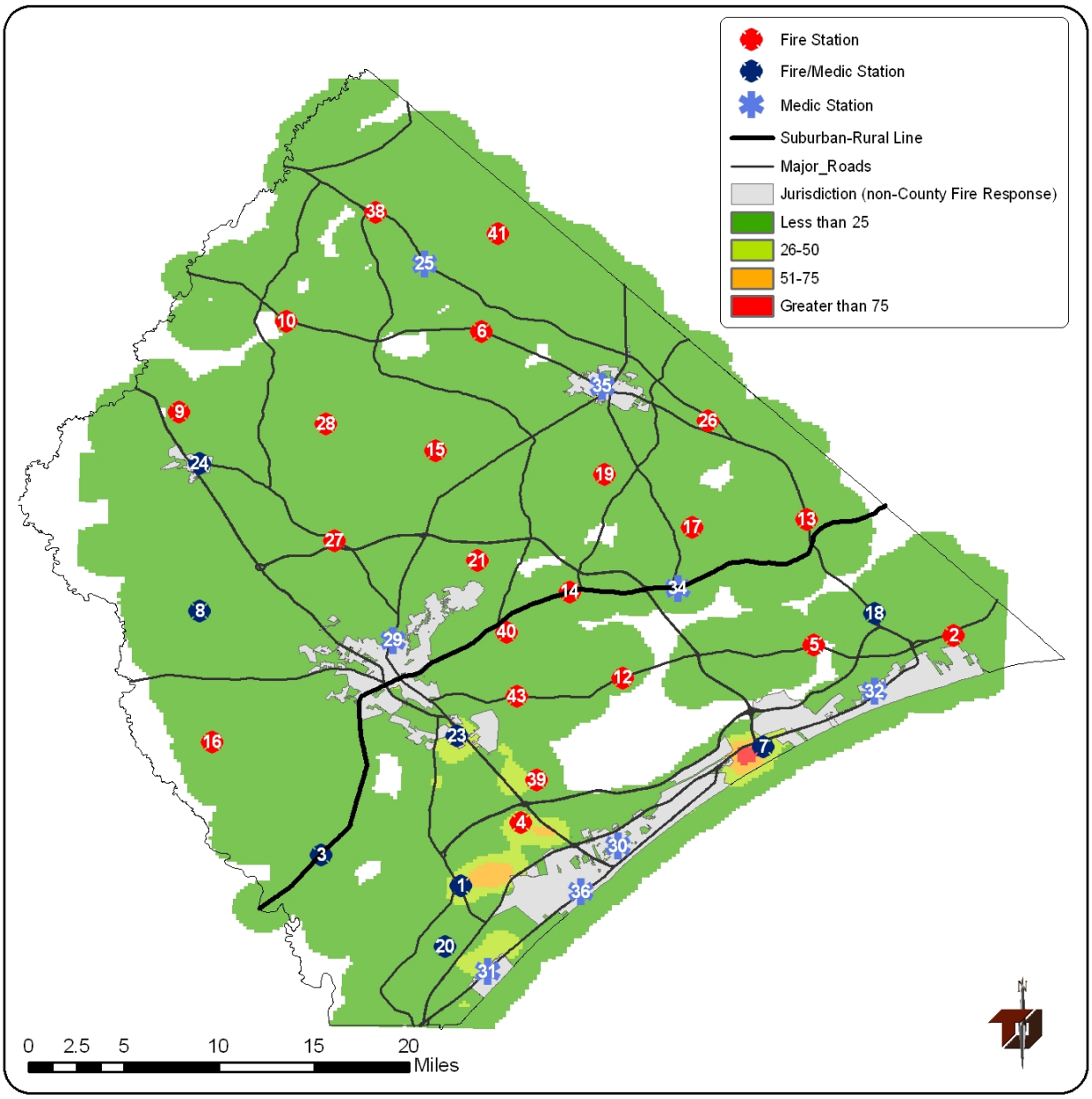
Demand

The highest concentrations of incidents are occurring near the coast and around the sub-jurisdictions according to the CAD data for 2006-2007. Map 8 and Map 9 show the incident density per square mile for both EMS and fire incidents, respectively. The density calculations are based on the geocoded incidents recorded in the CAD for 2006-2007; thus about a third of the incidents are not included in the density calculations. The geocoding data limitations may skew the relative densities somewhat, but they still probably give the correct overall impression.

Map 8: EMS Density



Map 9: Fire Density



Also of importance is the distribution of certain incident types. More specifically, cardiac arrests and structure fires are considered the most serious EMS and fire incident types, respectively, and are generally handled as the highest priorities. Table 42 shows the number of structure fires and cardiac arrests by station as recorded in the CAD data. Station 1 had the most structure fire calls with 84 and Station 31 had the most cardiac arrest calls with 82.

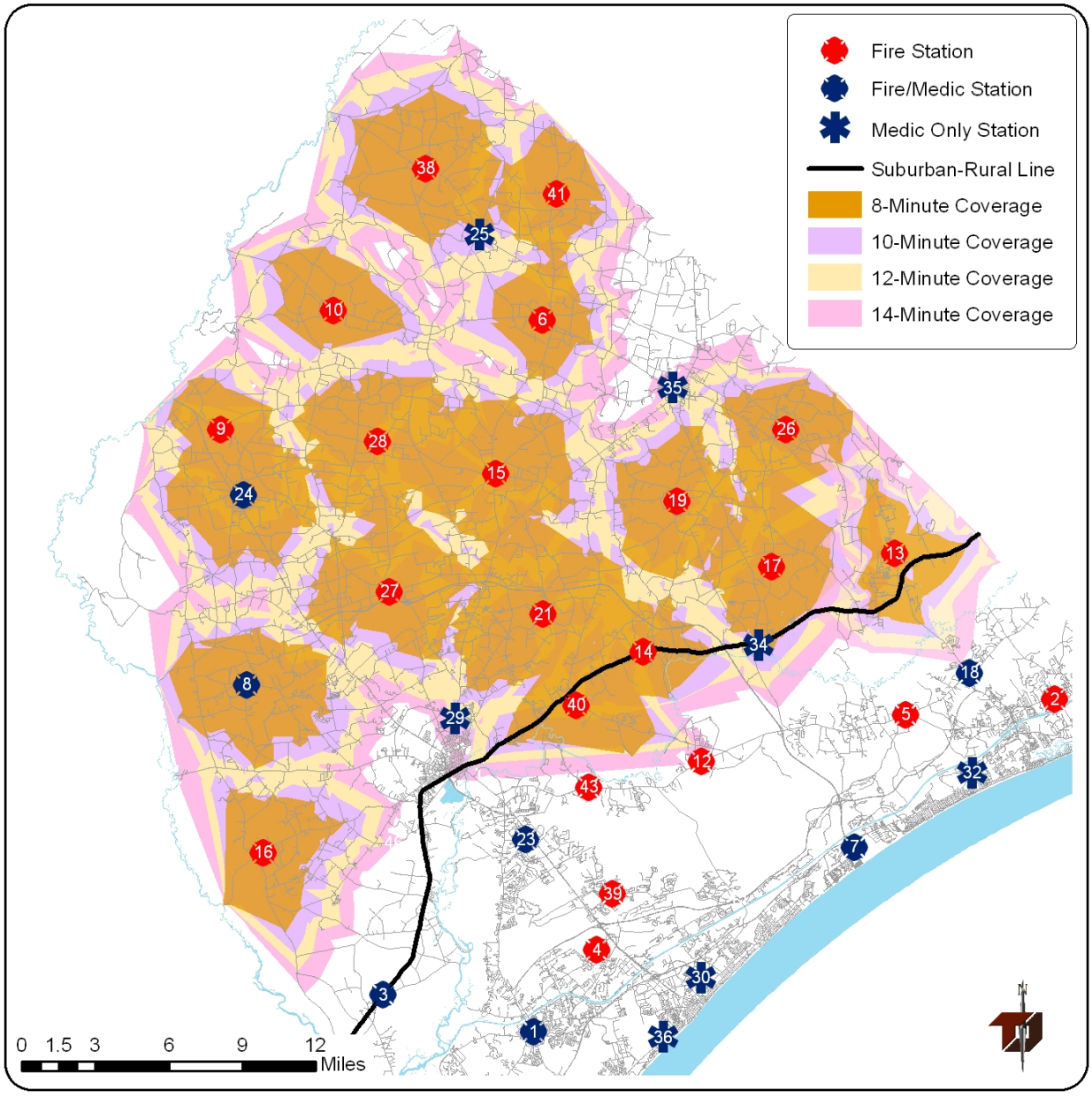
Table 42: Structure Fires and Cardiac Arrests by Station

Station	Station Type	Cardiac Arrests		Structure Fires	
		Number	Percent	Number	Percent
1	Fire/Medic	75	9.6%	84	12.5%
2	Fire	12	1.5%	26	3.9%
3	Fire/Medic	13	1.7%	25	3.7%
4	Fire	20	2.6%	56	8.3%
5	Fire	0	0.0%	8	1.2%
6	Fire	3	0.4%	20	3.0%
7	Fire/Medic	42	5.4%	40	5.9%
8	Fire/Medic	16	2.0%	17	2.5%
9	Fire	2	0.3%	8	1.2%
10	Fire	0	0.0%	3	0.4%
12	Fire	3	0.4%	6	0.9%
13	Fire	2	0.3%	6	0.9%
14	Fire	1	0.1%	3	0.4%
15	Fire	2	0.3%	12	1.8%
16	Fire	5	0.6%	9	1.3%
17	Fire	1	0.1%	7	1.0%
18	Fire/Medic	57	7.3%	50	7.4%
19	Fire	5	0.6%	13	1.9%
20	Fire/Medic	53	6.8%	40	5.9%
21	Fire	2	0.3%	0	0.0%
23	Fire/Medic	56	7.2%	60	8.9%
24	Fire/Medic	28	3.6%	34	5.1%
25	Medic	16	2.0%	7	1.0%
26	Fire	3	0.4%	6	0.9%
27	Fire	0	0.0%	5	0.7%
28	Fire	4	0.5%	4	0.6%
29	Medic	71	9.1%	13	1.9%
30	Medic	48	6.1%	7	1.0%
31	Medic	82	10.5%	12	1.8%
32	Medic	53	6.8%	3	0.4%
34	Medic	17	2.2%	6	0.9%
35	Medic	28	3.6%	7	1.0%
36	Medic	42	5.4%	4	0.6%
38	Fire	7	0.9%	8	1.2%
39	Fire	5	0.6%	45	6.7%
40	Fire	4	0.5%	13	1.9%
41	Fire	1	0.1%	1	0.1%
43	Fire	3	0.4%	5	0.7%

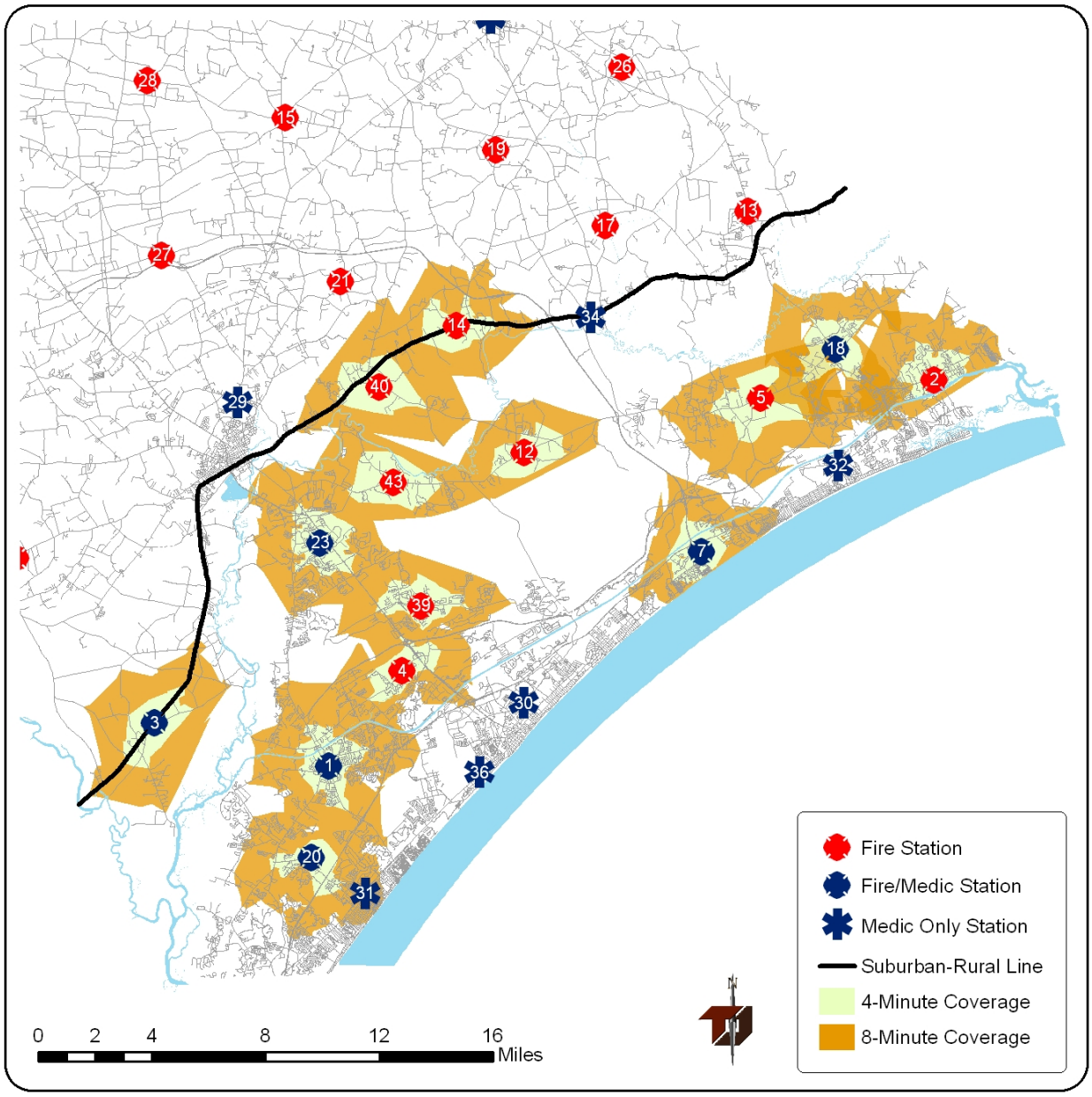
Geographic Operational Areas

As described earlier, the fire department operates from 38 stations distributed fairly evenly over more than 1,100 square miles. Map 10 shows the current 8, 10, 12, and 14-minute travel time coverage for the rural fire and fire/medic stations and Map 11 shows the current 4 and 8-minute travel time coverage for the suburban fire and fire/medic stations. Map 11 shows the current 10-minute travel time coverage for rural fire/medic and medic only stations and Map 12 shows the current 8-minute travel time coverage for suburban fire/medic and medic only stations. The travel time goals are discussed earlier in this chapter as well as the rural/suburban division.

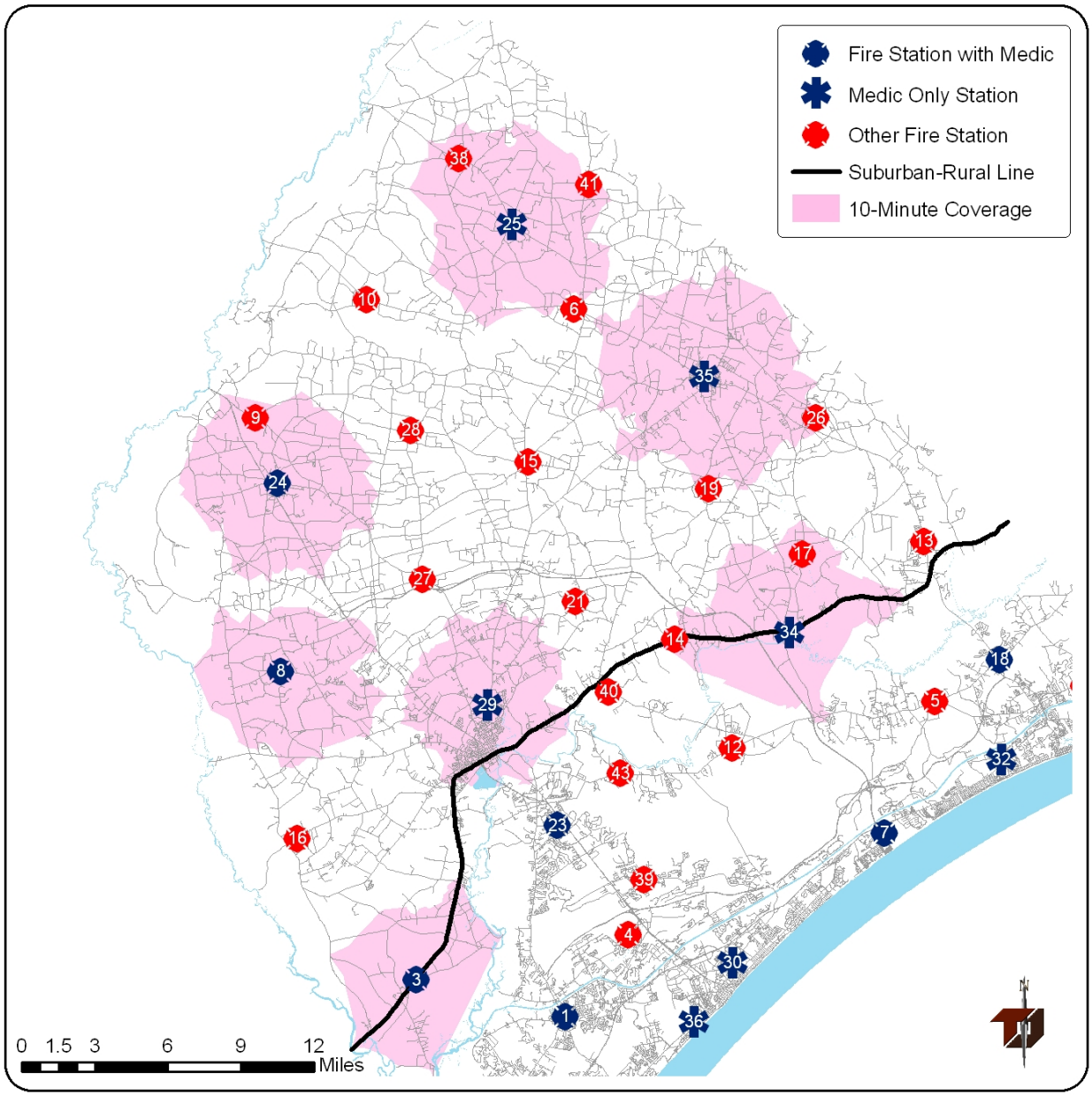
Map 10: Current Rural 8, 10, 12, and 14-Minute Travel Time by Fire Station



Map 11: Current Suburban 4 and 8-Minute Travel Time by Fire Station

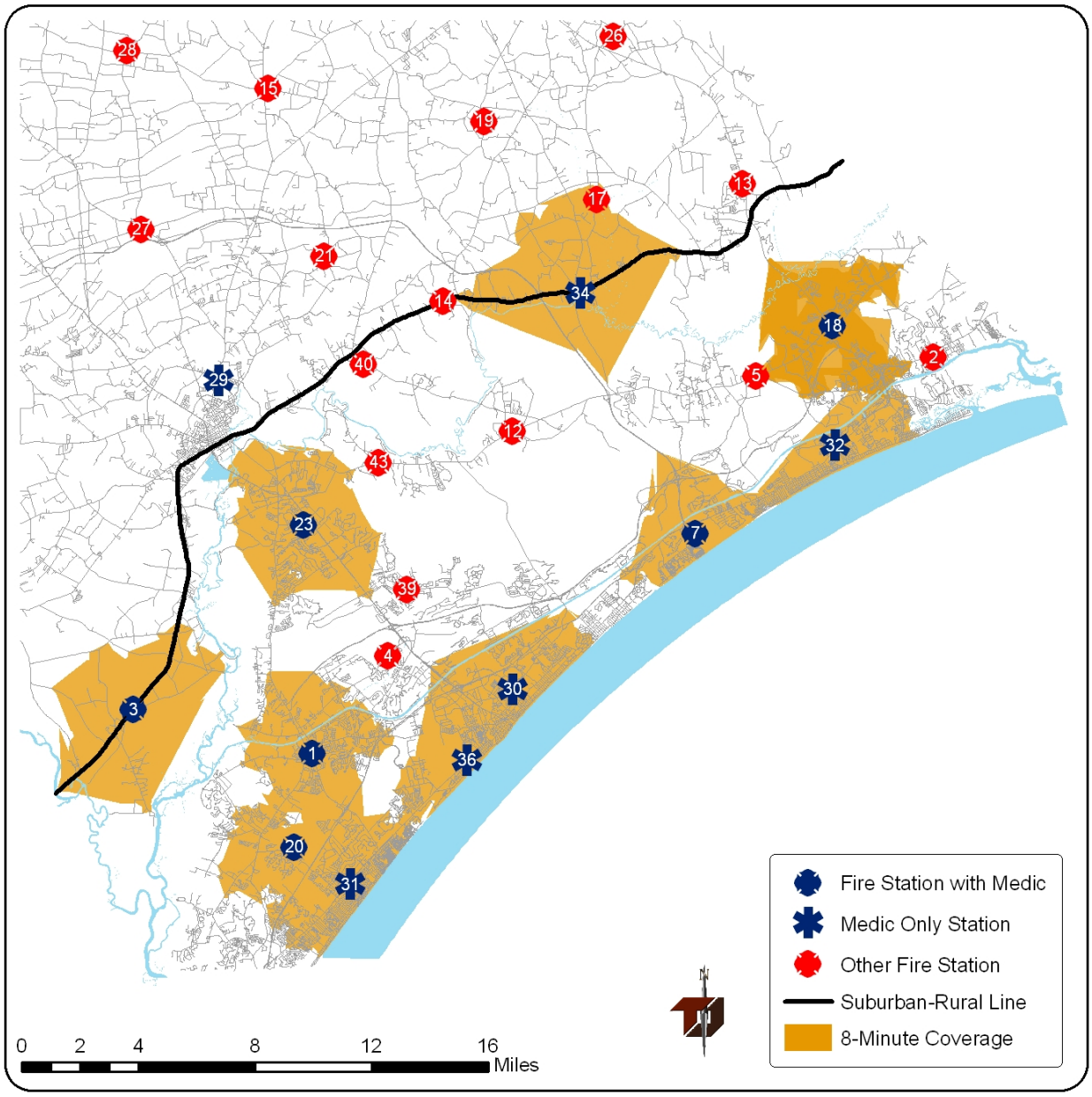


Map 12: Current Rural 10-Minute Travel Time by ALS Medic Station



As can be visualized by the GIS map, large gaps in EMS coverage are prevalent in the rural area even when a longer than desired 10-minute travel time is considered.

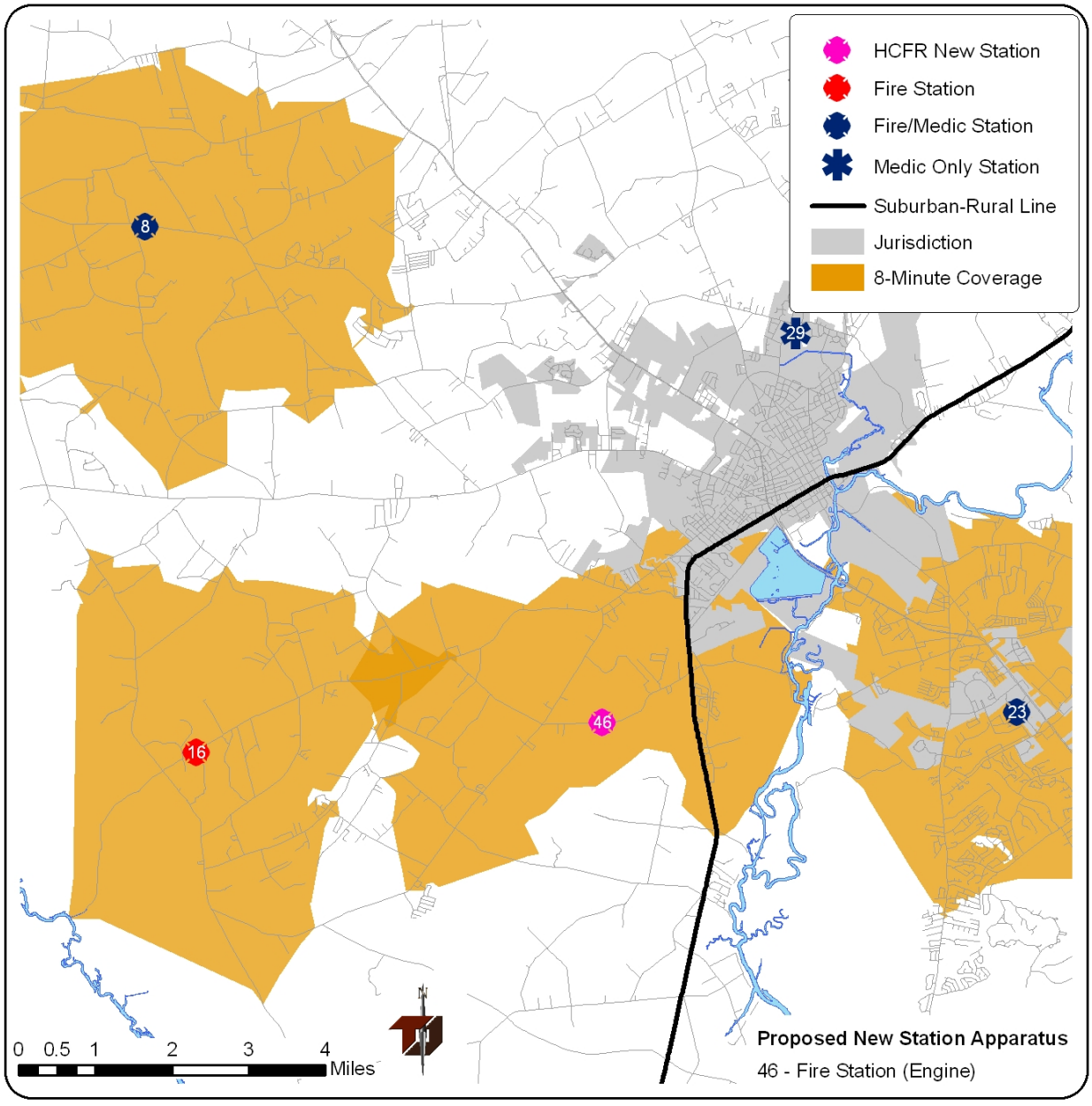
Map 13: Current Suburban 8-Minute Travel Time by ALS Medic Station



Overall, the county could gain better coverage by adding two additional stations and relocating one existing station. A gap in fire coverage exists in the rural portion of the county to the west of Conway, east of Station 16, and south of Station 8. In this area, 8-minute engine and 14-minute tanker/ladder travel time coverage for Stations 16 and 8 do not reach this area. The area around Conway also has a high density of EMS and fire calls, so the gap is particularly significant. Adding an additional station just to the west of Conway will provide faster fire service coverage, and also serve as a first responder for the areas just outside Conway to cover the high volume of EMS incidents. To address the coverage, the county is considering adding a

new station (number 46) on Pitch Landing Road and this appears to be a good location. However, a more thorough analysis of the exact location should be conducted before the final decision is made. Map 14 shows the location identified by the fire department for Station 46 with an 8-minute travel time coverage area for rural engine response.

Map 14: Proposed Station 46 8-Minute Engine Coverage

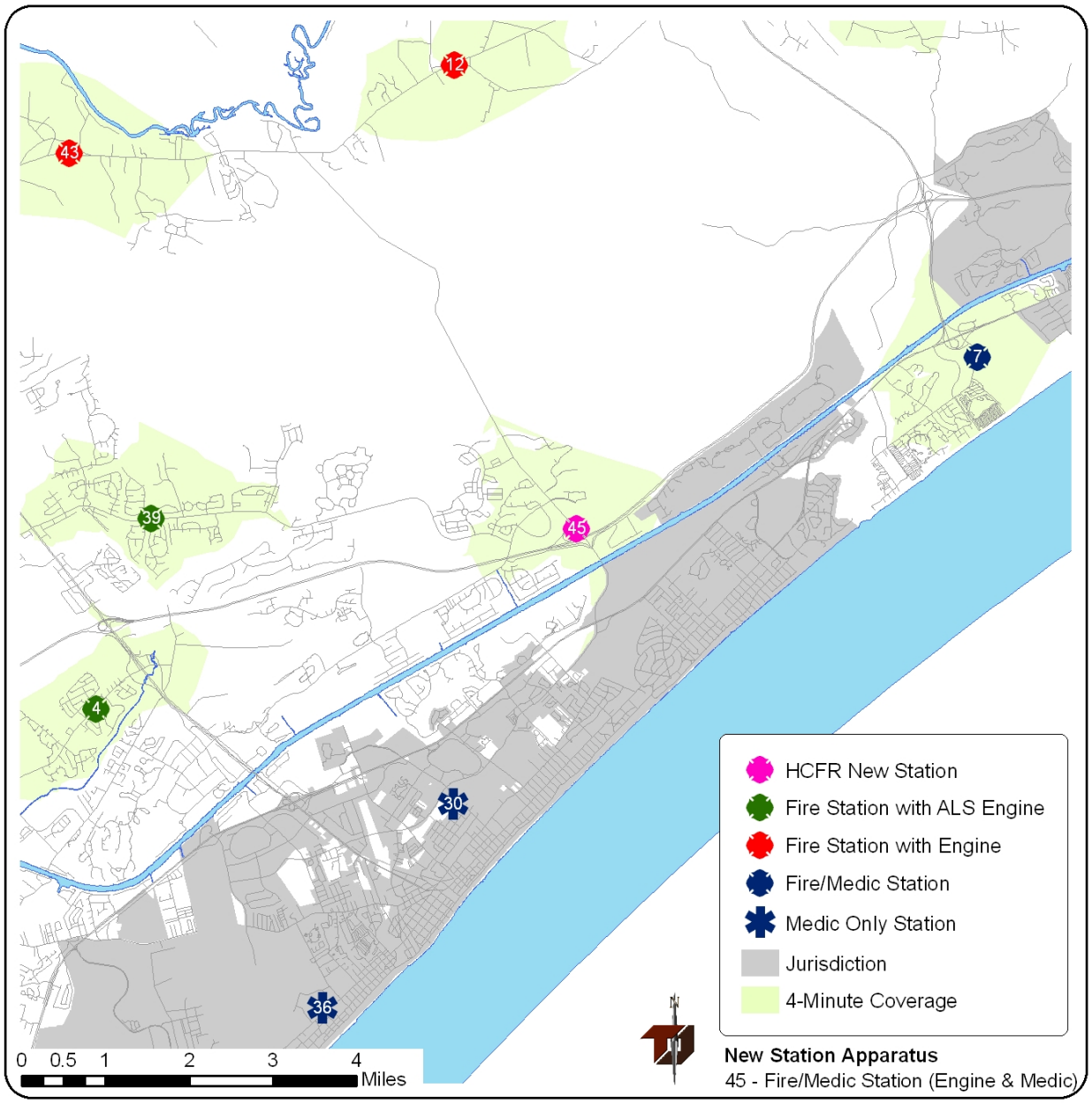


Recommendation 50: Build a new station in the vicinity of Pitch Landing Road just to the west of Conway.

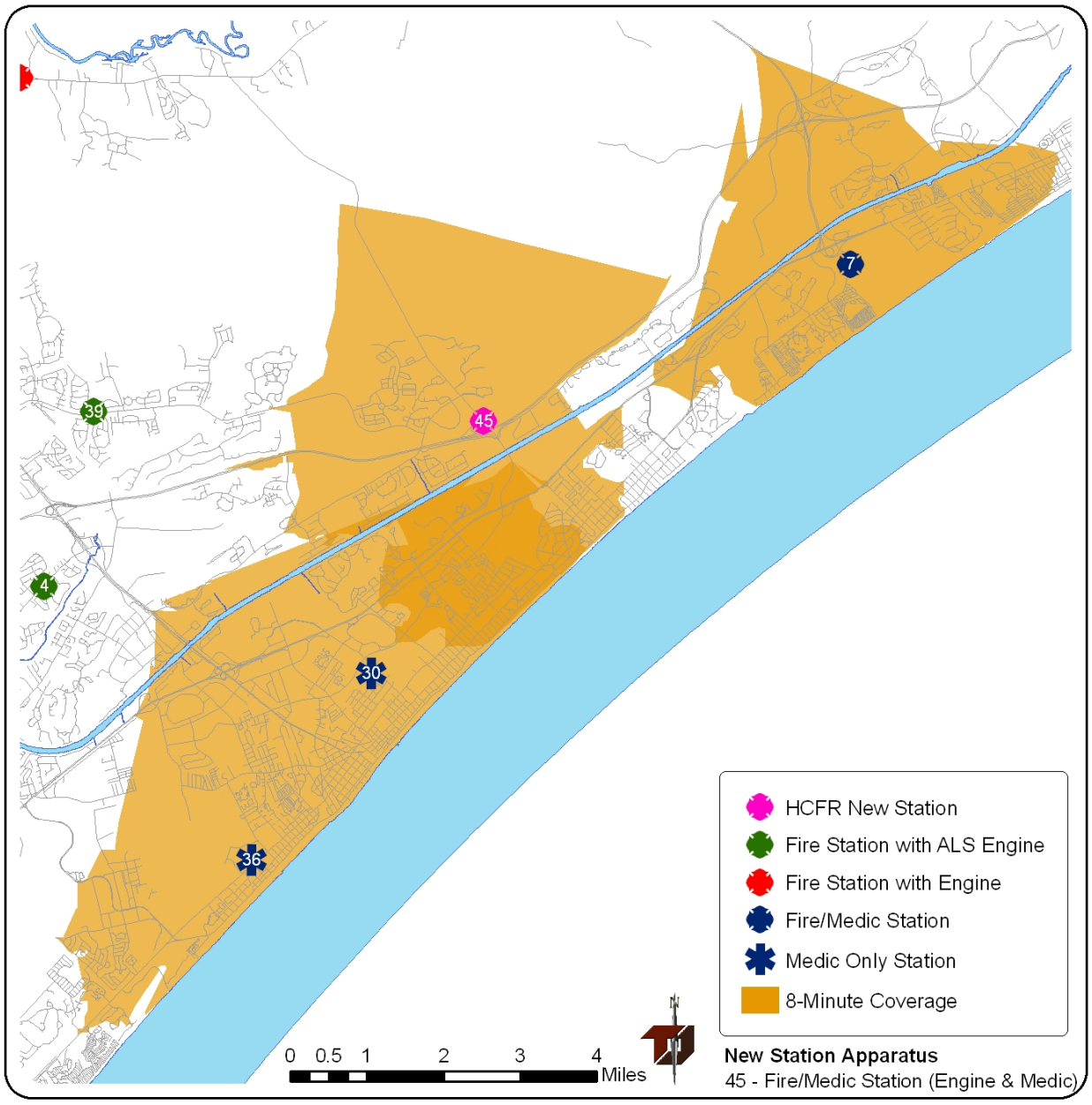
The addition of a second new station in the suburban area will also provide faster coverage for a high-volume call area. The county has already built a new station (45) in the gap

area previously identified in this analysis. The new station, to be opened in the near future, is located at 790 International Drive to the southwest of Station 12 and southeast of Station 43, just off the coastline. Based on existing stations' travel time reach, the location of new Station 45 is appropriate. The new station will provide additional coverage in a high-volume incident area and is also well placed in a developing area of the county. It is recommended to place an engine and medic at Station 45. Map 15 shows the new Station 45 with 4-minute engine coverage and Map 16 shows the 8-minute medic coverage.

Map 15: New Station 45 4-Minute Engine Coverage



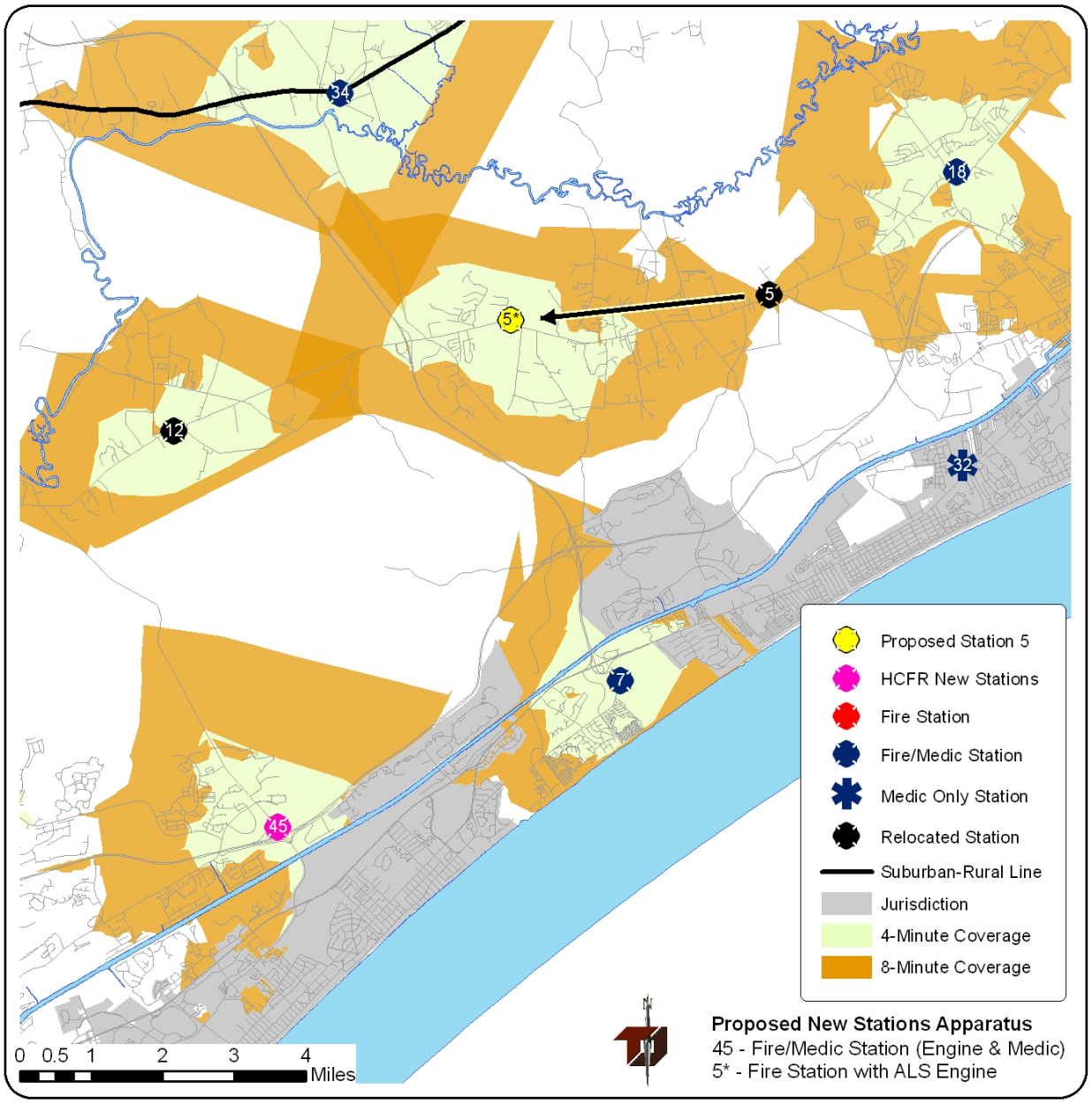
Map 16: New Station 45 8-Minute Medic Coverage



Recommendation 51: As currently planned, Station 45 should house one engine and one medic unit.

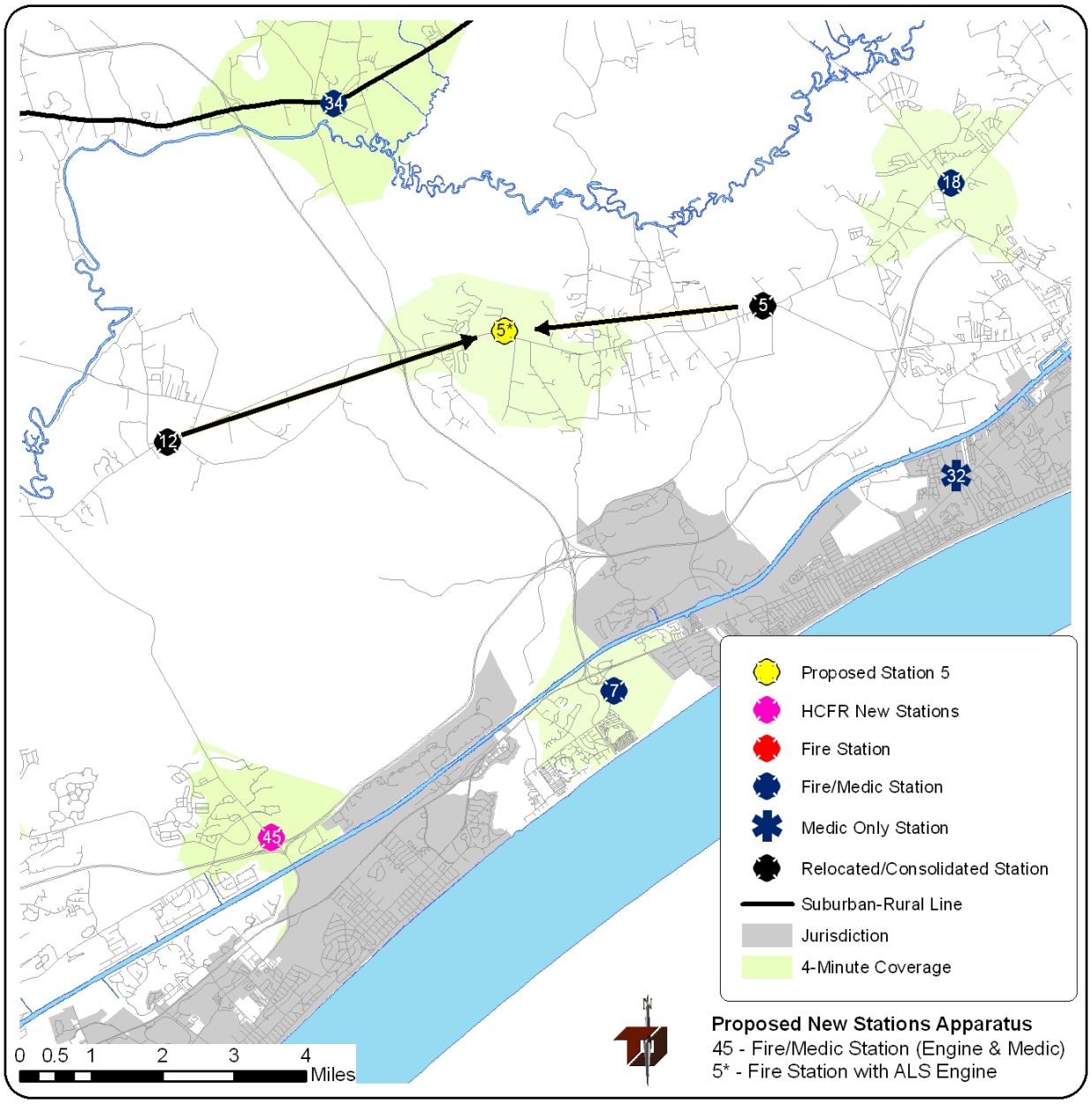
Lastly, the relocation of Station 5 to the west of its current location will provide a more efficient coverage area with less overlap of Station 18's reach. It is recommended to locate the new Station 5 along Highway 90 near the intersection of Vaught Ridge Road and Highway 90. It is also recommended that the new station house an ALS engine thus providing increased engine coverage in an area where there is currently a gap. Map 17 shows the 4 and 8-minute engine coverage for the proposed new Station 5.

Map 17: Proposed Station 5 4 and 8-Minute Engine Coverage



In addition to a new Station 5, a long term consideration is to consolidate the new Station 5 and current Station 12. This new combination would be located at the new Station 5. It is important to keep this potential long-term change in mind when selecting a location for the new Station 5 as to not have too much overlap with the new Station 45. The consolidated new Station 5 and current Station 12 would house an ALS engine and tanker. Map 18 shows the 4-minute engine coverage for the proposed consolidation.

Map 18: Proposed Consolidated Station's 5 & 12 4-Minute Engine Coverage

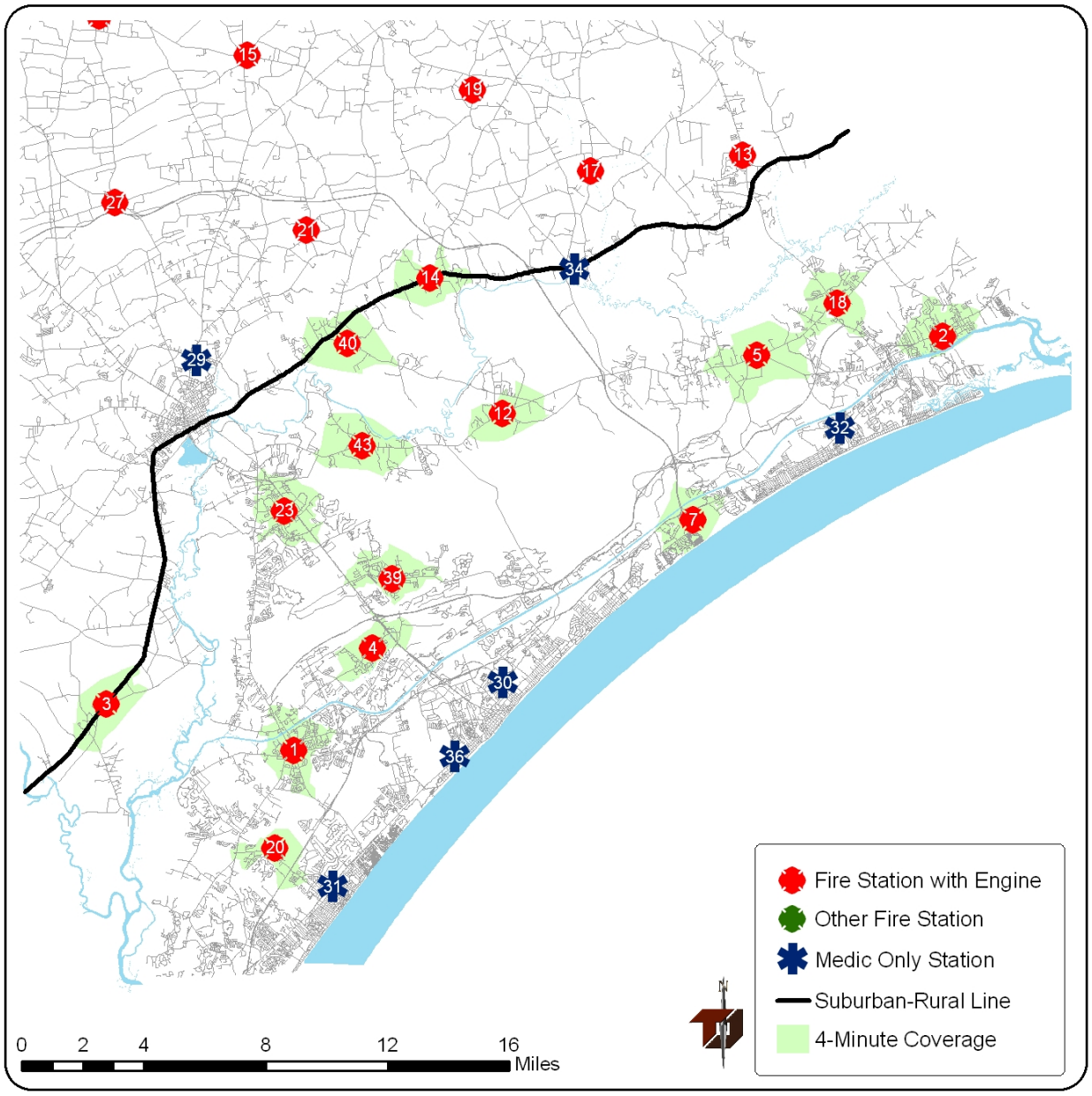


Recommendation 52: Relocate Station 5 in the vicinity of Highway 90 and Vaught Ridge Road. Consolidate Station 12 and the new Station 5 and house an ALS Engine and Tanker at this location.

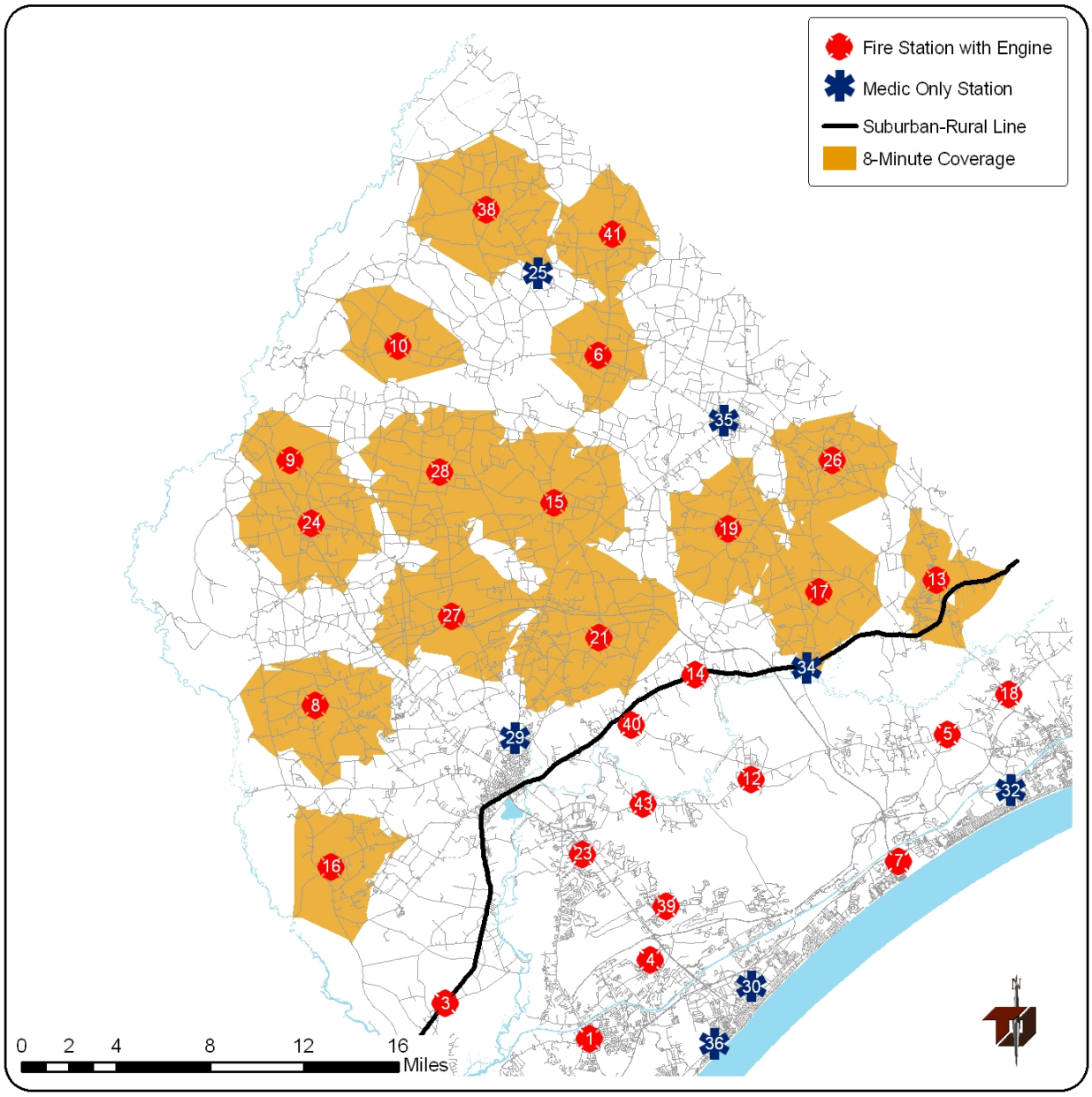
Apparatus Deployment

Engine Locations – Engine placement throughout the county is generally adequate for current call density; however there are some gap areas. This engine placement provides 4-minute travel time reach to approximately half of the suburban areas and 8-minute travel time reach to most rural areas as shown in Map 19 and Map 20, respectively.

Map 19: Current 4-Minute Suburban Engine Coverage



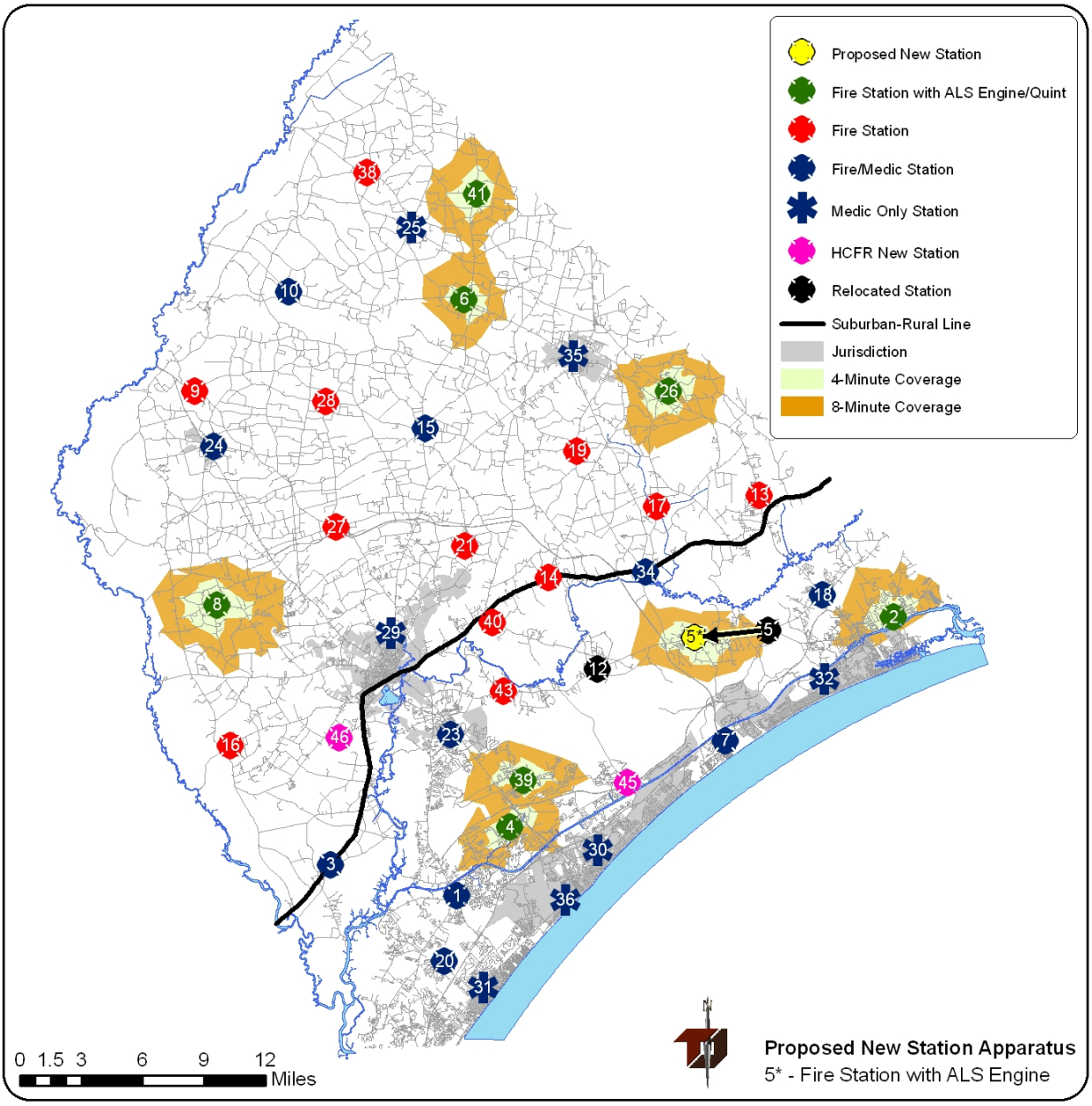
Map 20: Current 8-Minute Rural Engine Coverage



Engine companies generally provide first responder service to fire and EMS incidents. For this reason, it is important to consider spatial demand patterns for both fire and EMS incidents when assessing engine placement and respective travel time reach. Shown earlier, Map 8 and Map 9 depicted the densities of medical and fire incidents, respectively. It is clear from these maps that there are many more EMS calls than fire calls. Furthermore, the concentration of both types of incidents is located near the coast in the suburban section with hotspots identified in and around jurisdictional boundaries. Adding an Advanced Life Support (ALS) crew member to the engine/quint staffing at certain stations provides a higher level of patient care quicker,

given engines typically are the first on the scene for both fire and EMS incidents. In addition to greater coverage, adding the ALS engines will greatly improve the chances for survival from a cardiac arrest. Map 21 shows the 4 and 8-minute travel time reach for the stations that would house the proposed ALS Engines/Quints.

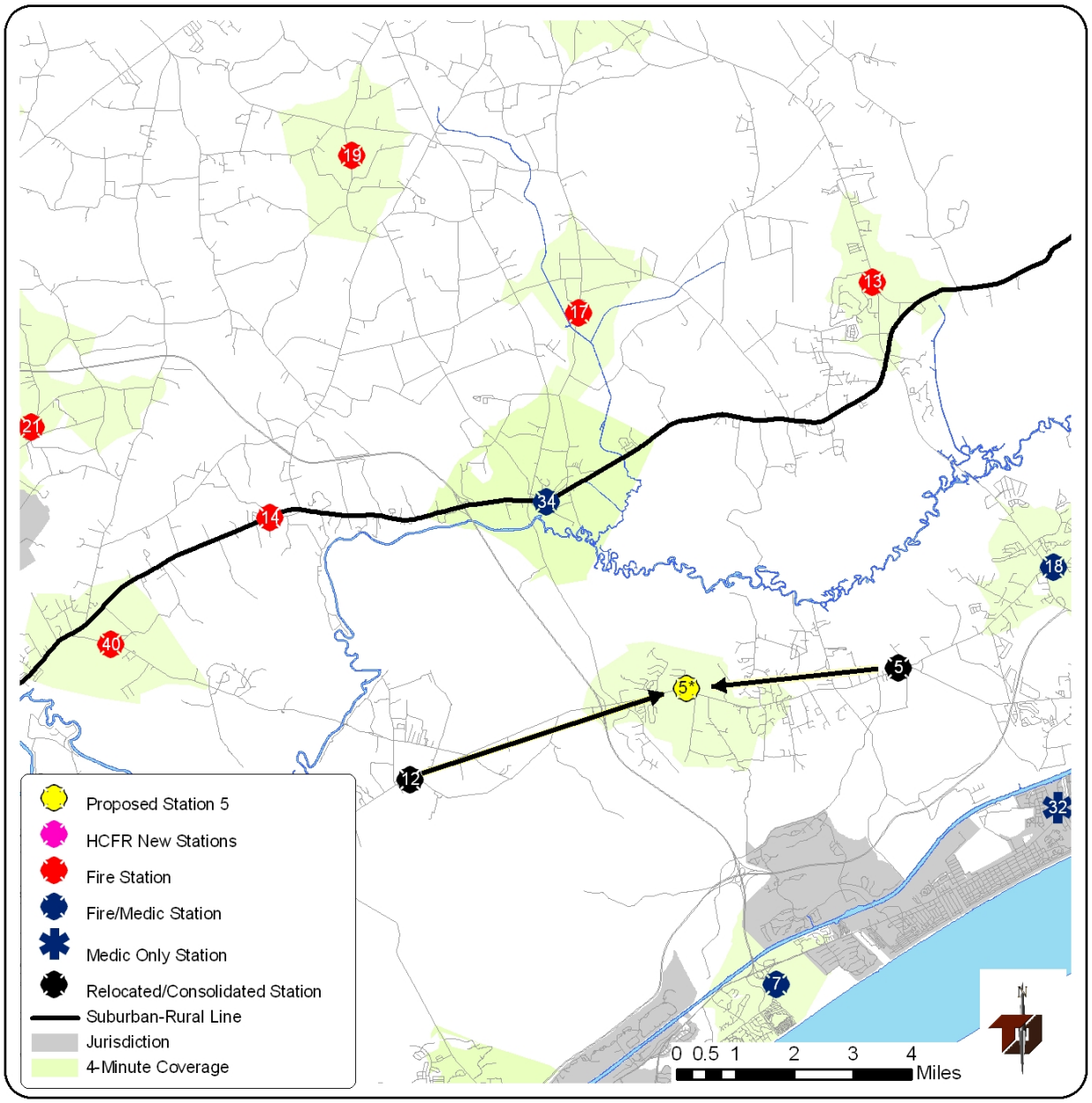
Map 21: Proposed 4 and 8-Minute Travel Time Reach for ALS Engines/Quints



Recommendation 53: Place ALS engines or quint at Stations 2, 4, 5, 6, 8, 26, 39, and 41.

In addition to adding ALS engines, Station 34 would benefit from the addition of an engine company. Station 34 is currently a medic-only station and by adding an engine can extend the reach, especially to the northeast toward Station 17. In combination with the previous recommendation for the new Station 5 and associated apparatus placement, adding an engine at 34 provides most complete coverage while remaining efficient. Map 22 shows the proposed 4-minute engine coverage for Station 34.

Map 22: Proposed Station 34 4-Minute Engine Coverage



Recommendation 54: Place an Engine at Station 34.

Summary

HCFR response times exceed the recommended 90th percentile goals with compliance at the 20th percentile in suburban areas and 52nd percentile in rural areas. To improve overall response times, call processing, turnout, and travel times should be reduced. Call processing times were at 1 minute 59 seconds at the 90th percentile for 2006 through 2007. The NFPA 90th percentile call processing goal is one minute, which was met at the 50th percentile. Turnout times were at 1 minute 29 seconds at the 90th percentile, just above the NFPA 90th percentile goal of one minute. Travel times were also above the recommended 90th percentile goals for both suburban and rural areas. Reducing travel time may be accomplished by considering the current and proposed distribution of stations, apparatus, and personnel.

The current station deployment is generally adequate for most of the county. However, the county is increasing in population, especially along the rural-suburban line, and improving coverage is key. Needed now is a more efficient plan that maintains good fire and EMS response coverage while at the same time improving total response times and capabilities.

Table 43 shows the current and proposed stations and apparatus deployment. Under this deployment, stations and apparatus are located in areas of current and projected high-demand for both fire and EMS. The proposed stations would add two stations in Horry County, Station 45 in the suburban area and Station 46 in the rural area. In addition to the new stations, it is proposed to add paramedic staffed engines and a paramedic staffed quint. The overall proposed deployment of apparatus is shown in Map 23 through Map 26 with respective coverages. All of the proposed changes will enable the department to more efficiently serve the county and better handle the call volume.

Table 43: Current and Proposed Placement of Apparatus by Station

[Current Apparatus indicated in black font]

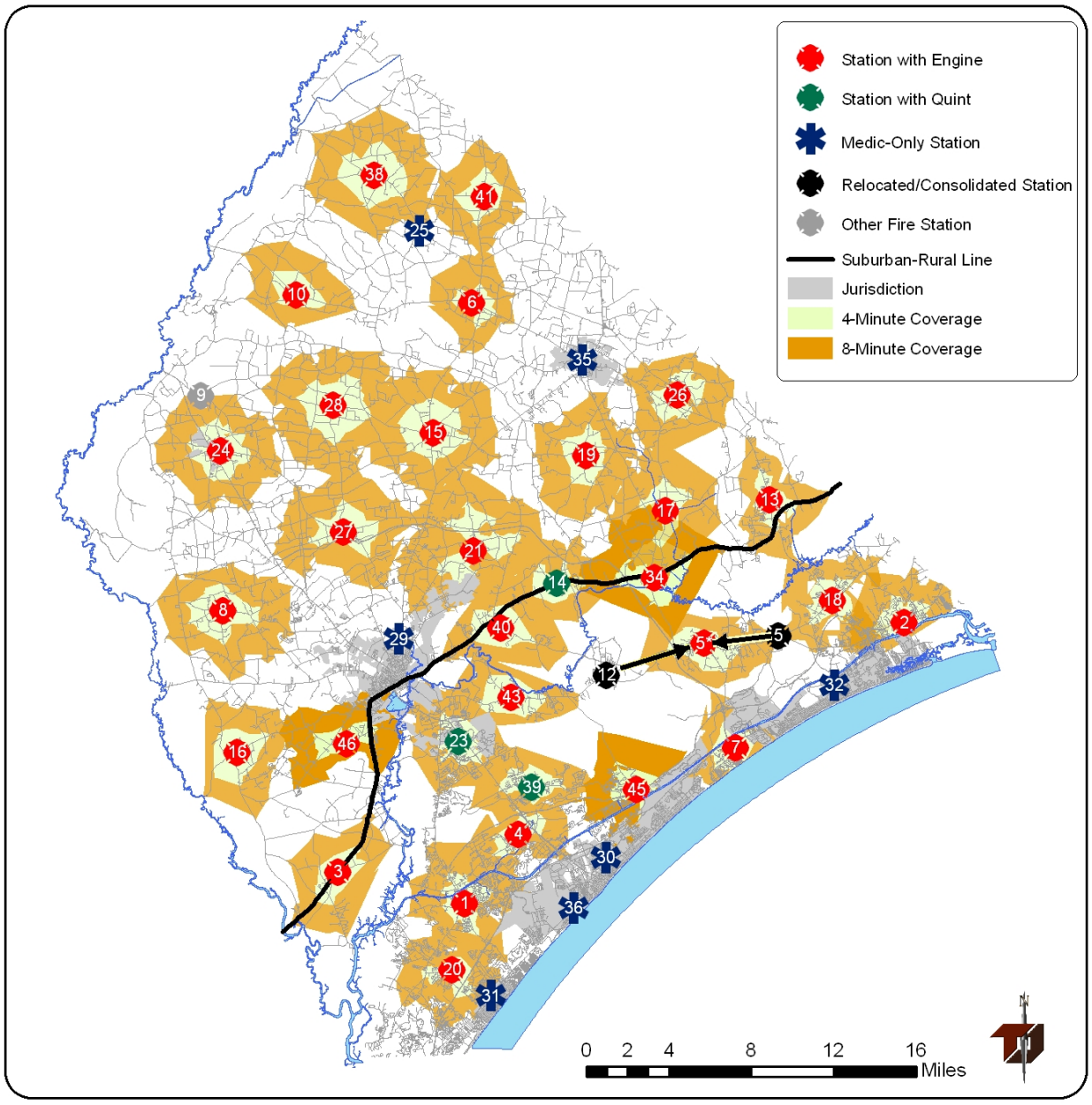
[Proposed Apparatus indicated in red font]

Station	Engine*		Medic		Ladder /Tower		Quint **		ALS Pumper /Tanker		Rescue		Brush		Tanker		Squad		Wild-fire Unit		Marine Utility		Boat		Haz Mat /Tech		Air Unit		Battalion Chief		EMS CPT /LT	
1	✓	✓	✓	✓	✓	✓					✓	✓																	✓	✓		
2	✓	PME			✓	✓							✓	✓			✓	✓														
3	✓	✓	✓	✓											✓	✓																
4	✓	PME			✓	✓															✓	✓	✓	✓								LT
5	✓	PME																														
6	✓	PME											✓	✓	✓	✓														✓		LT
7	✓	✓	✓	✓	✓	✓																										
8	✓	✓	✓	✓									✓	✓									✓	✓						✓		LT
9	✓														✓	✓																
10	✓	✓		✓																												
12	✓									✓					✓																	
13	✓✓	✓																														
14	✓							✓							✓																	
15	✓✓	✓		✓																												
16	✓	✓													✓	✓																
17	✓✓	✓																														
18	✓	✓	✓	✓							✓	✓																				
19	✓	✓													✓	✓																
20	✓	✓	✓	✓									✓	✓																		
21	✓	✓																														
23	✓		✓	✓				✓																	✓	✓	✓	✓				
24	✓	✓	✓	✓									✓	✓																		
25			✓	✓																												
26	✓	PME											✓	✓																		
27	✓	✓																														
28	✓	✓													✓	✓																

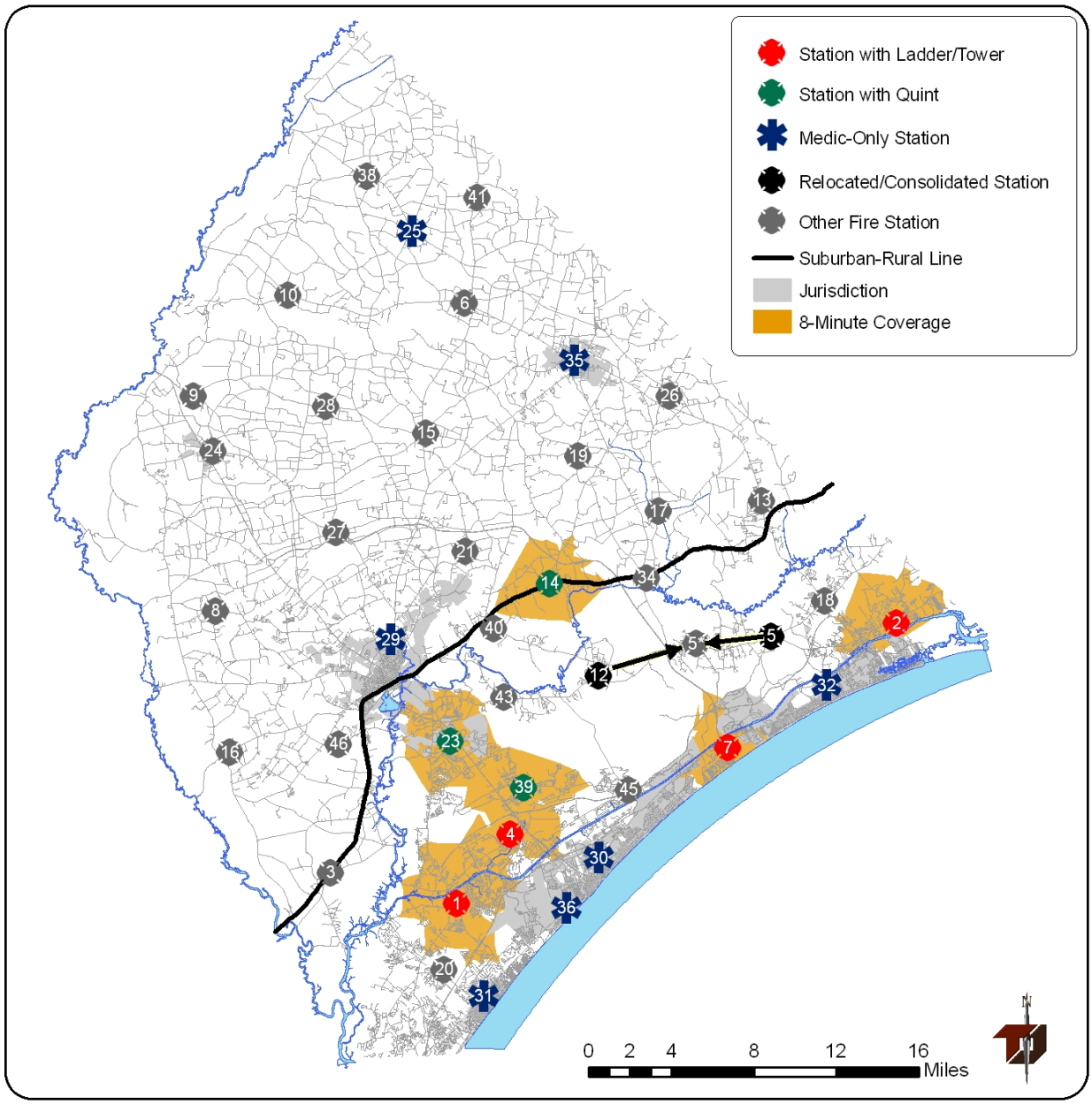
Station	Engine*		Medic		Ladder /Tower		Quint **		ALS Pumper /Tanker		Rescue		Brush		Tanker		Squad		Wild-fire Unit		Marine Utility		Boat		Haz Mat /Tech		Air Unit		Battalion Chief		EMS CPT /LT	
29			✓	✓																												
30			✓	✓																												
31			✓	✓																												
32			✓	✓																												
34		✓	✓	✓																									✓	✓		CPT
35			✓	✓																												
36			✓	✓																												
38	✓	✓													✓	✓																
39	✓				✓			PMQ					✓	✓																		
40	✓	✓											✓	✓					✓	✓											✓	
41	✓	PME																														
43	✓	✓															✓	✓														
45		✓		✓																												
46		✓																														
Total	***33 21, PME***		***16 19***		***5 4***		***0 2, 1 PMQ***		***0 1***		***2 2***		***8 8***		***9 7***		***2 2***		***1 1***		***1 1***		***2 2***		***1 1***		***1 1***		***2 4***		***1 3 LT, 1 CPT***	

*PME = Paramedic (ALS) Engine
**PMQ = Paramedic (ALS) Quint

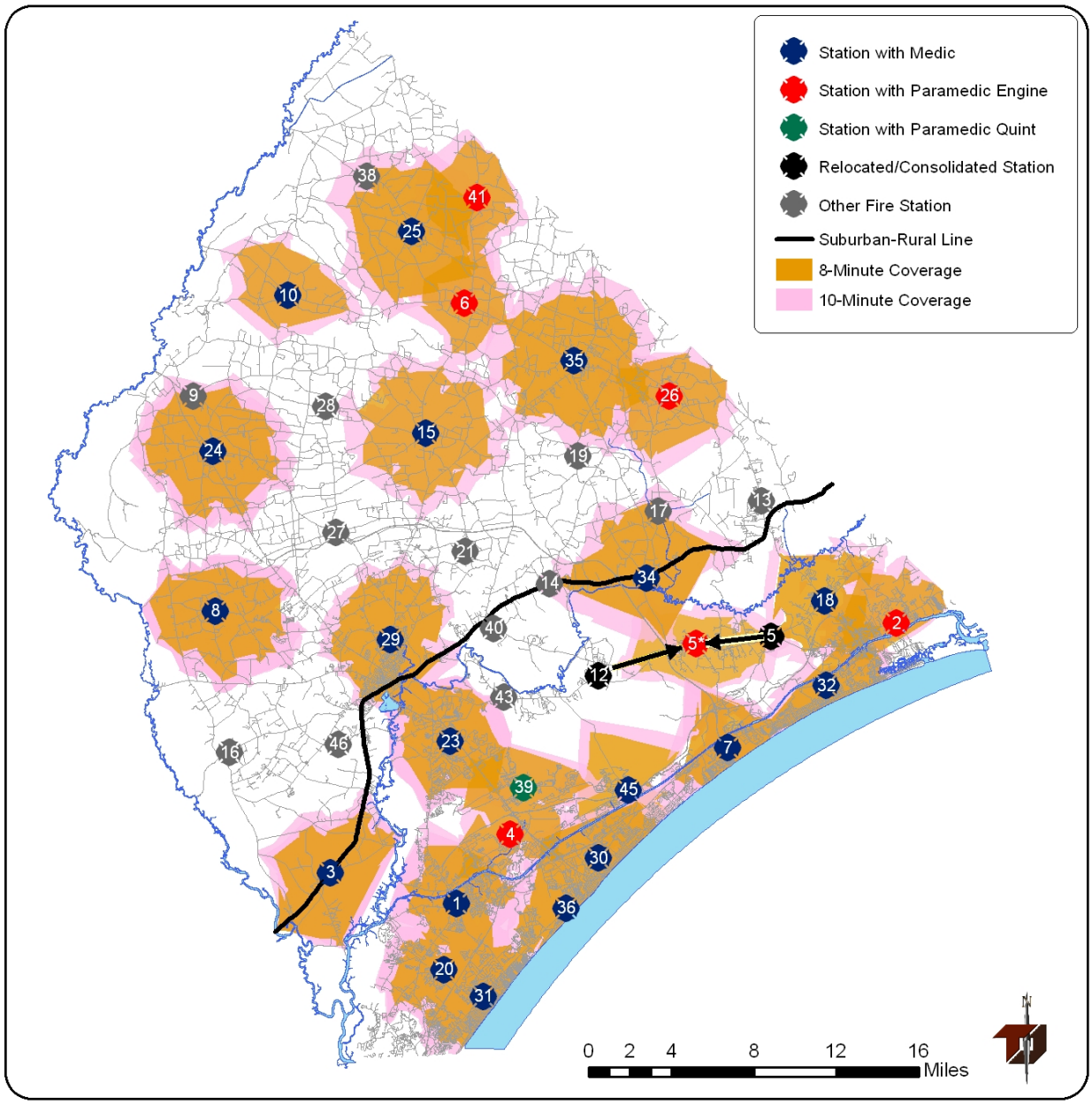
Map 23: Proposed Engine Deployment



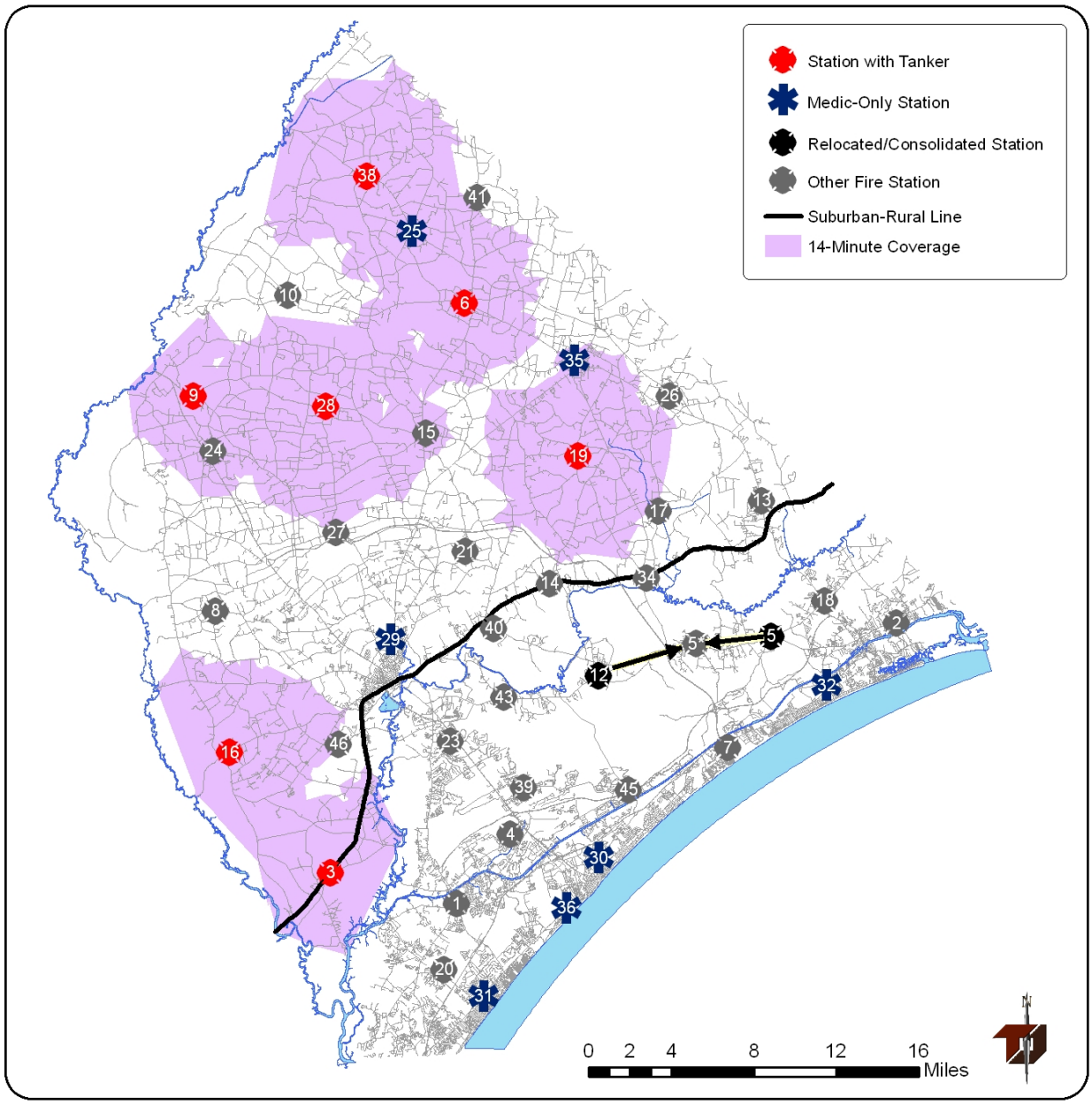
Map 24: Proposed Truck Deployment



Map 25: Proposed Medic and Paramedic Engine/Quint Deployment



Map 26: Proposed Tanker Deployment



VI. Training, Apparatus, and Capital Needs

To provide services, HCFR must have reliable apparatus, good training for volunteer and career staff, and adequate facilities. Over the past several years the county has made improvements to its fleet, in particular modernizing its fleet of ambulances. However, the training program lacks sufficient staff and the training facility is inadequate to meet the fire department's future needs. Likewise, a majority of the fire stations lack basic amenities and several are located on property where the leases are set to expire. There are also too few fire apparatus mechanics which is causing the maintenance program to be reactive rather than proactive. And there is also a critical need for space to perform maintenance on fire vehicles.

Training

Good fire and EMS organizations are noted for the resources they devote to training. Unfortunately, HCFR does not devote much to training and the programs are limited mostly to basic fire suppression operations. There is no training for supervisors or management personnel, albeit the administration is encouraging more people to take advantage of professional development opportunities offered elsewhere.

For a department of its size, HCFR is one of the least resourced training divisions and the facility is very inadequate. To their credit, the training staff is making the best of a bad situation through their ingenuity and they have made some nice improvements to the current center. For the county to meet its future service needs, it will need to make significant enhancements to the present facility or build a new one. It will also have to add instructors to the fulltime staff.

At the time of this project HCFR had two training efforts. EMS training is provided by a EMS personnel under the direction of the EMS battalion chief while fire/rescue training for career and volunteer staff is provided by the fire training division, which is the responsibility of an assistant chief (Life Safety).

The department's training center is located in at Station 15, which is in the Bayboro section of the county, 12 miles northwest of Conway. In its present location, the fire training facility is not in a particularly good location because of the travel time for most of the stations. The addition of career staff has helped the training staff because the personnel at Station 15 can assist when they are not on a call.

Budgeted positions for fire training include one division chief and one fire training officer (captain equivalent). The training chief's position has been vacant for some time and the

department was attempting to fill the position at the time of this study. With almost 500 personnel (career and volunteers), the staffing level to provide training is very inadequate.

There is considerable frustration on the part of many fire personnel about the department's training program. Although training is considered a high priority for the department's leadership, funding issues make it less so in the department's overall priorities. The result is a revolving door by training officers who are frustrated. The workload is also high since there are too few training personnel.

The limited staff at fire training means that the fire department can only provide essential, basic-level training, for new career and volunteer personnel. Shift work personnel have been used to augment the fulltime training staff, which is a good practice. Relying on shift personnel too much can also be a problem for program consistency. Improvements to improve training include:

- Increasing the number of fulltime officers and instructors
- Merging EMS and fire training under the same commander (discussed in chapter 2, Management and Organization)
- Improving officer development
- Budgeting a specific amount of overtime (in the training budget) for adjunct instructors
- Implementing a facility improvement plan to include possibly moving the training facility to a more central location and partnering with other jurisdictions
- Creating multiple training locations, particularly for classroom instruction
- Appointing a training committee consisting of career and volunteer personnel

Career Training – A majority of the department's training effort is directed at training new career recruits. Recruit training requires a significant level of effort and the typical class is approximately 19 weeks. Adjunct instructors from the field are brought in to help with the class as each class requires several instructors. The department typically runs two recruit classes each year. The minimum competency level for career firefighters is Firefighter I (NFPA 1001), which is a nationally recognized curriculum. In addition, career firefighters are required to be EMT-Basic certified.

Besides recruit training, there is little in-service training provided by the training cadre and the department relies on company officers for the day-to day continuing education for shift personnel. The training staff provides station officers with monthly training bulletins, which they then use for training. This is a typical arrangement in other departments. Battalion chiefs are

supposed to monitor the station-level training but this is rarely done because there are too few battalion chiefs.

While new firefighters receive the basic training they need, the same cannot be said for supervisors (lieutenants and captains) or managers (battalion chiefs and above). The fire department does not provide leadership training to prepare them for their new responsibilities. In addition, few officers avail themselves to management or leadership training opportunities outside of the department. Going forward, resources should be allocated for officer training, in particular at least several weeks for newly promoted lieutenants.

Recommendation 55: Provide officer training for newly promoted officers and develop officer educational standards. The current staffing level in training is such that this will be a longer-term goal.

Turnover has been a continual problem for the training division. Reasons vary but most believe it is related to the workload and the absence of a clear mission. That resources are scarce is also a factor. The training division has also hired several individuals from outside the department and then had them transfer to other positions in operations. For the long-term success of the training mission, officer assignments, particularly the top position, must be for a longer period and the department must be committed to the mission. A best practice is for training divisions is to require up-and-coming chief officers to serve at least one tour in training.

Recommendation 56: Change the strategy for assigning career officers to training from the current 'volunteer mentality' such that future leaders of the organization are expected to serve at least one tour in the training division.

Career officers are currently required to attain NFPA Fire Instructor I as part of the promotional requirements. However, officers are not required to teach, nor are they required to take additional instructor certifications for other promotions. Going forward, instructor credentials should match the rank structure with captains and battalion chiefs obtaining even higher levels of certification. Such an approach will be needed if the previous recommendation is to be achieved.

Recommendation 57: Consider requiring NFPA Fire Instructor II for captain and Instructor III for battalion chief. Even when captains and battalion chiefs are not assigned to the training division, one of their most important responsibilities is to provide adequate instruction.

At the time of this study, the officers at fire training had developed an outstanding strategic plan for training. We reviewed the plan and found it to be well thought out and realistic. Program goals are identified in the plan as are specific training objectives for every rank. The plan also recognizes the need to augment fulltime trainers with field staff, particularly for special

programs. Although the plan does identify the training-hour requirements for each program, it does not go to the next level and articulate the level of effort and the staffing requirements to implement the plan. The hard work has been mostly completed and the next step is to formulate the full and part-time instructors necessary to implement the plan. Cost estimates can then be developed as well. Reportedly, the fire administration has not yet adopted the plan.

Recommendation 58: Update the training plan to include staffing and cost requirements and prioritize the programs based on their need. Then develop a multi-year implementation schedule that meets the department's needs.

Volunteer Training – Training for volunteers is a critical issue both in terms of availability and requirements. Many volunteers believe that training is not available to the degree that it should be and some believe the requirements for volunteers are too extensive. In an earlier chapter we discussed the need for training standards that apply to both career and volunteer officers.

Volunteer fire personnel are required to complete the 80-hour OSHA-level training stipulated as the minimum by South Carolina and they must complete a certified CPR program. The 80-hour OSHA curriculum, although good, provides only minimum hands-on training opportunities. Minimum training standards cited by the state, while reasonable when applied statewide, are not very high and they do not provide the level of hands-on training to be proficient in fire suppression. This is particularly true in Horry County where the structures are significantly more complex than those found in rural areas. The strategic plan developed by the fire department increases the minimum training standard from the OSHA, 80-hour level to NFPA Firefighter I, which is appropriate.

Recommendation 59: Raise the minimum training standard for new volunteers to the NFPA Firefighter I level. Volunteers currently on the active roles should not be required to meet the higher standard unless they request to do so.

In addition to training new career firefighters which requires a large effort, the training division is also tasked with training volunteers. However, staffing is inadequate to handle both career and volunteer training. In many cases; however, volunteers are not taking advantage of the training availed to them despite the fact that many said that too few training opportunities are provided. In fact, we found just the opposite.

For the period January through November the department offered 173 classes specifically designed with volunteers in mind. These classes included introductory topics for new members and more advanced training such as hazmat and vehicle driving/operations. We reviewed the schedule and found that 60 percent (101) of the classes were cancelled because no one had

enrolled. Of the cancelled classes, 30 were vehicle operator classes, which the volunteers said were not being offered enough.

Because of the county's size training logistics is a problem and there is insufficient classroom space at the primary training facility. There are also long travel distances for volunteers and the career units to get to the county's training center. A better approach is for the department to decentralize as much of its training as possible to other sites, which it tries to do now. However, there are a limited number of training sites available, including classroom space. To provide training more efficiently, training facilities should be incorporated into several new stations when they are constructed.

Recommendation 60: Decentralize more of the department's training by incorporating classroom space and small drill areas into several of the new stations.

EMS Training – Most EMS training is provided by three instructors assigned to the EMS division. Previously, EMS and fire instructors were all assigned to the training division. However, a recent reorganization put EMS instructors back under the EMS battalion chief. Coordination between the fire instructors, who are assigned to the training center and EMS instructors, who assigned to headquarters is less then optimal. Future reorganization of the department should include moving EMS training back to the training decision to provide a more cohesive effort.

Recommendation 61: Merge fire and EMS training under the same division chief. Until the present facility is upgraded or a new one constructed, EMS and fire instructors cannot be located at the same location because of limited space. However, there overall training function can be improved with better coordination under one chief officer.

A significant cost is incurred by the county to provide continuing education for paramedics. Under existing guidelines, 72 hours of continuing education is required bi-annually to maintain ones status as a Nationally Registered paramedic. Paramedics with more than seven years in the system (under the pre-merger system) are required to have 48 hours of continuing education training bi-annually. Training is required in several key areas:

- Cardiac
- Medical
- Trauma
- Pediatrics/Ob/Gyn
- General Education

How best to provide continuing education for paramedics is an issue for most departments due to the cost. HCFR does this mostly by using paramedics hired on overtime. At the time of this study there were efforts to automate medical continuing education such that it

could be accessed remotely by station personnel; who could receive the training while they are on duty. This is a good move and one the county should aggressively pursue since it will reduce overtime. Adding the additional EMS supervisors we recommended in a previous chapter will also help since they should be able to provide continuing education in their district while they are on-duty.

Recommendation 62: Investigate the requirements for automating major portions of the ALS (and BLS) continuing education requirements and develop a plan, including costs, to implement such a program.

Training Facility – The training facility has been at its present location since 1985. Since then there have been few improvements and the facility does not provide the environment or training opportunities necessary to support HCFR. For example, there is no space for driver training, pump or aerial operations training, and classroom space is very limited. Office space for the training staff is also poor as are locker facilities, showers, and other amenities. Improvements to the current facility include a burn structure made from shipping containers that were added in 1980 and a small classroom added in 2000.

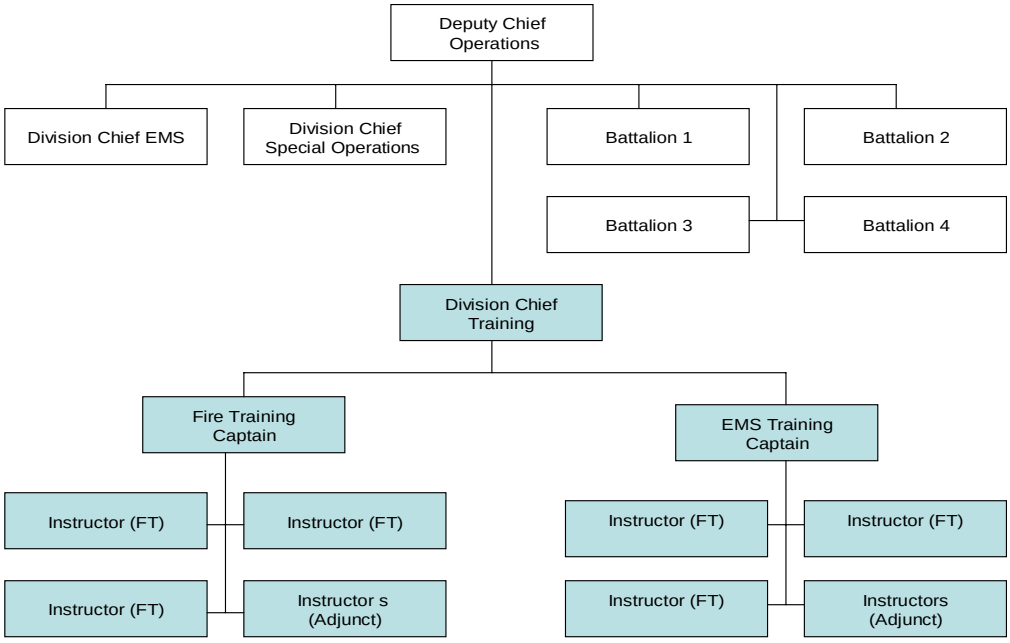
A number of departments in the Grand Strand area have their own training facilities and several are considering major improvements. To provide the best possible training opportunities, and do it efficiently, training should be a regional, not parochial effort. Because of the county's tremendous growth there are probably opportunities to partner with the state's training effort and these other communities to construct a regional facility. A regional approach makes much better sense economically and operationally than the county going it alone and duplicating effort. Staffing the facility can also be regionalized.

A full analysis of training facility requirements and possible locations is beyond the scope of this study. Such a study is needed and the various jurisdictions in the Grand Strand region should partner with the state on the study. Until such time as the study is performed, discretion should be used in how much is put into the current facility.

Recommendation 63: Partner with the state and other departments in the Grand Strand region to build (and staff) a regional training facility. One example of a regionalized facility staffed by multiple jurisdictions is found in Roanoke, VA.

Organization – Facilities aside, organization and staffing of the training effort is not suffici8ent to meet the department's needs. Until the strategic plan we discussed earlier is finalized and programs are actually approved it is difficult to say what the final staff level for training should be. To begin; however, we suggest the following as the organizational structure that should be used in parallel with the overall department reorganization.

Figure 18: Proposed Training Organization



Under the proposed reorganization, EMS and fire report to the same division chief. In addition, captains are responsible for the major program areas with instructors reporting to the captains. Until the strategic plan is completed and the actual level of effort determined, a reasonable cadre is nine personnel, including the division chief. This provides one supervisor and three fulltime instructors for fire training and the same for EMS. Fulltime instructors are supported by adjunct field instructors.

There is also a need to involve more stakeholders in the training effort and provide guidance on training needs, especially from the volunteer segment which has specialized needs such as training schedules. To plan for the department's future training needs, a committee can provide useful information on what training is needed; how to provide it; and the best scheduling to fit the various needs? A best practice for combination departments is to get this input via a training committee.

Recommendation 64: Reorganize the training division under one division chief with captains in charge of the major program areas for EMS and fire training.

Recommendation 65: Establish a training committee with representatives for volunteer and career personnel as well as officers.

Apparatus

The overall condition of the fire and ambulance fleet is improving. The ambulance fleet is in much better condition than is the fire apparatus fleet, which is poor in some areas. The average age of the ambulances is much lower than fire apparatus fleet, primarily because the ambulance fleet has received quite a number of new units over the last two years. Efforts are being made to upgrade the fire apparatus fleet; however, the funding level is too low to purchase units and make the necessary improvements As a result, the situation is likely to get worse before it gets better. The fire department is aware of the situation and it is taking the necessary steps to obtain additional funding.

There are also issues with fleet maintenance, which is a cooperative arrangement between the fire department and county fleet services. Mechanics budgeted to HCFR are responsible for fire apparatus maintenance while ambulances and staff vehicles are maintained by mechanics at the county's central maintenance facility. To improve fire apparatus maintenance additional mechanics are needed as is an expansion to the county's maintenance facility.

Fleet Services – County fleet service is responsible for all EMS units and staff vehicles. The fleet director and the fire department's assistant chief of logistics coordinate fleet repair needs and the coordination appears top be working well. There were no major problems reported at the time of this study and the fire department is generally satisfied with the service it receives from fleet services.

County fleet maintenance uses a business enterprise model. It has an annual budget of approximately $1.3M with 18 employees: seven heavy equipment mechanics; three light-duty mechanics; and, eight support staff, which include supervisory staff and a parts person.

It was first believed that fire maintenance mechanics should be merged into the county's fleet maintenance division. However, fire mechanics have a very close working relationship with station personnel and, as a result, have a better grasp of the needs of fire personnel and the operation of the apparatus. There are no savings if fire mechanics are merged into the county's fleet services division, thus the change would be organizational in nature only. Fire mechanics are also budgeted under the county fire tax, thus their salaries (and benefits) are appropriate reflections of the fire service effort.

With only two heavy equipment mechanics, the fire department does not have enough staff to handle its large fleet; therefore, maintenance is mostly reactive, not proactive. A third person, light duty mechanic, is also funded; however, this individual is used only to shuttle fire apparatus from the stations to repairs facilities and back. One heavy equipment mechanic is assigned to each of the two battalions. Reportedly, the arrangement works well.

Fire apparatus mechanics perform mostly routine preventive maintenance (PM) such as oil changes, lube, and handling minor repairs. Regularly scheduled PM is performed by the county's vehicle maintenance staff, which is separate from fire. PM on career fire units is performed every 5k miles while volunteer unit PM is performed every six months. According to those with whom we spoke, PM is not up to date because of the limited staff. There are also issues with coordination between the fire maintenance personnel and the county's vehicle maintenance staff. Partially responsible is that these facilities are separate.

Fire apparatus repairs which cannot be performed at a fire station are often made at an older, two-bay facility, which is no longer used as a fire station. The facility is clearly outdated and in many ways, unsafe. One consideration is to enlarge the county's maintenance facility to provide additional space for fire mechanics. Such a plan was considered when the county maintenance facility was originally constructed in 2000; however, the plan was not implemented. The foundation already exists for the expansion and the cost to make the addition is probably less than $400k. At the same time, the county should consider merging the fire department's supply/logistics operation to the site as well instead of leasing space.

The county uses a much older and inefficient AS400 system to track maintenance costs but HCFR has no access to the system except to review work orders. The only available data on fire vehicle maintenance is to review paper records which are not completely accurate. As a result a points system used to decide which vehicles to replace and when, is not working well for the fire department.

Vehicle maintenance work orders are coordinated through headquarters and mechanics pick up the work orders on their periodic stops at headquarters. Work orders are not processed via computer even though each fire station is equipped with one. Fire mechanics also do not have access the county's fleet MIS system, which is an older AS400 version. To improve efficiency and to track the total cost of fire fleet maintenance, repair orders, including labor and parts charges, should be collected by the same fleet MIS system.

Although fire and fleet are separate budgets, a new MIS could easily accommodate separate accounts. The county's vehicle replacement policy includes points for repair costs and these are well documented for EMS vehicles; however, the same information is not always available for fire units without an exhaustive process. Achieving greater accountability by updating the fleet MIS system should be a high priority.

Training for fire mechanics is mostly on-the-job and additional training after mechanics are hired is non-existent. Fortunately, two of the three fire department mechanics are experienced with heavy equipment, pumps, and hydraulic equipment. Unfortunately, the mechanics do not

have certifications from the major manufacturers, which could be an issue if a repair is questioned, or a malfunction occurs.

Most of the major fire apparatus manufactures and engine/transmission vendors conduct excellent training programs, most at a nominal cost. The cost is typically for travel to the training and per-diem expenses. It is to the county's benefit when fire mechanics have the latest information on apparatus. To make such training efficient, each mechanic could specialize in a particular subject area. New mechanics hired by the county should be required to have completed some formal instructions and they should be afforded opportunity to attend training on a periodic basis.

Recommendations to improve the department's fleet maintenance effort include:

Recommendation 66: Add at least one heavy-equipment mechanic.

Recommendation 67: Expand the county's maintenance facility to provide several bays for fire apparatus maintenance.

Recommendation 68: Update the county's AS400 system to a newer, fleet RMS system.

Recommendation 69: Establish minimum training standards for new heavy-equipment mechanics and provide annual training opportunities to attend programs offered by apparatus manufacturers.

Vehicle Replacement – The fire apparatus replacement program has not been funded to the level necessary to keep the fleet up-to-date. EMS units, which are funded by the general fund, have fared much better and the ambulance fleet is excellent. Since 2005, 14 new ambulances have been purchased, which is 54 percent of the total fleet (26). In this section we discuss the fire apparatus replacement program, which is currently the highest priority.

To address the fire apparatus problem, HCFR developed a comprehensive apparatus replacement plan. The plan is well written and the recommendations are solid. To address the problem of an aging fleet, the county authorized the fire department to add $300k to vehicle replacement account beginning in 2004 and raised the amount to $500K in 2007. Even with the increase, the annual funding level is too low to keep the fleet up-to-date.

At the time of this study, the fire apparatus fleet included 31 first-line engines, 16 reserve engines, 5 aerial ladders/towers, and 9 tankers. Specialized units included 2 heavy rescues, 2 squads, and 8 brush units. The department also operates specialty units such as a hazardous material technical rescue unit. In terms of age and overall condition, aerial ladders/towers, brush units, and tankers are the most up-to-date as are the two rescue units.

Table 44 depicts the current apparatus roster, including the unit type, age, and make of the units.[54]

Table 44: HCFR Apparatus Fleet

Unit Type	Make
Engines	
1986	GMC E-One
1986	GMC E-One
1990	Ford E-One
1990	Ford E-One
1990	Ford E-One
1990	Ford E-One
1990	Ford E-One
1990	Ford E-One
1990	Ford -One
1990	Ford E-One
1990	Ford E-One
1990	Ford E-One
1990	Ford E-One
1990	Ford E-One
1990	Ford E-One
2000	Luverne Spartan
2000	Luverne Spartan
2000	Luverne Spartan
2000	Luverne Spartan
2000	Luverne Spartan
2000	Luverne Spartan
2000	Luverne Spartan
2000	Luverne Spartan
2004	M & W International
2004	M & W International
2004	M & W International
2004	M & W International
2004	M & W International
2004	M & W International
2004	M & W International
2006	Ferrara HME
Reserve Engines	
1986	GMC E-One
1986	GMC E-One

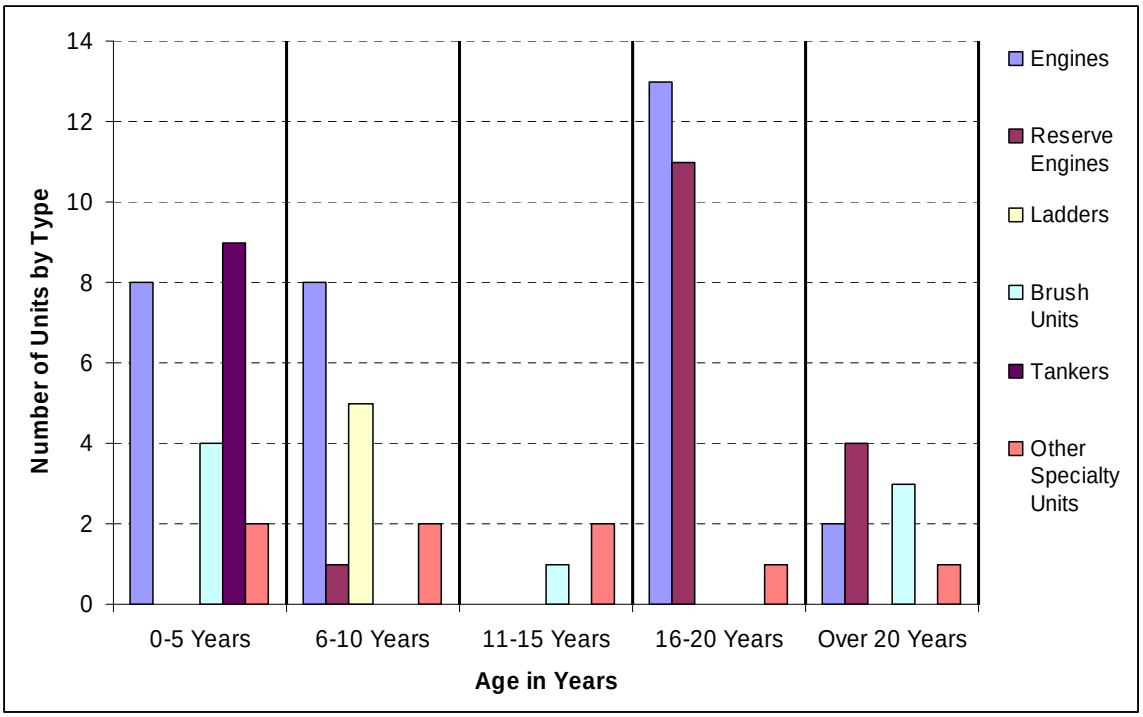
[54] At the time of this study, several older engines were being removed from inventory and sold.

Unit Type	Make
1986	GMC
1986	Fed Motors E-One
1989	Ford KME
1989	Ford KME
1989	Ford KME
1989	Ford KME
1989	Ford KME
1989	Ford KME
1989	Ford KME
1990	Ford E-One
1990	Ford E-One
1990	Ford E-One
1990	Ford E-One
2000	Luverne Spartan
Ladders/Towers	
2000	Ferrara 105' Tower
2000	Ferrara 75' Ladder
2000	Ferrara 75' Ladder
2000	Ferrara 105' Tower
2000	Ferrara 105' Tower
Tankers	
2004	International
2004	International
2004	International
2004	International
2004	International
2006	Kenworth
2006	Kenworth
2006	Kenworth
2006	Kenworth
Specialty Units	
Brush/1985	Chevy 1500
Brush/1986	Chevy 1500
Wildfire Engine/1986	GMC E-One
Brush/1986	Chevy 1500
Mobile Air Unit/1990	Chevy C-6550
Squad/1996	Ford F-350
Squad/1997	Ford F-350
Brush/1997	Ford F-350
Haz-Mat/Tech Rescue Utility/1998	Chevy C-6550
Marine Utility/2000	Chevy C-6550

Unit Type	Make
Brush/2004	Ford F-550
Brush/2004	Ford F-550
Brush/2004	Ford F-550
Brush/2004	Ford F-550
Rescue/2006	Seagrave
Rescue/2006	Seagrave

The bar graph in Figure 19 shows the apparatus fleet by age distribution.

Figure 19: Age Distribution of Fire Apparatus by Unit Type



The number of engines and reserve engines in the 16–20 year range (and over 20 years) is a concern to us and it should be a concern for the county as well.

As is evident from Figure 19, apparatus replacement funding is and has been inconsistent. Past practice is to wait until the fleet is in bad shape, then purchase a significant number of units at one time. Looking at the fleet roster one can see the peak years when many new vehicles were purchased. The problem with this approach is that large portions of the fleet become old at the same time; which is the current situation faced by the county. A better approach is to establish a revolving program where funds are set aside each year based on a long-term replacement schedule.

Since 2000, apparatus replacement funding from the county has included monies from two fire bonds ($1.21M) and $300k in the 2007 general fund budget mentioned previously. At

the time of this study, $218K remains in the county's bond fund for apparatus purchases. Over the seven year period, the annual average funding level is less than $225K, which is clearly not enough to keep the fleet up-to-date, let alone correct the aging fleet situation.

To address the situation, HCFR developed a long-term comprehensive vehicle replacement program, which was reviewed as part of this study.[55] The report clearly documents the situation with the fleet and it provides a wealth of information. As we understand it, the vehicle replacement plan was reviewed by the fire chief and public safety director; however it was not adopted and there is no long-term plan in place.

Important facts uncovered in our review of the fire department's report include:

- Over the 22-year period of 1985–2007, 50 engines were purchased by the county
- Major engine purchases occurred in 1985, 1989, 1990, 2001 and 2004
- Apparatus maintenance costs go up as the vehicles age; pumpers less than 10-years old cost $.66/mile while pumpers over 20-years old cost $1.22/mile to maintain (not including fuel)
- The recommended replacement schedule for fire units is 12 years; which is reasonable considering the county's use pattern
- Estimated replacement costs for the various vehicle types is generally reasonable; the exception is the replacement cost for new aerials/ladders, which we believe are too high
- Considering the current fleet size and types of apparatus, the vehicle replacement funding level should be $1.8M per year
- Out-year vehicle replacements are rational and it identifies the specific units to be replaced based on a point system used by the county

The replacement plan put forth by the fire department is a good one. In fact, it is the same methodology that TriData uses when calculating the projected costs for vehicle replacement and determining the schedule. The department's plan also includes a revolving fund concept, which maintains a fund balance in years when fewer units are purchased.

For the county going forward, it should consider the merits of establishing a revolving apparatus replacement fund to avoid high costs later. For example, it could set aside a large

[55] Due to the size of the document we chose not to include it as an appendix. However, it is available from the fire department.

amount in the next year or so in addition to the funds needed to upgrade the current fleet. Money unspent in the fund will continue to earn interest such that the county's portion for apparatus replacement in 10 or 15 years will be considerably less than the current pay-as you-go system.

Recommendation 70: Increase the level of funding for apparatus replacement using the fire department's plan and implement a revolving- fund program to lower out-year costs.

Recommendation 71: Continue to use the county's point system that considers maintenance costs when deciding on apparatus replacement. To make this process more efficient and to track the total cost, the county's RMS system should be updated from the AS400 system as previously recommended.

Vehicle Standardization – There is also a need to standardize the fire fleet to improve efficiency. As it stands now, the fire department has too many vehicle makes and models in its inventory. In parallel with the long-term apparatus replacement program, the fire department should also standardize its fleet as much as possible.

The low-bid system used by the county, and most governments, make it difficult to achieve standardization. In the long run, going with the low bid can end up costing the county more dollars because more parts must be stocked (higher inventory costs). Purchasing solely on low bid also increases labor costs because mechanics have different makes of vehicles to work on. Fire departments, especially large ones like Horry County, also benefit with improved standardization because personnel are often detailed to other stations, and standardization improves their job performance. Training is also easier and more efficient with standardization since there are fewer vehicles for operators to learn. To improve standardization, several strategies have proven beneficial elsewhere:

- Multi-year contracts with selected vendors
- Using 'open' state and federal contracts
- Considering out-year efficiencies and costs when considering the initial specification and bid

Recommendation 72: Take steps to improve standardization of the HCFR fleet.

Capital Needs Assessment

There are a number of capital needs in the fire department. Older stations, including most of the volunteer facilities, do not have basic amenities such as lockers, showers, or sleeping facilities. As the county and demands for service grow, stations should be outfitted such that career personnel can spend an entire shift. Likewise, volunteer stations should have basic amenities such that their personnel can remain at the station for extended periods. In the station-by-station matrix depicted later in this section, we identify the stations where such improvements are needed.

The most pressing situation however, is to address property leases. At the time of this study, 14 stations were located on property leased from private owners. In one case (Station 27), the owner will not renew the lease. There are also several leases set to expire in 2011.

The capital budget includes a number of projects:

- $75K – renovate Station 17 (Mount Vernon)
- $750K – replace Station 27 (Allens)
- $100K – expand Station 34 (Red Bluff)
- $50K – repair the apron on Station 18 (Stephens Crossroad)
- $1.0M – construct Station 46 (Pitch Landing)
- $1.1M – construct Station 45 (Carolina Forest)
- $459K – upgrade and expand Station 16 (Cates Bay)
- $670K – purchase leased property
- $500K – Murrells Inlet fire station (Mutual Aid)

Each project is needed and they fit into the overall plan recommended by TriData. However, $100K may not be enough for the Red Bluff (Station 34), which is recommended to be upgraded from an EMS-only facility to a full-service station.

The county is also making the right move to purchase the leased properties. In the future the county should purchase land instead of leasing. Even if the property considered for a fire station ends up not being in the best location, the county can sell the property and buy another one in the correct location, and probably at a lower cost than if it waits.

Table 45 identifies each station, the units to be deployed and level of service, and the capital needs situation by priority.

Table 45: County-Owned Facilities/Capital Needs

Station/Constructed	Recommended Units	Proposed Service Level	No. Bays	Situation/Capital Needs	Priority
1 – Socastee 1999	1 Engine 1 Rescue 1 Ladder/Tower 1 Medic 1 Battalion Chief	Combination	1	None	
2 - Little River 2002	1 PM Engine 1 Ladder/Tower 1 Brush 1 Squad	Combination	4	None	
3 – Bucksport 1995	1 Engine 1 Tanker 1 Medic	All-career	1	None – Renovated in 2001	
4 – Forestbrook 2003	1 PM Engine 1 Ladder/Tower 1 EMS lieutenant 1 Marine Utility 1 Boat	Combination	2	None – EMS lieutenant is a new service	
5 – Wampee 1989	1 PM Engine	All-career	2	No showers, lockers, or sleeping facilities Station recommended for relocation and consolidation with Station 12	High
6 - Finklea 2005	1 PM Engine 1 Tanker 1 Brush 1 EMS lieutenant 1 Battalion Chief	All-career	3	None Battalion chief and EMS lieutenant are new services	

Station/Constructed	Recommended Units	Proposed Service Level	No. Bays	Situation/Capital Needs	Priority
7 – Lake Arrowhead 2003	1 Engine 1 Tower 1 Medic	All-career	3	None	
8 - Juniper Bay 1985	1 PM Engine 1 Medic 1 EMS lieutenant 1 Brush 1 Boat 1 Battalion Chief	All-career	2	None Property lease expires in 2011 Battalion Chief and EMS lieutenant are new services	 Very High
9 – Antioch 1989	1 Tanker	All-volunteer	2	No showers, lockers, or sleeping facilities Property lease expires in 2013	Moderate High
10 - Ketchup Town 1980	1 Engine 1 Medic	Combination	2	No showers, lockers, or sleeping facilities Lease expires in 2011 Career medic is a new service	High Very High
12 – Nixonville 1986	1 Pumper/Tanker	All-career	2	No showers, lockers, or sleeping facilities Property lease expires in 2011 Station recommended for consolidation with Station 5 at a new site	Moderate Low High
13 – Longs 1981	1 Engine	Combination	2	No showers, lockers, or sleeping facilities Property lease expires in 2012	High Very High

Station/Constructed	Recommended Units	Proposed Service Level	No. Bays	Situation/Capital Needs	Priority
14 – Shell 1981	1 Quint	Combination	2	No showers, lockers, or sleeping facilities Unable to accommodate the recommended quint Property lease expires in 2011 Consider a total replacement at or near the same site	High Moderate Very High High
15 – Bayboro 1980	1 Engine 1 Medic	All-career	2	Renovated in 2007	
16 - Cates Bay 1989	1 Engine 1 Tanker	All-volunteer	2	$459K allocated for major expansion beginning in 2008	
17 - Mount Vernon 1993	1 Engine	All-volunteer	2	No showers, lockers, or sleeping facilities $75K allocated for station improvements to HVAC, roof, and flooring Property lease expires 2047	Moderate Low
18 - Stephen's Crossroad 1993	1 Engine 1 Rescue 1 Medic	Combination	3	Renovations in 2001m 2005 and 2007	
19 - Cherry Hill 1993	1 Engine 1 Tanker	All-volunteer	2	No showers, lockers, or sleeping facilities Property lease expires 2015	Moderate High

Station/Constructed	Recommended Units	Proposed Service Level	No. Bays	Situation/Capital Needs	Priority
20 – Scipio 2003	1 Engine 1 Medic 1 Brush	Combination	3	None	
21 – Maple 1991	1 Engine	All-volunteer	2	No showers, lockers, or sleeping facilities Property lease expires in 2013	Moderate High
23 – University 1993	1 Quint 1 Medic 1 Hazmat/Tech Unit 1 Air Unit	Combination	2	Station completely renovated in 2007	
24 – Aynor 1997	1 Engine 1 Medic 1 Brush	All-career	1	Need additional bay to accommodate medic and brush Property lease expires in 2013	Moderate High
24 - Aynor #2 1989	Vacant	N/A	3	None	
25 - Mount Olive 1992	1 Medic	All-career	1	None	
26 – Goretown 1991	1 PM Engine 1 Brush	Combination	2	No showers, lockers, or sleeping facilities Property lease expires 2015	High High

Station/Constructed	Recommended Units	Proposed Service Level	No. Bays	Situation/Capital Needs	Priority
27 – Allens 1993	1 Engine	Combination	2	Property lease expires in 2017; the owner will not renew Identify new location and construct station	Very High
28 - Joyner Swamp 1992	1 Engine 1 Tanker	All-volunteer	2	No showers, lockers, or sleeping facilities	Moderate
34 - Red Bluff 1992	1 Engine 1 Medic 1 EMS captain 1 Battalion Chief	All-career	1	$100K allocated for additional apparatus bay Engine is a new service	
35 - Loris	1 Medic	All-career	1	None	
38 – Floyds 1992	1 Engine 1 Tanker	All-volunteer	2	No showers, lockers, or sleeping facilities Property lease expires in 2041	Moderate Low
39 - Carolina Forest 2003	1 PM Quint 1 Brush	Combination	2	None	
40 - Hickory Grove 2005	1 Engine 1 Wildfire Unit 1 Brush 2 ATV's	Combination	2	None	
41 - Iron Springs 2005	1 PM Engine	All-career	2	None New service in an existing station Property lease expires in 2027	 Low
43 - Lee's Landing 2005	1 Engine 1 Squad	All-volunteer	2	None	

Station/Constructed	Recommended Units	Proposed Service Level	No. Bays	Situation/Capital Needs	Priority
45 - Carolina Forest 2008	1 Engine 1 Medic	Combination	2	$1.1M allocated for construction of new station to open in May 2008	
46 - Pitch Landing 2009	1 Engine	Combination	2	$1.0M allocated for construction of new station to open in 2009	

Listed by priority, following are the capital facility needs:

Very High

- Identify the location and funding source to relocate Station 27
- Negotiate a new property lease for Station 8
- Renew the property leases for Stations 10, 13, 14

High

- Add showers, lockers, and sleeping facilities to Stations 10, 13, 19 and 26
- Renew the property leases for Stations 9, 21, and 24
- Identify the location and funding source to merge Stations 5 and 12
- In lieu of being able to renew the existing property lease for Station 14, construct a new facility at or near its present location

Moderate

- Add showers, lockers, and sleeping facilities to Station 9, 12, 17, 19, 21, 28, and 38
- Add an additional bay to Station 24
- In lieu of replacing Station 14 (high priority), add a new bay to accommodate a quint and upgrade the current facility

Low

- Renew the property leases for Stations 12, 17, 38, and 41

A Final Thought on Capital Needs – New fire stations in the county are being constructed mostly with pre-fabricated steel and some brick veneer. Older stations are typically concrete block. In our opinion, the construction methods and materials are not adequate considering the hurricane potential that is a constant consideration for the region.

In the event of a major hurricane, it is our opinion that few of the stations could withstand major winds and most would be unusable as a result. Although it is expected that the general population will evacuate during such an incident, fire stations in high-risk areas for hurricanes and earthquakes should be constructed to withstand the event and protect the responders who must oftentimes remain behind. Going forward the county should at least consider different construction techniques for new facilities, and existing stations should be evaluated for their capacity to withstand a major wind event.

For new structures one method uses concrete tilt-slab construction with poured-in-place or modular construction. For this project we looked at several websites and found a wealth of information on this topic. One site in particular noted that "concrete construction withstands winds better than stick-built structures, and cast-in-place concrete walls are stronger than concrete masonry block." [56] The county should at least evaluate whether the current construction techniques are appropriate for the hurricane risk.

Recommendation 73: Evaluate the potential of fire stations to resist a hurricane-force winds and the construction techniques used for county fire stations.

[56] http://www.pathnet.org/sp.asp?id=12387

Appendix A: Undated Fundraiser Policy

HORRY COUNTY

FIRE/RESCUE DEPARTMENT

PROUD * PREPARED *
PROFESSIONAL

STANDARD OPERATING PROCEDURE

APPROVED BY RANDALL S. WEBSTER, FIRE CHIEF:

DATE:

SOP 211

FUND RAISER ACTIVITY POLICY

PURPOSE OF THIS STANDARD

To establish procedures for all department personnel to follow when requesting a fund raiser activity.

1. **APPLICABILITY:** All Horry County Fire Rescue employees and volunteer members.

2. **POLICY:**

   a. All fund raiser activities must be requested in writing and approved by the Fire Chief at least two weeks prior to the beginning of the fund raiser activity. This is to ensure that adequate information is gained to deter any activity that may be deemed questionable or not within compliance of this policy.

   b. All funds raiser activities where the name of Horry County, the Horry County Fire Department, or Horry County Fire Rescue is used are subject to and must follow the Horry County Government Finance and Procurement Policies. This includes the wearing of any article of clothing or the use of any apparatus which displays the name and/or

insignia of Horry County, the Horry County Fire Department, or Horry County Fire Rescue.

3. **NON-PROFIT ORGANIZATIONS:**

   a. All fund raising activities being conducted through a non-profit organization, which is recognized by the State as in good standing, shall also be bound by the above policies. They will also be bound by the rules that govern that organization as stated in the forms submitted to the State.

   b. In order to maintain an updated list of non-profit organizations within Horry County Fire Rescue, a copy of the organization's status must be submitted to the Fire Chief's Office annually.

4. **EQUIPMENT PURCHASES:**

   a. Equipment purchased by any organization other than Horry County, the Horry County Fire Department, or Horry County Fire Rescue will not be placed on any apparatus or be made a permanent part of any building owned by Horry County, the Horry County Fire Department, or Horry County Fire Rescue, unless written authorization is obtained by the Horry County Fire Chief.

   b. Equipment purchased by any organization other than Horry County, the Horry County Fire Department, or Horry County Fire Rescue will not be maintained, repaired or replaced by Horry County, the Horry County Fire Department, or Horry County Fire Rescue, unless written authorization is obtained by the Horry County Fire Chief.

Appendix B: South Carolina Training and Operational Requirements

As a firefighter in South Carolina, what are the OSHA requirements on "Two-in and Two-out"?

The Federal Office of Occupational Safety and Health (OSHA) adopted in 1998 a revised safety standard on respirator protection, 29 CFR 1910.134 (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716). This standard, commonly referred to as the "two-in and two-out" regulation, included provisions concerning procedures for interior structural firefighting. "Two-in and two-out" is also the law in South Carolina.

The South Carolina Department of Labor, Licensing and Regulation, Office of Occupational Safety and Health (S.C. OSHA) operates an approved State Plan which must be "as effective as" the Federal OSHA program, including enforcement of standards. However, Federal OSHA does not cover public sector employees, such as firefighters, but state plans must include both private and public employees.

S.C. OSHA recognized 1) the special needs facing the public sector firefighters in urban and rural settings, and 2) the effectiveness of the South Carolina Fire Academy training program for firefighters and made a decision to adopt a limited amendment to section 1910.134(g)(4)(ii) of the respirator protection standard. The amendment was promulgated in 1998, approved by the General Assembly on May 19, 1999, and published in the State Register on June 25, 1999. (Document No. 2343 pdf)

S.C. OSHA standards require that whenever firefighters enter a burning structure that is immediately dangerous to life and health (IDLH), they must do so in teams of at least two that operate in direct visual or voice contact. Additionally, there must be at least two fully equipped and trained firefighters who remain outside the structure, who are capable of rescuing the firefighters inside should they become disoriented, trapped or injured. This is the "two-in and two-out" standard.

There is an explicit exemption in the standard, adopted by both federal OSHA and S.C. OSHA, that if human life is in jeopardy, firefighters can perform a rescue without following the "two-in and two-out" requirement.

In recognition that many fire departments have chosen to emphasize rapid response and in recognition that firefighters' safety is improved by preventing the full involvement of a structure by fire, South Carolina also allows a limited short-time deviation when the following five conditions are met:

1. the incident commander has completed the Incident Command System course or its equivalent as certified by the South Carolina Fire Academy;

2. the employees who enter the IDLH atmosphere have completed the Basic Firefighter course or its equivalent as certified by the South Carolina Fire Academy;

3. the incident commander has determined that the standard staffing pattern is not feasible;

4. the incident commander has determined that entry can be made safely with the personnel on-site; and

5. arrival of additional employees to complete the standard staffing pattern is imminent.

S.C. OSHA has determined that the "two-in and two-out" rule is in effect for every fire department at any fire which is beyond the initial or beginning stage and which cannot be controlled or extinguished immediately. Any fire beyond this stage is considered by S.C. OSHA to be "immediately dangerous to life and health" (IDLH).

The "two-in and two-out" rule, like all OSHA standards, states a minimum requirement. Employers should continuously strive to exceed the OSHA standards.

April 3, 2006

Memo: M-01-0020
Memo to: All Fire Academy Personnel
From: Ed Roper
Subject: State Laws Related to Fire Departments

We are often asked by many people, "What are the laws related to being a firefighter in South Carolina"?

There is no simple answer to this question. First of all, firefighters are employees of their department. All employment laws that apply to public sector employees apply to firefighters. These laws include the federal Fair Labor Standards Act (including the overtime and child labor provisions) and all federal anti-discrimination statutes. For detailed information concerning these laws, the most authoritative source is: http://www.dol.gov/esa/whd/

In addition firefighters must comply with OSHA standards. SC Code of Laws, Chapter 71, Article 1, Subarticle 6 states "This subarticle adopts the federal regulations in 29 CFR 1910, entitled "Occupational Safety and Health Standards for General Industry" with some modifications. Because South Carolina is a State OSHA state, these standards are applicable to all fire departments: paid, volunteer and industrial. Fire departments should review and comply with several specific key OSHA standards as follows:

1. 71-I-1910.156 Fire Brigades is applicable to fire departments both paid and volunteer and industrial fire brigades. This section covers training, instructor qualifications, PPE and other basic items related to a fire department. Item 1910.156 (c) Training and Education (1) states "The employer shall provide training and education for all fire brigade members commensurate with those duties and functions that fire brigade members are expected to perform. Such training and education shall be provided to fire brigade members before they perform fire brigade emergency activities". Item 1910.155 defines "Training" and "Education" related to 1910.156.

2. 71-I- 1910.156 (b) (2) states " The employer shall assure that employees who are expected to do interior structural fire fighting are physically capable of performing those duties which may be assigned to them during an emergency This section also explains the need for a physicians certificate of the employees fitness to participate.

3. 71-I-1910.134 outlines the requirements for employees who must wear SCBA or respirators and they must be medically qualified and properly trained. The Federal Two In-Two Out section in 29 CFR 1910.134 has been modified by South Carolina's Two In-Two Out rule listed in SC Code of Laws, Chapter 71, Article 1, Subarticle 6 item G. The state standard is somewhat more flexible but is very similar to the federal requirement.
4. 71-I-1910.120 deals with hazardous materials and the requirements for employees who will work with hazardous materials or respond to emergencies when hazardous materials e involved.

All other OSHA requirements in 29 CFR 1910 for general industry apply to fire departments both paid and volunteer. Please encourage the person asking the question to carefully read the regulations and, if necessary to get their lawyer to review it with them.

If you go to the SC OSHA web site www.scovp.state.sc.us click on publications and you will find listed a Fire Service Checklist that is an excellent tool to assist any person responsible for compliance with OSHA standards. You can download and print the document for your use.

SC Code of Laws Title 40 Chapter 80 also directly governs Employment and Registration of Firefighters. This law requires that all firefighters who join a fire department after June 30, 2001, must have a criminal background check. A record of certain convictions prevents employment as a firefighter in South Carolina. This law also requires that the fire chief must register all firefighters no later than 60 days after employment on their department with the State Fire Marshal's office. If a firefighter leaves a department the fire chief must notify the Fire Marshal's office within 60 days.

In summary, the one simple answer is YES there are state laws related to being a firefighter.

I hope this information may be of help to all of us when questions are asked. Please file this in your memo file. This memorandum may be updated if the academy identifies other applicable statutes or regulations. If you have any questions, please advise.

South Carolina Fire Training Academy

The South Carolina Fire Academy's facility is the most comprehensive state fire training facility in the U.S. It is on 208 acres just off Monticello Road (S.C. 215), four miles north of Exit 68 off Interstate 20. (See the map on page 2.) The campus has a dormitory facility for 116 people and a cafeteria. There is an auditorium and five classrooms. The facility is one of a select few to feature state-of-the-art, computerized, propane-fueled props. These give the Fire Academy's live fire training programs consistency, while increasing the level of student safety. The Fire Academy also features some traditional props that allow for a variety of training scenarios. These props include:

- A 2½-story, computer-operated, propane-fueled burn building with multiple burn areas and a flashover simulator, which can represent residential, commercial and industrial facility configurations.
- A 1½-story class-A burn building with multiple burn areas.
- A 5-story drill tower with different configurations on each floor, a search and rescue maze, sprinkler and standpipe props, and interior shafts for elevator and rope rescue training.
- Several large- and small- scale flammable liquid burn props, with rail cars and a chemical cracking tower for foam and extinguisher training.
- Several LP Gas props for hand-line training.
- Three multiple-configuration confined space rescue props.
- Two replica 737 aircraft crash/rescue simulators.
- Hazardous materials spill and leak props including several tank trucks and rail cars with live agent training.[57]

International Fire Service Accreditation Congress (IFSAC)

The South Carolina Fire Academy is accredited by the International Fire Service Accreditation Congress (IFSAC). This international group is made up of entities from the United States, Canada, Great Britain, Australia and South Africa. Accreditation guarantees that the Fire Academy certification program has been carefully reviewed by a group of fire service professionals and that it meets national and international standards. The Fire Academy currently offers accredited certifications meeting NFPA standards in several occupational areas, including:

NFPA 472 - Hazardous Materials Operations
NFPA 1001 - Firefighter I
NFPA 1001 - Firefighter II
NFPA 1002 - Driver/Operator-Pumper
NFPA 1002 - Driver/Operator-Aerial
NFPA 1002 - Driver/Operator-ARFF
NFPA 1002 - Driver/Operator-Mobile Water Supply Apparatus
NFPA 1003 – Airport Firefighter
NFPA 1021 - Fire Officer I
NFPA 1031 - Fire Inspector I
NFPA 1035 - Fire & Life Safety Educator
NFPA 1035 – Juvenile Firesetter Intervention Specialist-I
NFPA 1041 – Fire Instructor I
NFPA 1041 - Fire Instructor II

Membership in IFSAC currently consists of more than 80 organizations, including more than 40 states, the U.S. Department of Defense and armed forces branches, the Canadian Department of Defense, several Canadian

[57] http://www.scfa.state.sc.us/InsideSCFA/index.asp?file=facility.htm

provinces, the British Fire College, the South African Fire Service Institute, and the Australian Fire Trainers Association. South Carolina is one of only three states that was not grand fathered into the system. Reciprocity is available for IFSAC certificates issued by other accredited entities.

The practical portions of certification exams are administered in connection with Fire Academy training programs. The Fire Academy courses 1153 - Firefighter I and 1154 - Firefighter II are designed to prepare firefighters to perform on the fire ground. Each course references NFPA 1001 objectives. Course 1153 primarily references 1001 Level I objectives, while course 1154 primarily references 1001 Level II objectives. However, there is a mix of these two NFPA objective levels within the two courses. All the occupational level objectives must be tested before certification is granted for a level.

Separate written certification testing is offered throughout the state during the year. In some programs, certification exams have been incorporated into the course delivery. This is noted in the course description. Due to the need for verification of prerequisite courses, pre-registration is required and walk-in registration will not be allowed for written certification exams. Certification is offered to eligible South Carolina public fire service members at no cost.[58]

[58] http://www.scfa.state.sc.us/Education/index.asp?file=ifsac.htm