Orange County
Fire Rescue Department
Florida

Fire Station Location Study

Final Report

February 2015

TriData



ORANGE COUNTY, FL
FIRE STATION LOCATION STUDY

FINAL REPORT

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FOREWORD

TriData was contracted to conduct a fire station location study for the Orange County Fire Rescue Department. TriData is a nationally recognized firm specializing in public safety research and consulting. It has been conducting fire and emergency service research and studies similar to this one since 1982.

TriData is a division of System Planning Corporation (SPC), and is based in Arlington, Virginia. SPC is a defense and national security contractor specializing in high-level systems engineering and national security.

Over the past 33 years, TriData has completed over 210 fire and EMS studies for communities of all sizes. In addition, TriData has undertaken research on a wide range of public safety issues for the U.S. Fire Administration, Department of Homeland Security, other Federal and state agencies, and the private sector. TriData also conducts international research on emergency response topics and has conducted extensive research on effective fire prevention strategies worldwide.

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EXECUTIVE SUMMARY

This study analyzed the current deployment of fire stations, and the potential need for additional ones to meet growing demand and development throughout Orange County. The fifth largest county in Florida, Orange County is a complex mix of rural, suburban, and metropolitan areas. Within its borders are 13 cities and towns, including Orlando. Future development within the unincorporated areas of the County is increasing significantly, with formerly undeveloped areas becoming more urbanized.

The study included three major tasks:

Task I: Review current allocation/locations of resources

Task II: Forecast future demands for service in light of expected growth

Task III: Recommend changes to current system, if any.

We reviewed the County's Destination 2030 comprehensive plan, which covers a 20-year planning period of 2010-2030. With the assistance of County planners and OCFRD staff, the study team also developed the first ever set of planning areas for the County. Demand, response times, and fire station locations then were analyzed by planning area. The 16 areas in the text were:

East Colonial	Conway
East Orange/Deseret Ranch	Edgewater
Goldenrod	Gotha/ Orlo Vista
Horizon West/Four Corner	Hunter's Creek/Meadow Woods
I-Drive South/Dr. Phillips/Williamsburg	Innovation Way
Northwest Orange County/Tangerine	Pine Hills
Pinecastle/Taft/Oak Ridge	South Apopka
University of Central Florida	Valencia College

A review of the estimated population, infrastructure, and future development for each area is provided in Chapter II, County Planning and Development.

Population Growth

The County's 2013 population of 1.2 million included 800,000 residents in the unincorporated areas of Orange County, the remaining in Orlando and the other 12 cities and towns. Over the next 25 years it is expected that 400,000 residents will be added just to the unincorporated areas.

Areas with the highest population density (metropolitan) are Pine Hills, Goldenrod, UCF, Conway, and Valencia College. Goldenrod, UCF, Pine Castle/ Taft/ Oak Ridge, Hunter's Creek/ Meadow Woods, and the western portion of I-Drive/ Dr. Philips/ Williamsburg will soon become a metropolitan area. Population growth will result in a significant increase in demand, especially for EMS.

Demand and Risk Analysis

From 2010-2013, the annual incident demand increased by 16%, from 87,000 to 100,000 calls per year. Seven out of every ten calls were for EMS, and they increased the most in this period, by 40%.

This study analyzed the expected future demand two ways: 1) regression analysis following recent trends; 2) calculating future demand as a percentage of the expected population growth. The results were similar for the mid-range projection of future demand in 2025. A midrange of 177,000 calls per year, a large increase of 76,000 calls per year by 2025, is predicted. Total demand could be as high as 200,000 calls per year. As in past years medical calls are likely to increase the most. Edgewater, Pine Hills, Gotho/ Orla Visto, Pine Castle/ Taft/ Oak Ridge, Conway, Goldenrod, and UCF were the areas with the highest fire risk.

Response Time and Station Location Analysis

Response time is the most common performance measurement used by the fire service. If nothing else, citizens expect its fire department to arrive as fast as possible. Citizen expectations for better service are generally higher for urban and metropolitan areas. These are also the same areas where demand is highest.

The standard most used to analyze career fire department response time is the National Fire Protection Association's (NFPA) 1710. It is a professional consensus standard thus communities do not have to adopt or meet the standard. Few fire departments in metropolitan communities can meet the NFPA 1710 standard all of the time, but it is useful as a benchmark. .

Response time in NFPA 1710 has three time segments: call-taking and dispatch; turnout (sometimes referred to as reaction time); and travel time. The standard suggests 90th percentile compliance, meaning 10% of calls will take longer to reach than recommended.

This study determined that dispatch and turnout times are good and the OCFRD has a policy of monitoring them to keep them good.

Travel times in Orange County are quite long, especially in the rural and suburban areas, where emergency response distances are greatest. But travel times in the metro areas also are high, and that is where the demand is highest. The 90th percentile travel time for the first-arriving unit in the metropolitan area was almost eight minutes, far exceeding the standard recommended

time of four minutes. When a less rigorous compliance of 80th percentile is applied, travel times improved but were still high.

Table 1. First Arriving Unit Travel Time, 2013

	Average	80th Percentile	90th Percentile
Metro	5:05	6:32	7:38
Urban	4:50	6:27	7:34
Suburban	5:22	6:49	7:56
Rural	5:43	7:36	8:55
(all)	5:10	6:43	7:53

Based on the call density and current response time profiles, the main focus of our station-location analysis was on improving response times in the metropolitan and urban areas.

We recommend using the following travel and total response time targets for the various population density areas. Total response times include the call-processing and turnout times, thus the addition of 2.2 minutes above the travel time.

Table 2. Recommended Performance Standard

Population Density	Travel Time	Total Response Time
Metropolitan	5:20	7:40
Urban	6:00	8:20
Suburban	7:00	9:20
Rural	9:00	11:20

The analysis of response times showed mixed results. Travel times for the metropolitan and urban areas are slower than the revised goals (6:32 and 6:27). Suburban and rural travel times were better than the goal, with travel times in rural areas under 9:00. The analysis determined that travel times in densely populated areas were the most problematic, especially in northeast Orange County. University of Central Florida (UCF) and Goldenrod/ Valencia College planning areas were especially poor and have significant demand, which led to recommendations that new stations be located in those areas in the next five years, along with a new station for East Orange/ Deseret Ranch.

Recommendations

Fifteen new stations are likely to be needed over that next 20 years if growth continues as projected. Three are needed in the next five years for eastern Orange County. Four stations are recommended between 2020 and 2025, and the rest after 2025. In the next 10 years, 6 of the 7 station changes are new additions to the current 41 stations; one recommended change is relocating Station 30. Beyond 2025, five of the eight station changes are relocations and three are additional. If the entire set of stations were to be constructed, Orange County would have 55 stations after 2025.

The timing to add stations is dependent on local circumstances, as some developments are likely to build up faster than anticipated while others could take longer.

The approximate locations are as follows:

0-5 years

- North Dean Road & Winder Trail (UCF)
- Avalon Park South Boulevard (East Orange/ Deseret Ranch)
- South Goldenrod Road & Lake Underhill Road (border between Valencia College and Goldenrod)

5-10 years

- North Alafaya Trail & Research Parkway (UCF)
- Summerlake Boulevard & Ficquette Road (Horizon West)
- Daryl Carter Parkway near Palm Parkway (I-Drive/ Dr. Philips/ Williamsburg)
- Relocate Station 30 to West Colonial Drive & North Hiawassee Road (Station 30 is currently in Gotho/ Orla Visto; new location would be on the boundary between Gotho/ Orla Visto and Pine Hills)

10+ years (long-term)

- Relocate Station 71 to South Goldenrod Road & Pershing Avenue (Valencia College)
- Avalon Road & Horizon Boulevard (Horizon West)
- Avalon Road & Seidel Road (Horizon West)
- Relocate Station 32 to Avalon Road and Hartzog Road (Horizon West)
- Relocate Station 52 to Mandarin Drive Extension & Kirkman Road Extension (I-Drive/ Dr. Philips/ Williamsburg)
- Boggy Creek Station (Hunter's Creek/ Meadow Woods)
- Relocate Station 36 to Winter Garden-Vineland Road & Equestrian Drive (Horizon West)
- North Hiawassee Road & Silver Star Road (Consolidates Station 42 and Station 43) (Pine Hills)

CHAPTER I. INTRODUCTION

Scope of Project

The scope of work requested by the County for this project was to examine the current allocation of fire stations and the need for additional ones throughout the county. At its completion the project was to provide a complete report of findings "which may be used by key decision makers to make informed and competent decisions for the safety and well-being of the County."[1]

Three tasks were included in this study. They were:

Task I: Review current allocation/locations of resources. The emphasis of this task was to review the locations of current fixed and mobile resources and to analyze current demands, response times, unit availability, and reliability.

Task II: Forecast future demands for service. In Task II, the project was to analyze the expected demand and population growth for Orange County. TriData analyzed population and incident data provided by the County and provided estimates on the expected demand and population. With assistance of County's planners we also created the first-ever set of planning areas for the County and used these to show the results of the analysis. The deliverable for Task II was "…emergency response goals based on the County's population and community needs, using the guidelines of the Center for Public Safety Excellence, a recognized professional consortium specializing in emergency service planning.

Task III: Recommend changes to current system. From the analysis in Tasks I and II, recommendations for new stations, relocation or consolidation were developed. Especially important for the County was to recommend the number and location of future fire stations needed to meet expected future demand within respond time goals.

Study Process

The process used for this project combined multiple research techniques including interviews, collecting and reviewing background information, and analyzing computer-aided dispatch (CAD) and incident data provided by the OCFRD.

Following an initial site visit and interviews with OCFRD staff, TriData analyzed incident data and conducted a series of tasks related to the assessment of population growth, risk and demand and response times from the current set of fire stations. Also analyzed were the workloads of the various fire and rescue units deployed to the County's fire stations, as well as the reliability of services from these stations. We also met with Orange County planning officials to understand the expected growth and development patterns in future years.

[1] Request for Proposal, Scope of Work.

TriData's project team toured the County and visited many of the fire stations to become familiar with the geography, road network, risks, and community attributes (rural, suburban, urban, commercial, residential, etc.). Following these tours and after analyzing data provided by the OCFRD, TriData presented preliminary findings of the data analysis to the Department's management team. Feedback and discussion of the data analysis revealed some data reporting errors, which were then corrected and the data re-analyzed. Throughout the project follow-up phone calls and e-mails were exchanged as the project progressed.

Organization of the Report

The report findings and recommendations are addressed in the following chapters:

Chapter II, County Planning and Future Development, provides a review and discusses the pressures on the fire protection system, including an analysis of the near and longer-term development expected in various sections of Orange County. This section is important to understanding the critical infrastructure changes expected in the County, which affect where (and when) new fire stations will be needed.

Chapter III, Population Growth, Risk and Incident Demand Analysis, provides information on the population changes expected, as well as the current risks and demand (by planning area), and the expected future demand. Much of the analysis in this section is shown by the planning areas developed for this study.

Chapter IV, Response Time and Unit Workload Analysis, discusses the analysis of response times in the various planning areas and the workloads of the fire, EMS, and specialized units deployed by OCFRD.

Chapter V, Station Location Analysis and Recommended Changes, reviews and fire stations presently deployed and the recommended changes for the short, medium and long term.

Chapter VI, Fire/ EMS Operations and Facility Review, discusses the deployment of units by the OCFRD and the current status of the 41 stations deployed.

Chapter VII, Summary of Recommendations, is a matrix of the entire set of study recommendations with a summary of the rationale and suggested timing for each.

CHAPTER II. COUNTY PLANNING AND FUTURE DEVELOPMENT

As the fifth largest county within the state of Florida, Orange County is a complex mix of rural, suburban, metropolitan areas, cities, and towns. A top tourist and convention destination, there are over one million visitors to Central Florida in any given week, with the majority coming to Orange County. Orange County is diverse in terms of its demographic composition, employment centers, natural resources, and development patterns. Once considered a rural county, Orange County is becoming more urban as a result of its continual growth. While several areas are available for development, significant undeveloped areas have been defined as rural or conservation and those designations are expected to remain.

Having an understanding of the Orange County setting is important in assessing the County's current and future fire station operations and locations.

Planning Standards and Policies

Orange County's adopted comprehensive plan, known as Destination 2030, covers a 20-year planning horizon, 2010-2030. The Fire Rescue Element part of the plan was adopted on May 19, 2009. It was amended on November 19, 2013, with the amendments effective as of January 18, 2014. This Element provides the goals, objectives, and policies (GOPs) along with recommended standards for an effective and efficient Orange County Fire Rescue Department. This is the only official County document that sets performance standards for the Fire Rescue Department. The Element contains four goals that relate to: emergency response; non-emergency response; public education and awareness; and disaster preparedness and coordination.

Several policies in the County plan are relevant to the number and location of fire stations.

Policy FR 1.1.2 Orange County Fire Rescue shall periodically review and update station location, staffing needs and equipment deployment plans to ensure efficiency and effectiveness or resources. It shall evaluate resource and deployment strategies based on:

- Periodic review of reflex times
- Quarterly trend analysis and station response patterns
- Periodic evaluation of alarm activity to assess staffing and equipment allocations
- Quarterly review of data as part of the annual budgetary process
- Review of potential and actual growth in alarm activity
- Review and tracking of citizen complaints

Policy FR 1.2.2 The determination of ***where to construct new Fire Rescue facilities*** will be based on, but not limited to, the following:

- Adherence to established reflex time standards as determined by a Geographic Information System (GIS) data, and projected reflex times from the projected new station location

- Adherence to the fire station master plan document and the need to achieve a five mile separation between stations
- Minimal county response overlap to ensure workload equalization
- Minimal response overlap between County and various city stations
- Consideration of current and future impact(s) of Joint Planning Agreements (JPA)
- Consideration of city annexation and general growth patterns
- Availability of suitable land/property in area
- Projected alarm activity (number of alarms) generated in a geographic area
- Opportunities for joint stations

Policy FR 1.2.3 The determination of ***when to construct new Fire Rescue facilities*** will be based on, but not limited to, all or any combination of the following:

- When a major development is in construction phase and a fire station is planned
- When an analysis of reflex data indicates that the area cannot meet the department's reliability model for the predicted availability of the first due unit
- When stations in adjoining responses areas show escalation of alarms and response time and when adding a second response unit to an existing station will not meet the service response need
- When annexation of the area appears unlikely

Policy FR 1.2.4 The determination of ***when to decommission and close Fire Rescue facilities*** will be based on, but not limited to, all or any combination of the following:

- Reduction of service area due to annexation or other causes
- Ability to contract with another service provider for adequate service delivery (or)
- Reduction in the number of calls and ability to serve the location from other existing OCFRD facilities

The completion of the fire station location study addresses many of these policies' components. In addition, amendments to the Fire Rescue Element may be needed in order to be consistent with the study's findings.

Future Development

It is anticipated that development activities will continue in Orange County, within existing activity centers as well as new ones. This development will be directed away from constraints (rural and conservation areas, rural settlements, and municipalities) and will occur within designated activity centers (existing and emerging). As proposed projects go through the approval process, often the first step is the Technical Review Group (TRG) comprised of staff in Planning, Fire Marshal and Fire Planning. Since the Fire Rescue Department is represented on the TRG, the Department is able to monitor new development and anticipate the timing of any new facilities or services.

Development Constraints

Within the County's Destination 2030, there is a clear delineation between the Urban Service Area (USA) and the Rural Service Area (RSA) as presented in Figure 2. The USA includes areas that are built up, have significant infrastructure investments, and the County's 13 municipalities. The RSA includes areas of existing agricultural activities and little utility infrastructure investment. In addition, there are several natural assets that are being preserved, (such as St. Johns River, Econlockhatchee River, Wekiva River, Shingle Creek, Butler Chain of Lakes, and Lake Apopka) and designated conservation areas (such as: Wekiva Springs State Park, Hal Scott Regional Preserve and Park, Tosohatchee State Preserve, Seminole Ranch Wildlife Management Area, the TM Mitigation Bank, and the St. Johns Nature Wildlife Refuge).

Rural Settlements

In 1991, the County created the Rural Settlement designation as a means to preserve and protect rural communities in recognition of their historic nature, existing development patterns, and community cohesiveness. While they may develop in the future, there are development caps in order for these communities to retain their rural roots. There are 22 Rural Settlements within Orange County as presented in Figure 3.

Existing Activity Centers

There are two key existing activity centers within unincorporated Orange County. One, the **South International Drive** area, is anchored by the Orange County Convention Center and Sea World. This area is east of Interstate 4, between Sand Lake Road (to the north) and SR 528/Beachline Expressway (to the south). The Convention Center is the second largest convention facility in the United States with over 2 million square feet of exhibition space. Smaller attractions, numerous hotels, restaurants, and shops complete this activity hub. Development will continue to intensify in this area. For example, the recent announcement of the I-Drive 360 complex (north of the Convention Center) will account for a $200 million dollar investment and is expected to open in 2016. Walt Disney World (in Reedy Creek Improvement District) is southwest of this area with Universal Orlando located to the north within the City of Orlando. With this combined activity, Central Florida remains the top tourist destination in the United States.

The second existing activity center is the **University of Central Florida** (UCF) and associated Central Florida Research Park. This activity hub is located in east Orange County along Alafaya Trail (SR 434) and north of Colonial Drive/SR 50. UCF is the second largest university in the United States, with 60,000 students and 10,000 employees. UCF recently adopted its updated campus master plan, which anticipates capital improvements of $ 392 million over the next five years, with projects focused on building renovations, construction of new buildings, and utility and infrastructure improvements. To the south is the Central Florida Research Park (CFRP). Established in 1978, it has become the seventh largest research park in the United States, with over 10,000 employees. There are few large parcels left for development, so it is likely that future development in this activity center will be vertical. West of UCF is the

Quadrangle office park, home to Siemens Westinghouse. This park has been in place for almost 30 years and is unlikely to experience significant future development. These two activity centers will continue to be vibrant attractors, growing to meet future demand.

Emerging Activity Centers

Future development within the unincorporated areas of the County will occur either in currently undeveloped areas or redevelopment of existing developed areas. This development is already occurring, with major new activity centers likely to emerge in the next five to 10 years, and others in the long term. Here are the highlights of this anticipated development activity.

Immediate Activity – The County's Comprehensive Plan was amended in 1996 as a result of the sector plan prepared for **Horizon West**, an area of 20,704 acres conceptually approved for a Town Center and five villages. Horizon West is located in southwest Orange County, nestled between Reedy Creek Improvement District, Winter Garden, Windermere, and Lake County. From 1997 to 2008, Special Area Plans (SAPs) were approved for the Town Center and the individual villages, followed by several approved Planned Developments within each village. As of February 2014, more than 9,000 residential units have been built with more than 20,000 people calling Horizon West home. The project is at about 22.5% built out with most of the activity in the Lakeside and Bridgewater Villages. The development activity is summarized in Table 3.

Table 3. Summary of Horizon West Development Activity

	Approved (Sector Plan)		Built	
Village	**Residential (DU)**	**Non-Residential**	**Residential (DU)**	**Non-Residential**
Lakeside (approved1997; 60% built)	8,915	460,000 sf	5,319	0
Bridgewater (approved 1999; 35% built)	10,450	480,000 sf	3,678	0
Village F (approved in 2006; 0.2% built)	3,891	240,000 sf	6	0
Village H (approved in 2006; 0.6% built)	6,548	564,544 sf	41	0
Village I (approved in 2008; 0% built)	5,608	426,000 sf	0	0
Town Center (approved in 2004;0.6% built)	4,870	8,151,400 sf 1,200 hotel rooms	29	0
Total	**40,282**	**10,322,944 sf 1,200 hotel rooms**	**9,078**	**0**

Potential Activity over the Next 5-10 years – Southeast Orlando has emerged as an economic hub with Orlando International Airport, Lake Nona/Medical City at its core. The unincorporated area of Orange County just to the east is a mixture of rural settlements, established neighborhoods, and approved Developments of Regional Impact (DRIs). In 2005, Orange County initiated a visioning process for this area, known as ***Innovation Way***. This work provided the foundation for future development to contribute to the overall desired result of preserving key natural resources, clustering development, and a multimodal approach to transportation. Destination 2030 includes the policy direction and development parameters for the Innovation Way area as reflected in Figure 4.

This area has approvals for 10,811 residential units and 28.2 million square feet of industrial, commercial, office, and high-tech uses. In March 2014, the Camino Reale project submitted plans for 3,000 residential units and 330,000 square feet of commercial and office uses. This project is located along the southern boundary of the ICP DRI.

Projects to Monitor

The **Kelly Park Crossings** DRI is located in northwest Orange County, partially within the City of Apopka and partially within unincorporated Orange County. A large project that has potential impacts beyond the jurisdiction due to its size (and meets specific thresholds) becomes a DRI. A DRI goes through a regional review (providing stakeholders the opportunity to share input) before it goes to its local jurisdiction for approval. Development of this project hinges on the construction of an interchange with the Wekiva Parkway at Kelly Park Road. The Wekiva Parkway, a toll facility that connects the SR 429 to I-4 is under construction and is scheduled to open in 2016 in this area. This DRI's initial development program consisted of: 8 million square feet of commercial and industrial uses along with 900 residential units, with build out expected by 2032.

In east Orange County, another proposed large project, formerly known as the **Rybolt** DRI (Rybolt Ranch property), is located east of the UCF campus and the Econlockhatchee River. In 2009, the Orange County Board of County Commissioners denied its original development program of 5,000 residential units and 2.225 million square feet of non-residential uses. The project is now part of the Rural Transition area that is going through a comprehensive plan amendment (included in the first cycle for 2015). This new proposed program includes 4,961 residential units and 250,000 square feet of non-residential uses.

In southeast Orange County is the northern part of **Deseret Ranch**, situated on 290,000 acres in Orange, Brevard, and Osceola Counties. Owned by the Church of Jesus Christ of Latter Day Saints for more than 60 years, this property is one of the largest cattle ranches in the United States. Development plans in Osceola County, known as the North Ranch Sector Plan District, have been approved, including new roadway connections into east Orange County. It is anticipated that it will be at least 40 years before the property in Orange County is considered for development.

Redevelopment Opportunities

There are several redevelopment opportunities throughout unincorporated Orange County. While no specific projects are underway or proposed, it will be helpful to monitor future proposals as a result of establishing the Pine Hills Neighborhood Improvement District; the County's Infill Master Plan; and transit-spurred development.

Pine Hills – This district is located between the cities of Orlando and Ocoee; and Colonial Drive and Silver Star Road. It is the largest community within unincorporated Orange County, with an estimated population of 80,000. This community is represented by the Pine Hills Community Council and the Pine Hills Safe Neighborhoods Partnership. In 2004, the Pine Hills Land Use Analysis and Strategic Plan were created. The Town Center, located at the Pine Hills Road and Silver Star Road intersection, becomes the community's focus. Based on this work and a market study, the Pine Hills Neighborhood Improvement District (NID) was established in 2011 along the Silver Star Road and Pine Hills Road corridors, providing a funding mechanism for future investments. With this framework in place, the area is poised for redevelopment activity.

In 2008, the Orange County *Infill Master Plan* was created, which identified five communities with redevelopment opportunities. In addition to Pine Hills, the other targeted communities include: Chickasaw, Edgewater, Pine Castle, and Americana.

It is anticipated that redevelopment will occur as a result of *regional transit initiatives*. The first phase of SunRail, the regional's commuter rail service, opened in 2014 with one station in unincorporated Orange County, the Sand Lake Road station. It currently is the southern terminus of SunRail's Phase One and eventually will become the intermodal transfer hub for transit service that will connect the International Drive area to Orlando International Airport. There will be one more station in unincorporated Orange County once the second phase opens in 2016, the Meadow Woods station. Additional redevelopment activity is likely to occur as a result of the proposed enhanced transit service along SR 50 from the Lake County line to UCF.

Potential Annexations – The primary means for funding the Fire Rescue Department is through a specific millage rate tied to properties located within unincorporated Orange County. Currently, as unincorporated Orange County property is annexed, the revenue from the specific millage rate is lost (since that specific jurisdiction will provide Fire Rescue services). Identifying potential areas of annexation is therefore a key factor in assessing future fire rescue needs and investments.

Within unincorporated Orange County, there are seven Preservation Districts: Dr. Phillips, Gotha, Pine Castle, Taft, Tangerine, Zellwood, and Zellwood Station, as presented in Figure 6. By ordinance, these districts will not be annexed and will remain in unincorporated Orange County.

Annexations must be consistent with Chapter 171, Florida Statutes. At a minimum, property must be contiguous with existing municipal boundaries. In Orange County, annexations may occur in three different ways: within the specified boundaries of Joint Planning Areas

(JPAs), enclaves within existing municipalities, and property owner requests. Currently, there are five Joint Planning Agreements with: Apopka, Ocoee, Winter Garden, Maitland, and Oakland, as presented in Figure 7. (Note that the JPA's with Mt. Dora and Reedy Creek Improvement District relate only to utility services.) It is understood that these municipalities may eventually grow to the limits of these JPA boundaries. There are no Joint Planning Agreements with Windermere (terminated in 2006) and Orlando (expired in 2006).

Enclave areas within municipalities provide a second opportunity for annexation, often done to remove duplication of services (such as fire rescue). Orange County completed an enclave study in 2011, focusing on: Apopka, Eatonville, Oakland, Ocoee, Orlando, Windermere, Winter Garden, and Winter Park. Enclave annexations are completed by inter-local agreement and no property owner voting is involved.

Individual properties may petition a municipality for annexation. Often this occurs as large developments go through the approval process. For example, the Innovation Place DRI property (located in southeast Orange County) was annexed into the City of Orlando in 2013. Figure 8 shows the locations of the municipal annexations from 2010 through 2014. In addition, the Town of Windermere is considering two annexations as presented in Figure 9.

Infrastructure Improvements – Future infrastructure investments may affect the ability to provide fire rescue services. Each year, Orange County prepares a Capital Improvement Program (CIP), which outlines upcoming capital investments for the next five years.

Roadways: In assessing fire station locations and service, future roadway investments should be considered from two perspectives: (1) travel disruption during construction and (2) having greater access to service areas once investments are in place. Table 4 provides a list of the upcoming state and regional roadway construction projects.

Table 4. State and Regional Roadway Construction Projects

Project	Limits	Years Under Construction
Interstate 4 (widening)	Kirkman Road to SR 434	2015-2021
Wekiva Parkway (Segments 1A, 1B, 2A, 2B, 4A, 4B in Orange County)	SR 429 to Lake County line	2013-2019
SR 528 (All Aboard Florida)	OIA to Brevard County line	2015-2016
SR 50	Dean Road to Avalon Park Road	Underway; complete by Winter 2016

Table 5 provides a list of the upcoming Orange County roadway construction projects from 2014/2015 through 2019/2020. Figure 10 depicts the long range transportation improvements within Orange County.

Table 5. Orange County Roadway Construction Projects, 2014/2015 through 2019/2020

Project	Limits	Type of Improvement
Valencia College Lane	from William C. Coleman Road to Econlockhatchee Trail	from 2 to 4 lanes
International Drive	from Westwood Blvd. South to Westwood Blvd. North	from 4 to 6 lanes
Reams Road	from Taberfield Avenue to Dilmar Avenue	from 2 to 4 lanes
Wetherbee Road	from Balcombe Road to Orange Avenue	from 2 to 4 lanes
International Drive	from Convention Way to International Drive	new, two way pedestrian bridge
John Young Parkway/Sand Lake Road interchange	at existing intersection of John Young Parkway and Sand Lake Road	new, 6-lane interchange
Ficquette Road	from Overstreet Road to Fossick Road	from 2 to 4 lanes
Destination Parkway	from Tradeshow Blvd. to Lake Cay	new 4-lane road
Hamlin Trail Extension	from New Independence Parkway to Tiny Road	new 4-lane road
Lake Underhill Road	from Econlockhatchee Trail to Rouse Road	from 2 to 4 lanes
International Drive Transit Lanes	from Destination Parkway to Universal Blvd.	1 new, shared lane per each direction
Holden Avenue	from John Young Parkway to Texas Avenue	new, 4-lane road
Holden Avenue	from Texas Avenue to Orange Blossom Trail	from 2 to 4 lanes
All American Boulevard	from Clarcona Ocoee Road to Kennedy Blvd.	new, 4-lane road
Taft Vineland Road	from Orange Blossom Trail to Orange Avenue	from 2 to 4 lanes
Richard Crotty Parkway – Segment 1	from SR 436 to Harrell Road	new, 4-lane road
Boggy Creek Road	from Osceola County line to SR 417	from 2 to 4 lanes

Water Service Improvements: Orange County provides water service and has several projects under construction to improve service it is customers. Table 6 provides a list of the upcoming capital improvement construction projects.

Table 6. Orange County Water Improvement Construction Projects

Project Name	Project Description	Years Under Construction
Eastern Regional WST Phase IIIA	Standby power and rehabilitation	Spring 2014
Eastern Regional WSF Phase IIIB	From 50 MGD to 62.5 MGD	TBD
Horizon West	16" water main in Village F; serves Villages H & I	February 2014

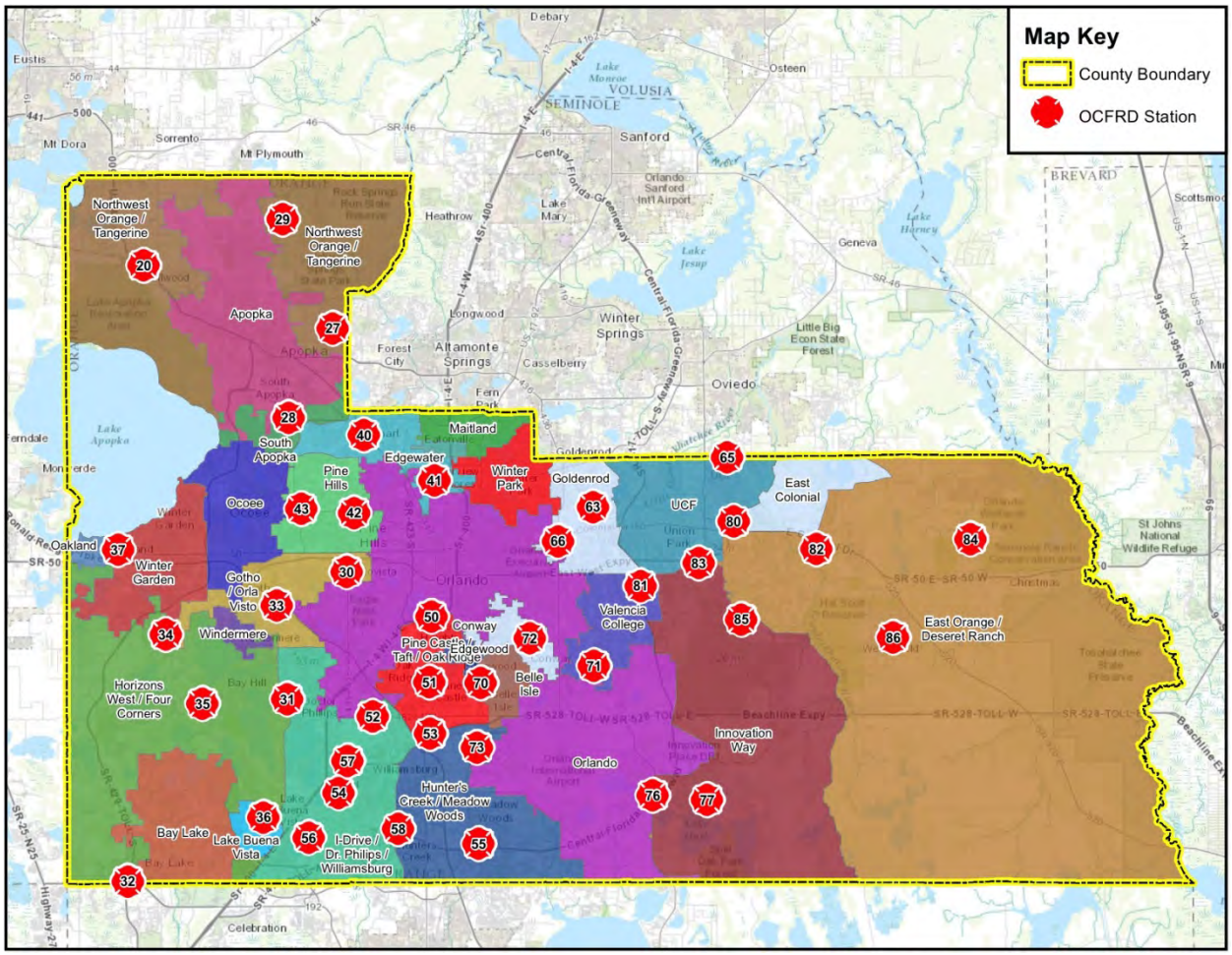
Community Planning Areas

Unincorporated Orange County was divided into 16 community planning areas, based on identifying common community bonds, grouping census blocks, and input from Orange County planners, as listed below and shown in Figure 1. These planning areas also may be used for other County planning activities beyond this study.

- East Orange/Deseret Ranch
- East Colonial
- University of Central Florida/Central Florida Research Park
- Innovation Way
- Valencia College
- Goldenrod
- Conway
- Pinecastle/Taft/Oak Ridge/Holden Heights
- Hunter's Creek/Meadow Woods
- I-Drive South/Dr. Phillips/Williamsburg
- Horizon West/Four Corners
- Gotha/Orlo Vista
- Pine Hills
- Edgewater
- South Apopka
- Northwest Orange County/Tangerine

Figure 1 shows the location of the 16 community planning areas.

Figure 1. Community Planning Areas for Unincorporated Orange County



Descriptions of each planning area and the fire stations serving it are presented on the following pages.

East Orange/Deseret Ranch

Existing Fire Stations:	84, 86
Commission Districts:	4, 5
Description:	 This area of Orange County is located within the County's Rural Service Area and much of this area is undeveloped. The main roadways serving this area are: State Road 50, State Road 520, and State Road 528 (a toll road known as the Beachline Expressway). Conservation areas have been set aside in this part of the County for permanent preservation of natural lands and will not experience any development in the future. These areas include: Hal Scott Regional Preserve and Park, Tosohatchee State Preserve, Seminole Ranch Wildlife Management Area, the TM Mitigation Bank, and the St. Johns Nature Wildlife Refuge. The northern part of Deseret Ranch is located in eastern Orange County, part of the total 290,000 acres held in Orange, Osceola, and Brevard Counties. Deseret Ranch is one of the largest cattle operations in the United States and has been owned for more than 60 years by The Church of Jesus Christ of Latter Day Saints. Planning activities are underway for part the 113,000 acres located in Osceola County (known as the North Ranch Sector Plan District) and new roadway connections into east Orange County are being considered. This planning initiative is in anticipation of growth several decades from now.
Rural Settlements:	• Christmas • North Christmas • Wedgefield
Development:	• Existing Land Uses: rural service area; conservation areas; small residential communities • Future Land Uses: remains rural/low density • Potential Development: Deseret Ranch – long term development not happening here for 40 years
Potential for Future Annexations:	None

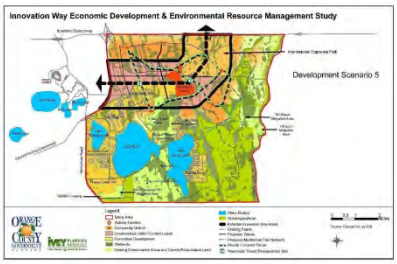
East Colonial

Existing Fire Stations:	82
Commission Districts:	5
Description:	 This planning area is nestled between the UCF area and the rural areas of eastern Orange County. East Colonial is the area's oldest community, established in 1912 as a stop along the Florida East Coast Railway's Okeechobee Branch. With its roots based in lumbering and poultry farming, the town was incorporated in 1922. After the collapse of the land boom in the 1920's, economic conditions of the area worsened. In the early 1970's Orange County petitioned the state legislature to revoke the town's charter so that the County could provide improvements to the area. Recently, East Colonial has been experiencing a revival centered on the East Colonial Village, the location of a community school, resource center, and space for small businesses. The community's health issues are being addressed through a partnership with Florida Hospital.
Rural Settlements:	• Lake Pickett • East Colonial • Corner Lake • Sunflower Trail
Development:	• Existing Land Uses: Low density residential with commercial along SR 50 • Future Land Uses: low density residential; rural settlements; commercial along SR 50 • Potential Development: East Colonial revival (East Colonial Village)
Potential for Future Annexations:	None

University of Central Florida/Central Florida Research Park

Existing Fire Stations:	65, 80, 83
Commission Districts:	3, 4, 5
Description:	 This area is generally bounded by Toll Road 417, Toll Road 408, the Econlockhatchee River, and Seminole County. Alafaya Trail (State Road 434) is the major north-south road running through the heart of this area. At the core of this planning area is the University of Central Florida (UCF), the 2nd largest university in the United States with an enrollment of over 60,000 students. UCF's traditional emphasis on engineering and technology resulted in the location of the Central Florida Research Park (7th largest research park in the United States) just south of the UCF campus. Siemens Westinghouse is located west of UCF and is part of The Quadrangle (an office park of technology based firms). This dynamic setting is one of the Orange County's major activity centers, accounting for about 40,000 employees. Residential areas close to UCF are a mixture of single family neighborhoods and student housing. South of UCF is the Waterford Lakes community, which includes a major outdoor shopping area along with a mixture of residential neighborhoods.
Rural Settlements:	None
Development:	• Existing Land Uses: UCF, Central Florida Research Park, The Quadrangle, Waterford Lakes • Future Land Uses: intensified mixed uses along Alafaya Trail, University Boulevard, and Colonial Drive/SR 50; student housing and suburban residential • Potential Development: UCF campus; Central Florida Research Park (vertical construction in the future); Rybolt/Rural Transition (comprehensive plan amendment in the 2015 first cycle; 4,961 residential units and 250,000 sf of non-residential uses)
Potential for Future Annexations:	None

Innovation Way

Existing Fire Stations:	76, 77, 85
Commission Districts:	3, 4
Description:	For years, this planning area's sparse development included: the OUC Curtis Stanton Power Plant, the Orange County landfill, and Lockheed Martin. In the 1980's, the International Corporate Park DRI was approved for over 12 million square feet of office/distribution uses.  This area connects the UCF/Central Florida Research Park area to the Lake Nona/Orlando International Airport area. Although located in the City of Orlando, the Orlando International Airport (OIA) and Lake Nona play a key role in this planning area's future. OIA is the 13th busiest airport in the United States, serving 35 million passengers over the last 12 months. East of OIA is Lake Nona, a mixed used community that includes a range of residential neighborhoods and a hub of medical-based activities that includes: UCF Health Sciences campus (home to the medical and nursing schools), Sanford-Burnham Institute Medical Research Institute, future VA Hospital, Nemours Children's Hospital, University of Florida Research and Academic Center, and the future National Simulation Center – SIMLearn.  Given this strategic location and recent development pressures, Orange County completed a planning study for the unincorporated area known as Innovation Way. This work has provided the foundation for future development to contribute to the overall desired result – preservation of key natural resources, clustering of development, and a multimodal approach to transportation. With the Innovation Way Plan in place, the International Corporate Park DRI is revising its development program, replacing a portion of the industrial uses with a mixture of office and retail uses. Other developments have been proposed with some being built or under construction. Moss Park DRI is partially built, which includes residential areas as well as the headquarters for Campus Crusade for Christ International. Eagle Creek has been approved as a collection of golf course communities and continues to be built. The Innovation Way East DRI and the Camino Reale project are currently going through the approval review process.
Rural Settlements:	• Lake Mary Jane • Lake Hart/Whippoorwill

Development:	• Existing Land Uses: OUC Power Plant, Orange County Landfill, Lockheed Martin, Waterford Lakes (outdoor shopping hub and neighborhoods), Avalon Park • Future Land Uses: Innovation Way District will transition to a collection of urban villages; Avalon Park (approved for 4,700 homes and 500,000 sf of commercial space on 1,860 acres as a mixed use, walkable community with its own town center) • Potential Development: Avalon Park will continue to build out; Innovation Way (no set time frame; will follow parameters of the Overlay District; 3 approved DRI's (ICP, Moss Park, Eagle Creek); projects going through approval process (Innovation Way East DRI and Camino Reale)
Potential for Future Annexations:	Need to monitor areas along Narcoossee Road, east of Lake Nona (no annexations in this area for one year while the City of Orlando and Orange County review this corridor's municipal future)

Valencia College

Existing Fire Stations:	71, 81
Commission Districts:	3, 4
Description:	This area is nestled between the City of Orlando, Toll Road 408, Toll Road 417, and Innovation Way. At the center of this planning area is the east campus of Valencia College that has an enrollment of 15,000 students. There is a mixture of residential communities ranging from apartment complexes to older, established neighborhoods like Rio Pinar and Pinar Estates. Florida Hospital East Orlando also is located here.
Rural Settlements:	None
Development:	• Existing Land Uses: Valencia College East Campus, Florida Hospital East, established neighborhoods (Rio Pinar and Pinar Estates) • Future Land Uses: suburban residential with institutional uses (college and hospital); commercial along major roads • Potential Development: small scale redevelopment
Potential for Future Annexations:	Unlikely

Goldenrod

Existing Fire Stations:	63, 66
Commission Districts:	3, 5
Description:	 This planning area includes the established communities of Goldenrod, Union Park, Azalea Park, and Lake Barton. It is located between incorporated areas of Orlando and Winter Park, Seminole County, UCF, and Toll Road 408. Goldenrod was initially settled in the 1870's with commerce centered on the citrus industry. In 1926, the Goldenrod Corporation was organized to build 158 suburban homes. Azalea Park was built in 1952 as an Orlando suburban community, featuring a variety of 1,100 single family homes. Over the years, demographics have change for Azalea Park with the percentage of Hispanic residents going from only 7% (1980) to 29% (2010). Union Park is an older, established community of single family neighborhoods centered on its local schools and Jay Blanchard Park. Most of the commercial activity is focused along SR 50, Goldenrod Road, and Semoran Boulevard (SR 436). Full Sail University was founded in 1979 and is located on the western edge of this planning area. The school's curriculum focuses on media and entertainment with an enrollment of 18,000 students.
Rural Settlements:	None
Development:	• Existing Land Uses: established communities (Goldenrod, Union Park, Azalea Park, Lake Barton); commercial along major roads • Future Land Uses: residential with commercial along major roads • Potential Development: redevelopment (Chickasaw Infill Master Plan)
Potential for Future Annexations:	Unlikely

Conway

Existing Fire Stations:	72
Commission Districts:	3
Description:	 Semoran Boulevard (SR 436) is the north-south roadway running through the heart of this community. This planning area is bounded by Conway Road (west), Goldenrod Road (to the east) Hoffner Road/City of Orlando (to the south), and City of Orlando (to the north). This is an older, established area of the County with commercial development lining the major roadways and several single family neighborhoods along residential streets. It is likely that the only future development in this area will be redevelopment of existing parcels.
Rural Settlements:	None
Development:	• Existing Land Uses: residential with commercial along major roads • Future Land Uses: residential with commercial along major roads • Potential Development: small scale redevelopment of existing parcels
Potential for Future Annexations:	Unlikely

Pinecastle/Taft/Oak Ridge/Holden Heights

Existing Fire Stations:	50, 51, 70, 73
Commission Districts:	3, 6
Description:	The cities of Orlando, Edgewood, and Belle Isle adjoin the northern half of this planning area with Florida's Turnpike and John Young Parkway abutting the southern half. The area is served primarily by Orange Avenue (north-south) and Oak Ridge Road (east-west). There is a SunRail station located at Sand Lake Road, which will serve as a transfer hub when east-west transit is in place that will connect the International Drive area to the Orlando International Airport.  Today, the area consists of older, established neighborhoods and commercial corridors. Pinecastle was settled in the 1840s and became known for its pioneering, "can do" spirit which is celebrated annually during Pioneer Days. The Taft community began as a citrus prospect in 1884. Its once rural setting has transitioned over the years to a mixture of industrial uses (next to the rail lines) and residential neighborhoods. Tangelo Park is an older, established neighborhood, surrounded by commercial activity (International Drive and Oak Ridge Road) and office distribution uses to the east. There are opportunities for redevelopment in this area; however, changes are likely to occur on a small scale.
Rural Settlements:	None
Development:	• Existing Land Uses: Preservation Districts (Pinecastle and Taft); older established neighborhoods; commercial along major roads; industrial at the rail line and Orange Avenue • Future Land Uses: same as existing • Potential Development: redevelopment of existing parcels – Sand Lake Road SunRail station and Pinecastle Infill Master Plan
Potential for Future Annexations:	Unlikely

Hunter's Creek/Meadow Woods

Existing Fire Stations:	53, 55, 58
Commission Districts:	1, 4
Description:	 This planning area is bounded by John Young Parkway (to the west), SR 528 (to the north), the City of Orlando (to the east), and Osceola County (to the south). Orange Blossom Trail (US 441), John Young Parkway, and Orange Avenue serve as the commercial corridors for this area with additional access from Toll Road 417. Tupperware's headquarters and Gatorland are located in this area. Two large residential communities (Hunter's Creek and Meadow Woods) also are located within this planning area; both were approved and developed as Planned Developments in the 1980's and 1990's as mixed residential communities. Together, they account for 40,000 residents. There is the potential for redevelopment in the Meadow Woods community once the SunRail station opens in 2016.
Rural Settlements:	None
Development:	• Existing Land Uses: older planned communities (Hunter's Creek and Meadow Woods) largely built out; Tupperware; Gatorland • Future Land Uses: same as existing land uses • Potential Development: redevelopment opportunities at future Meadow Woods SunRail station (opens in 2016) and within Hunter's Creek and Meadow Woods
Potential for Future Annexations:	Unlikely

I-Drive South/Dr. Phillips/Williamsburg

Existing Fire Stations:	31, 52, 54, 56, 57
Commission Districts:	1, 4, 6
Description:	 This area is focused on the International Drive South tourist corridor, anchored by the Orange County Convention Center and Sea World. The Convention Center is the 2nd largest facility in the United States, with 2.1 million square feet of exhibition space and over 1 million annual convention attendees in the past years. Sea World has been at this location since 19 73 and drew 5.1 million visitors in 2013. Williamsburg is an older, established neighborhood located between this tourist corridor and Osceola County. The Dr. Phillips area is located west of the International Drive area with commercial development focused on Sand Lake Road and Apopka-Vineland Road. A variety of residential neighborhoods are found here, ranging from traditional single family communities to the golf course communities of Bay Hill and Isleworth.
Rural Settlements:	None
Development:	• Existing Land Uses: Orange County Convention Center, Sea World, intense commercial/tourist uses along south International Drive, older established residential areas (Dr. Phillips, Tangelo Park, Williamsburg); Dr. Phillips is a Preservation District • Future Land Uses: same as existing land uses • Potential Development: commercial/tourist activities along south International Drive will continue to redevelop and intensify (such as the $200 million I-Drive 360 complex)
Potential for Future Annexations:	None

Horizon West/Four Corners

Existing Fire Stations:	32, 34, 35, 36, 37
Commission Districts:	1
Description:	 This area is located in southwest Orange County, surrounded by Reedy Creek Improvement District/Walt Disney World and Osceola County (to the south), Lake County (to the west), Butler Chain of Lakes (to the east), and Winter Garden and Gotha (to the north). The area is transitioning from a rural setting (orange groves and other agriculture) to a more developed landscape with Toll Road 429 in place. Rather than have a patchwork of random development projects, Orange County sponsored a planning initiative in 1996 that involved area stakeholders in creating the overall framework for future development activity. As a result, the 20,704-acre area (known as Horizon West) has an overall approval for 40,282 dwelling units distributed among five villages and a town center. To date, about 22.5% of the planned area is built out with 9,000 dwelling units built accounting for over 20,000 people. As development occurs, new infrastructure investment is taking place in: roadways, trails, park facilities, and utilities. Lake County is going through a similar planning initiative, known as Wellness Way, and has identified a potential to connect to Horizon West by a new east-west toll road.
Rural Settlements:	• Tildenville • Lake Avalon • West Windermere
Development:	• Existing Land Uses: residential clusters; rural settlements; agriculture; commercial along key roads • Future Land Uses: as Horizon West develops, transition from a rural to suburban to urban uses • Potential Development: Horizon West continues to build out; no changes to Rural Settlements; influenced by adjacent counties: Polk, Osceola (US 192 tourist corridor), and Lake (Wellness Way Sector Plan)
Potential for Future Annexations:	Only Horizon West areas adjacent to Winter Garden and not in a village.

Gotha/Orlo Vista

Existing Fire Stations:	30, 33
Commission Districts:	1, 6
Description:	 This area of west Orange County is located between Pine Hills, Horizon West, the City of Orlando, and the City of Ocoee. The main roadways serving this area are: Florida's Turnpike, Maguire Road, Toll Road 408, and Hiawassee Road. Gotha was founded in 1885 and settled by German immigrants. These historic roots and rural setting led to Gotha's designation as a Rural Settlement. The Orlo Vista community is nearby and includes the MetroWest development, an 1800-acre residential and commercial community that opened in 1987. The main campus of Valencia College has an enrollment of 19,000 students and is located on 180 acres within the MetroWest community.
Rural Settlements:	Gotha (also a Preservation District)
Development:	• Existing Land Uses: established communities (Gotha, Orlo Vista, MetroWest), new neighborhoods, Valencia College West Campus • Future Land Uses: same as existing land uses • Potential Development: redevelopment potential in MetroWest
Potential for Future Annexations:	Unlikely

Pine Hills

Existing Fire Stations:	42, 43
Commission Districts:	2, 6
Description:	Pine Hills is generally located between Pine Hills Road/City of Orlando (to the east), Old Winter Garden Road (to the south), Apopka Vineland Road/City of Ocoee (to the west), and Clarcona-Ocoee Road (to the north). It was originally developed in the 1950s as a suburb for Martin Marietta workers. With other housing and employment options emerging, Pine Hills experienced a decline in the 1980s and 1990s. Silver Star Road and Pine Hills Road form the commercial corridors of this community, which are supported by the mix of single family and multi-family homes. Over the last 10 years, several planning studies have been completed with the newly refurbished Evans High School as the focal point of the Pine Hills renaissance. In addition, the Pine Hills Neighborhood Improvement District was established in 2011 to support the anticipated future redevelopment. 
Rural Settlements:	None
Development:	• Existing Land Uses: residential with non-residential corridors (along Silver Star Road, Pine Hills Road, Colonial Drive/SR 50) • Future Land Uses: same as existing land uses • Potential Development: Future Town Center as anchor for redevelopment; other redevelopment opportunities as a result of the Pine Hills Trail and proposed BRT along Colonial Drive/SR 50
Potential for Future Annexations:	Unlikely

Edgewater

Existing Fire Stations:	40, 41
Commission Districts:	2
Description:	This planning area is bounded by South Apopka (to the north and west), Pine Hills (to the south), Orlando, Eatonville, and Maitland (to the east), and Seminole County (to the north). The major roads serving this area are Edgewater Drive, Orange Blossom Trail (US 441), Clarcona-Ocoee Road, and SR 414. Industrial uses are located along Edgewater Drive and Orange Blossom Trail. Residential areas are a mix of older established neighborhoods and new subdivisions. 
Rural Settlements:	None
Development:	• Existing Land Uses: mix of residential neighborhoods (established and new), including Lockhart • Future Land Uses: same as existing land uses • Potential Development: redevelopment using the Edgewater Infill Master Plan
Potential for Future Annexations:	Unlikely

South Apopka

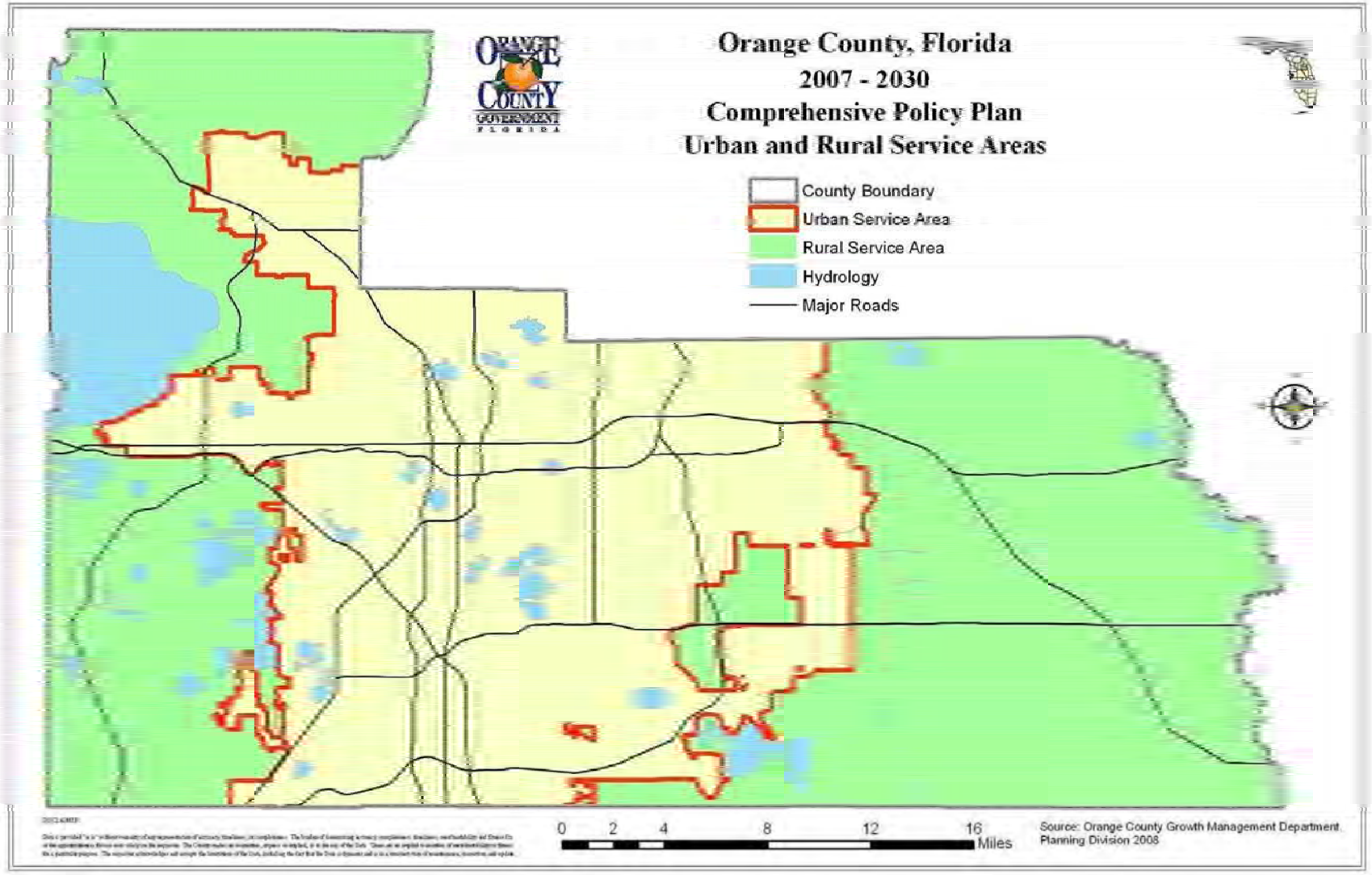
Existing Fire Stations:	28
Commission Districts:	2
Description:	The South Apopka area is surrounded by Seminole County, Pine Hills, and the cities of Apopka, Ocoee, and Orlando. The primary roads serving this area are: Clarcona-Ocoee Road, Orange Blossom Trail (US 441), Ocoee-Apopka Road, Clarcona Road, and SR 414. The area closer to the City of Apopka is an older, established series of neighborhoods. Further out, there is a mix of single family homes. 
Rural Settlements:	Clarcona
Development:	• Existing Land Uses: established older neighborhoods closer to Apopka; mix of types of single family homes further away from Apopka • Future Land Uses: same as existing land uses • Potential Development: small scale redevelopment
Potential for Future Annexations:	Unlikely

Northwest Orange County/Tangerine

Existing Fire Stations:	20, 27, 29
Commission Districts:	2
Description:	 Apopka is the County's second largest city with a 2012 population of 45,000. Situated in the middle of this planning area, it is anticipated that this area will continue to grow. Orange Blossom Trail (US 441) and Toll Road 429 are the key roadways serving this area. Toll Road 429 will be extended to the north (known as the Wekiva Parkway) which will provide additional access to and from this area. Encompassing 7,800 acres, Wekiwa Springs State Park is located in the eastern part of this planning area, which will remain undeveloped. The proposed Kelly Park Crossings DRI is located on 624 acres that will be located at the Wekiva Parkway interchange with Kelly Park Road. This DRI is going through the approval review process and is proposed to be a mixed-use community with a variety of commercial, residential, and industrial uses. The initial development program identified build out by 2032 with over 8 million square feet of non-residential uses and 900 dwelling units.
Rural Settlements:	• Tangerine • Zellwood • Zellwood Station • Rainbow Ridge • Otter Lake • North Apopka/Wekiva, Bridlepath, Paradise Heights
Development:	• Existing Land Uses: industrial (along US 441 and FEC rail line); agriculture (indoor foliage and citrus); residential communities; commercial (along major roads); Tangerine, Zellwood, and Zellwood Station are Preservation Districts • Future Land Uses – same as existing land uses • Potential Development: Kelly Park DRI (once approved and Wekiva Parkway is in place)
Potential for Future Annexations:	Yes, enclave annexations within JPA area

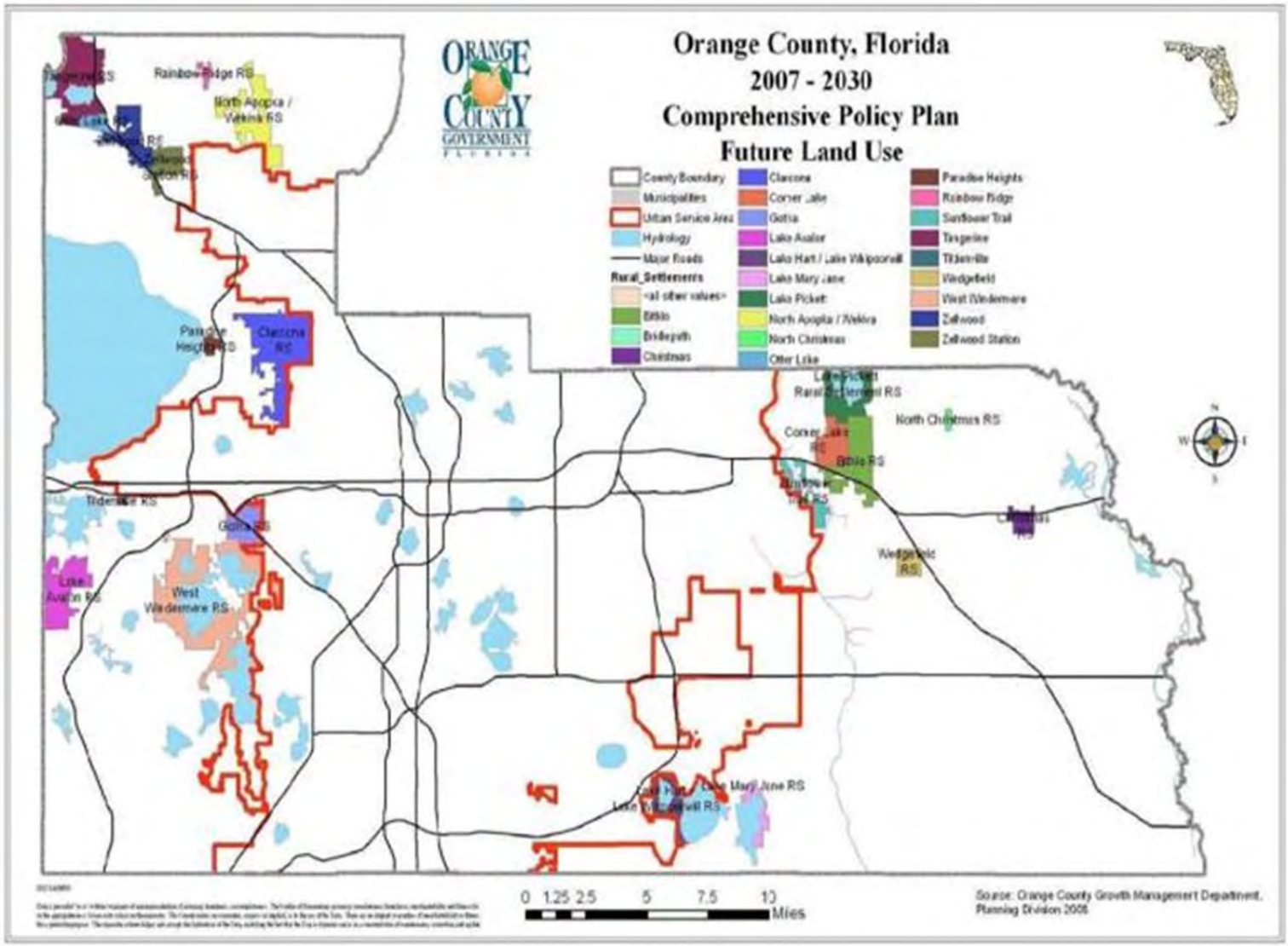
Figure 2 through Figure 10, which follow, are maps from the County's Comprehensive (Destination 2030) Plan. These and information from the County's plan were considered as we analyzed the expected development along with the current and future demand for services, associated risks, and response times. Further analysis of the County's expected development within the 16 planning areas and the expected impact on population growth and demand are discussed later in this report.

Figure 2. Orange County Urban & Rural Service Areas



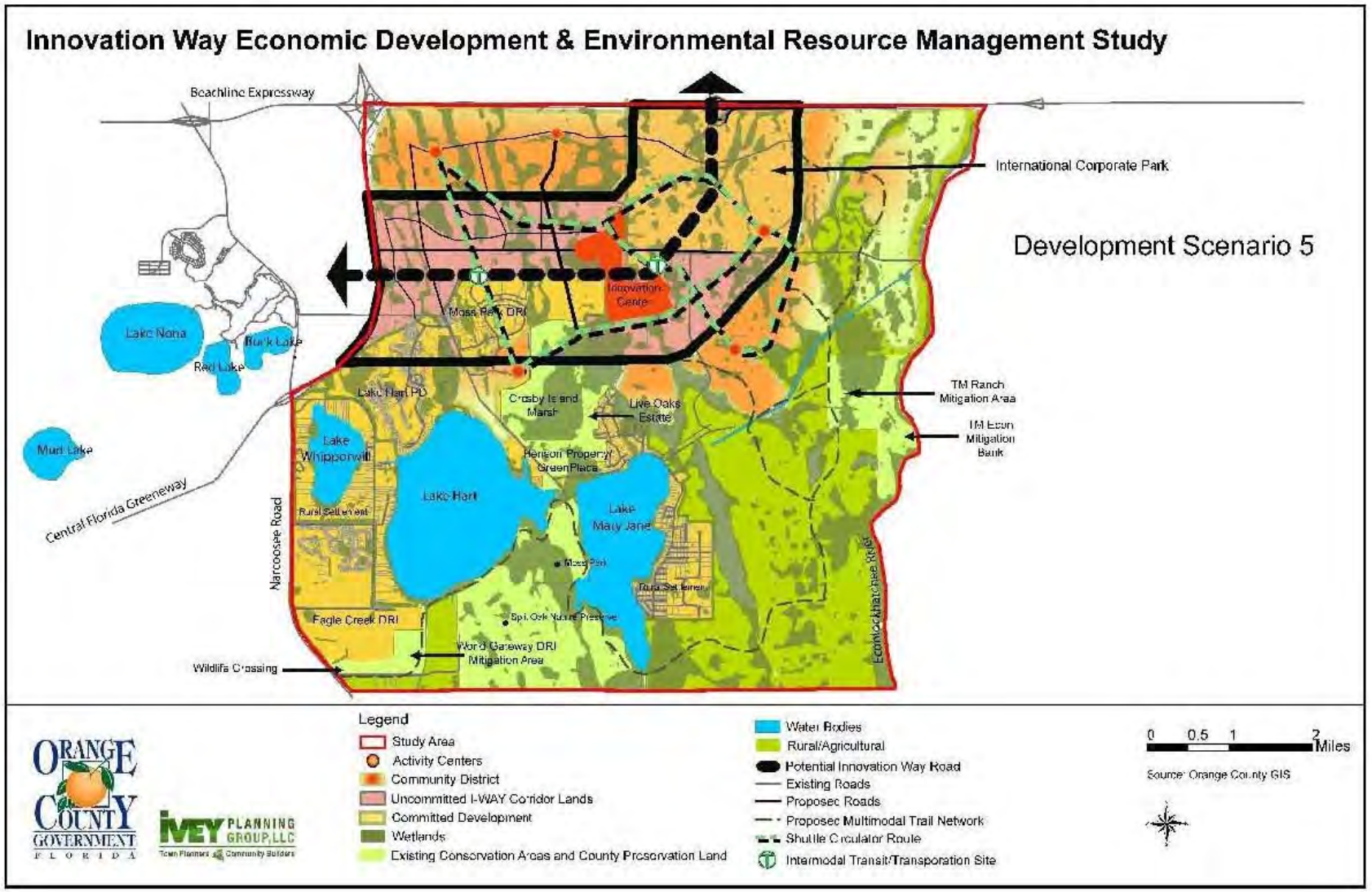
Source: Orange County Destination 2030, Future Land Use Map 5

Figure 3. Orange County Rural Settlements



Source: Orange County Destination 2030, Future Land Use Map 12

Figure 4. Innovation Way



Source: Orange County Destination 2030, Future Land Use Map 5

Figure 5. Camino Reale

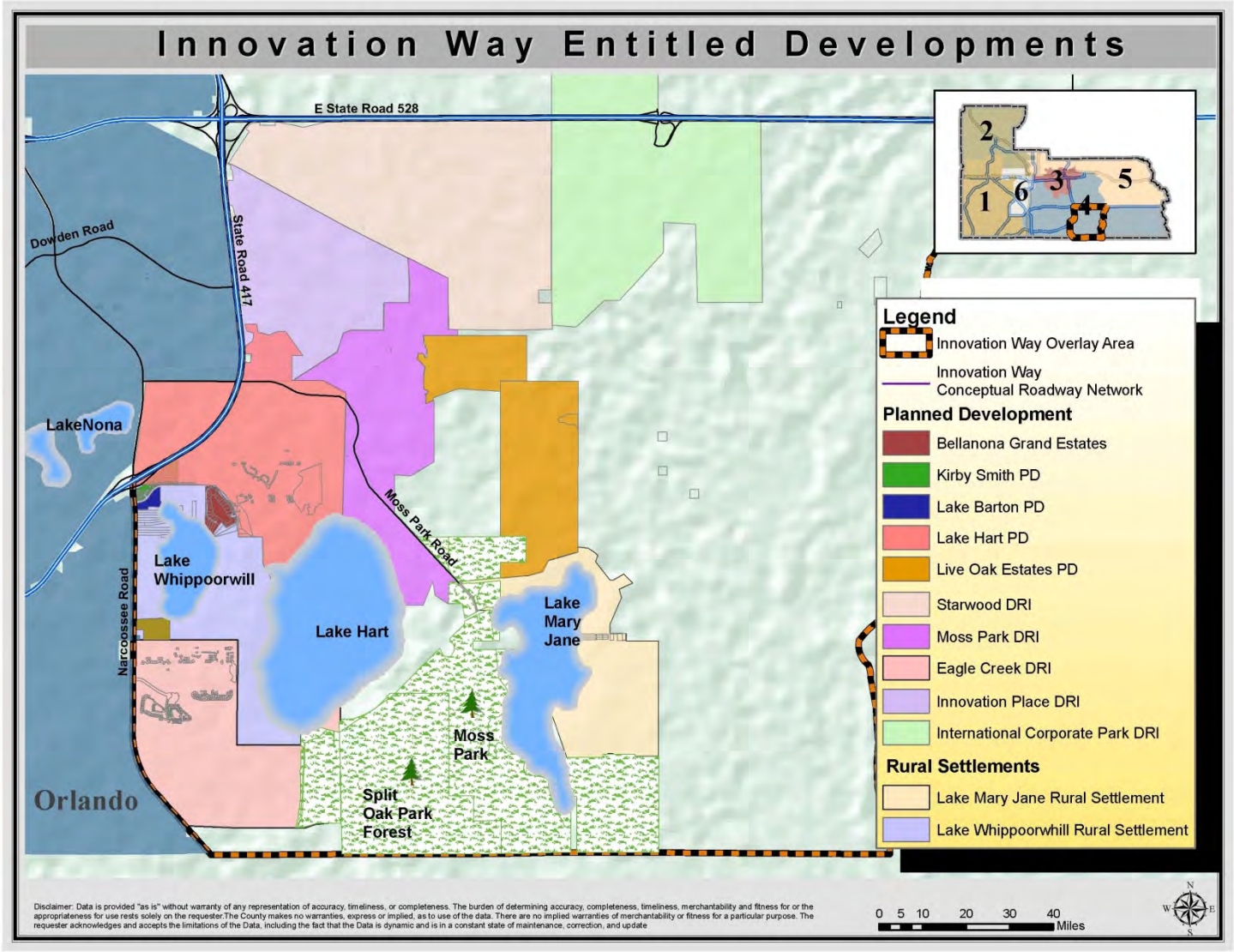


Figure 6. Preservation Districts in Orange County

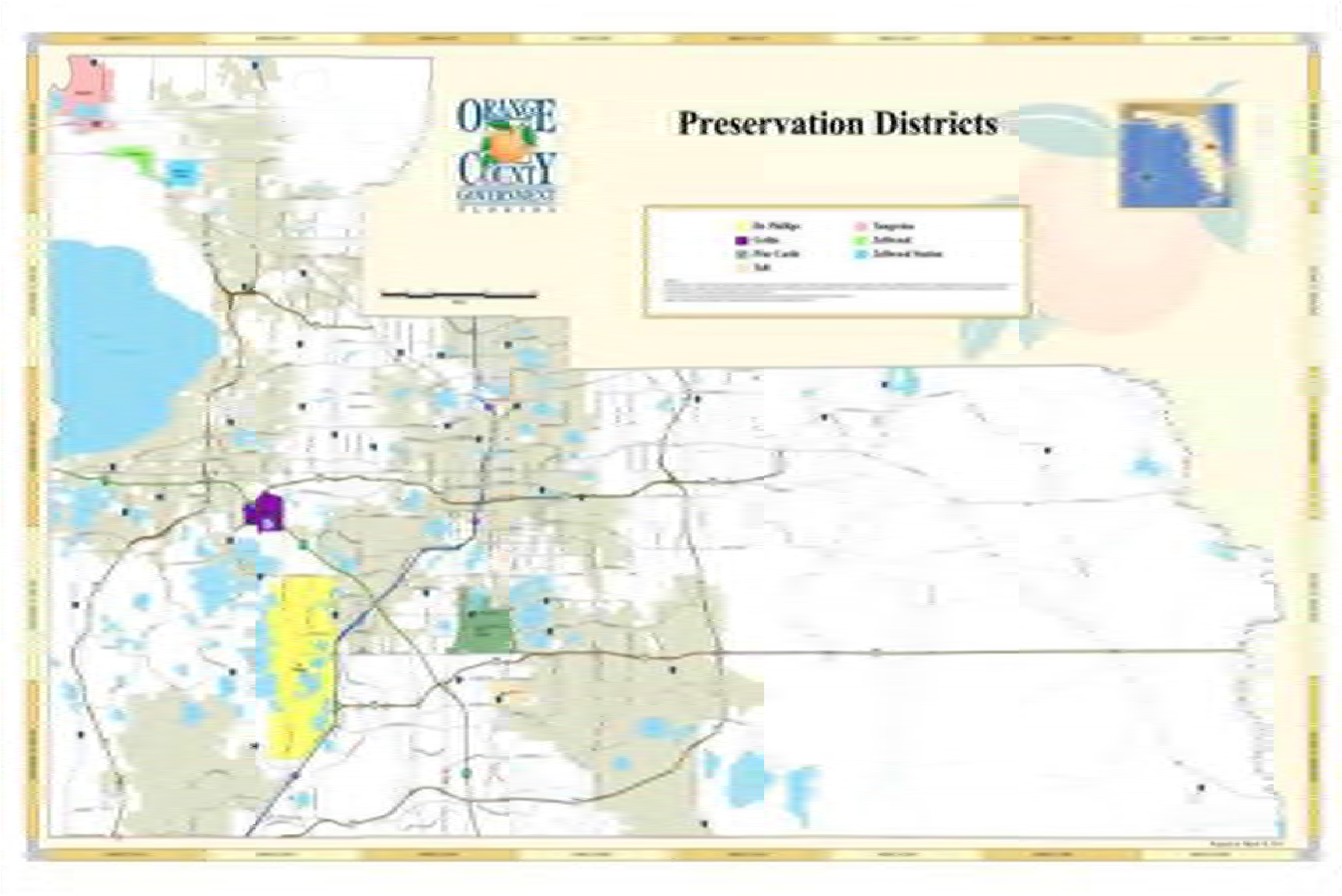


Figure 7. Joint Planning Areas in Orange County



Figure 8. Municipal Annexations from 2010 through 2014

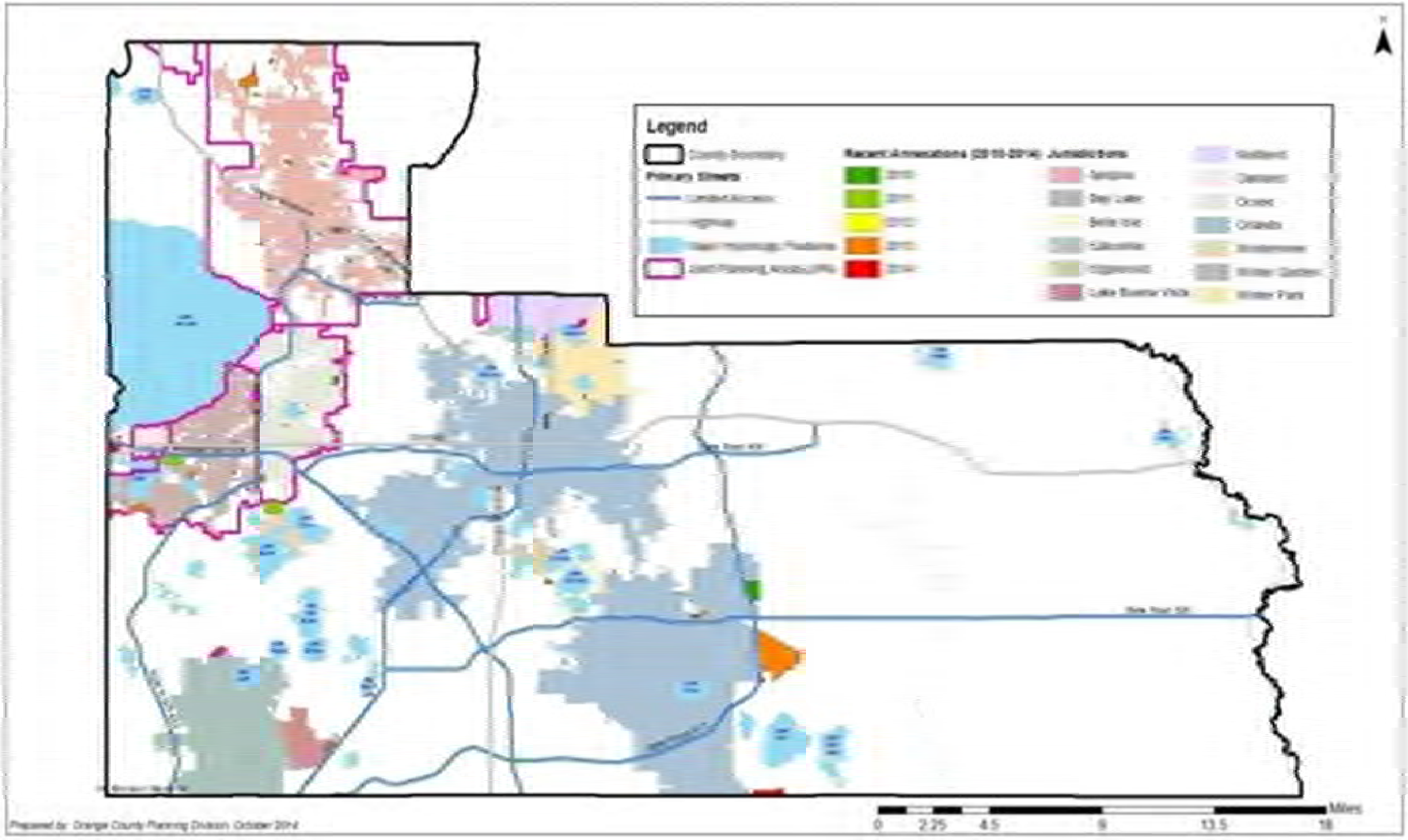


Figure 9. Potential Annexations into the Town of Windermere

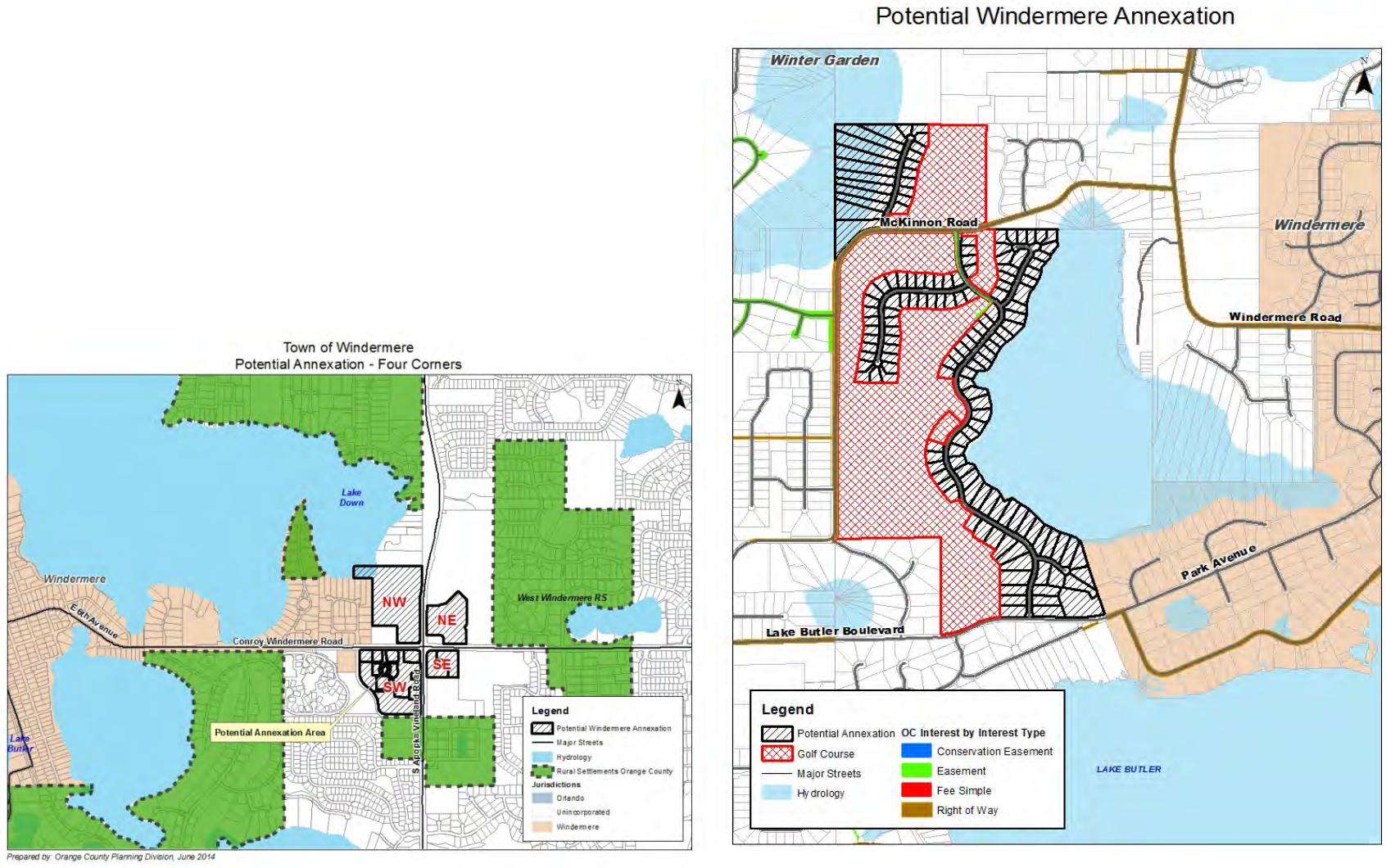
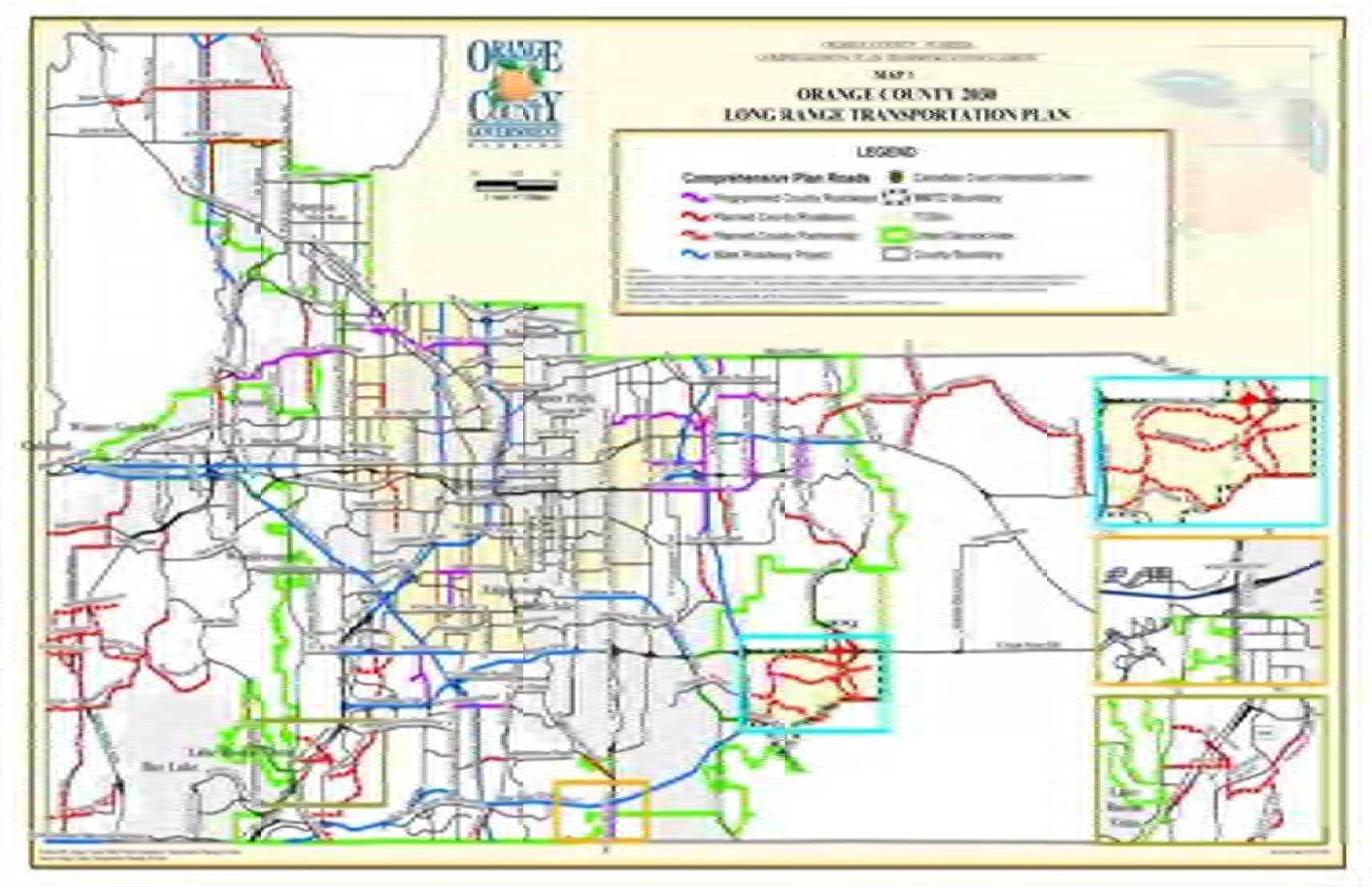


Figure 10. Orange County 2030 Long Range Transportation Plan



CHAPTER III. POPULATION GROWTH, RISK AND INCIDENT DEMAND ANALYSIS

This chapter reviews factors that can affect demand for emergency services, specifically population growth, fire risk, and historical demand for services. The analysis was conducted using the planning areas discussed in the previous chapter. The findings of this analysis were then used to determine the number and location of fire stations, as well as the timing for any new stations that will be needed. The station location analysis is discussed in the next chapter.

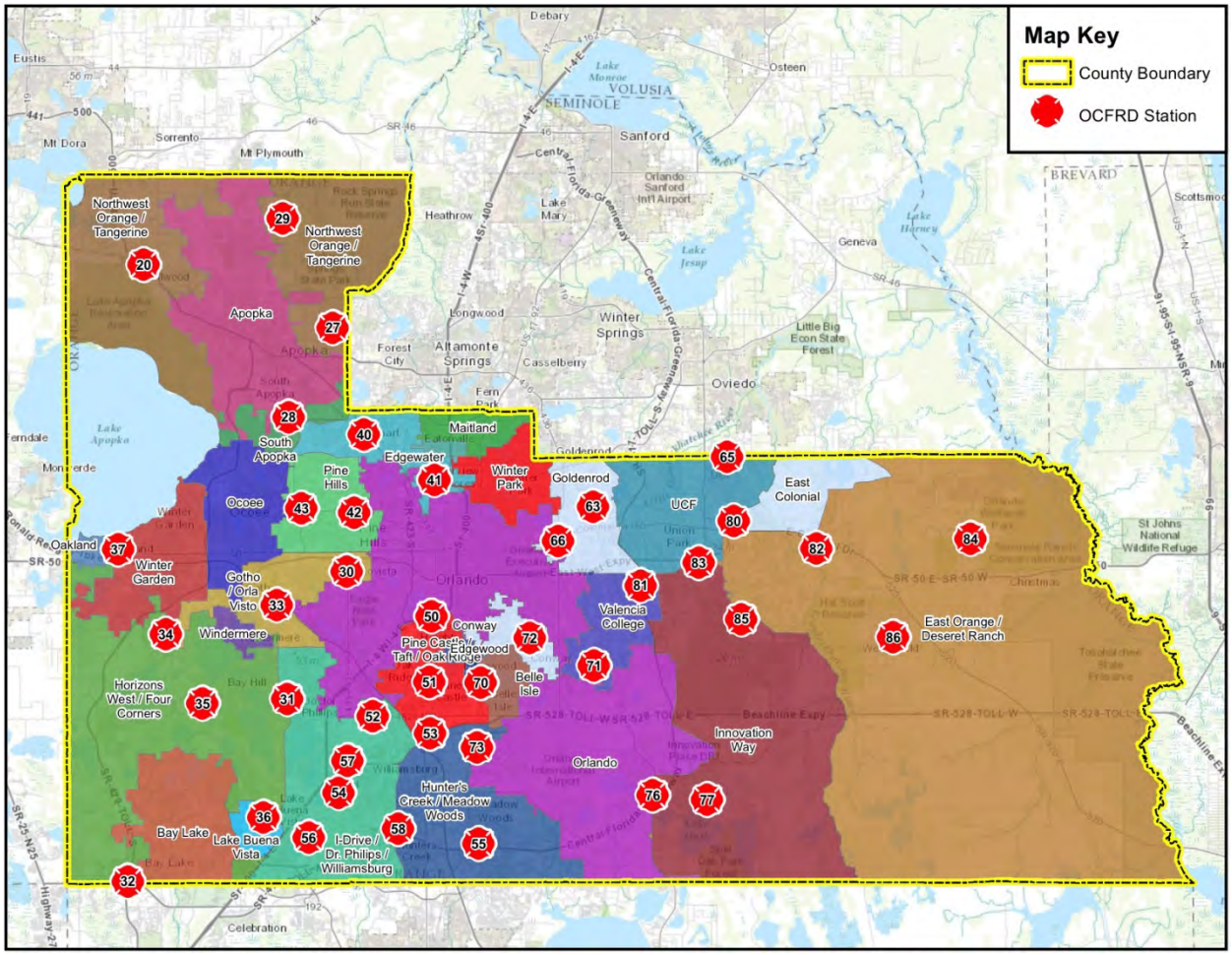
Planning Areas

It is good practice for fire departments to consider fire risk and demand for services at a neighborhood or planning-area level, rather than for an entire jurisdiction, because of the variation in local conditions from one area to another. If an entire county is analyzed as a whole, these differences may not be realized and a one-size-fits-all approach is used.

Early in this study the TriData team met with planning officials for the purpose of developing planning areas that could be used for this study. Several iterations were developed and maps created to show the location of the proposed planning areas that would be the basis for the analysis.

Figure 11 shows the different municipalities and planning areas used as the basis of analysis throughout this report, along with the location of fire stations in each.

Figure 11. Fire Study Planning Areas



The planning areas developed for this study can be used for other planning purposes as well. For example, it is useful to compare police activity or other service requirements such as building code inspections or violations to those of fire and EMS service delivery. Developing a uniform methodology to analyze community needs and services can improve understanding of service needs and delivery.

Recommendation 1: Consider adopting a framework of planning areas to be used by all County departments for study and analysis of service delivery.

A challenge for OCFRD is the continual annexations by municipal subdivisions in Orange County.[2] The long history of annexations has left a patchwork of unincorporated areas that makes it difficult to plan for fire stations (and other services). Following are the 13 municipal subdivisions in Orange County:

[2] Notably, the state of North Carolina passed legislation several years ago to prevent uncontrolled annexations. One of the reasons stated is that uncontrolled annexation was creating difficulty for planning of important public services such as fire and EMS.

Ocoee (City)	Apopka (City)	Bay Lake (City)
Belle Isle (City)	Eatonville (Town)	Edgewood (City)
Lake Buena Vista City)	Maitland (City)	Oakland (Town)
Orlando (City)	Windermere (Town)	Winter Garden (City)
Winter Park (City)		

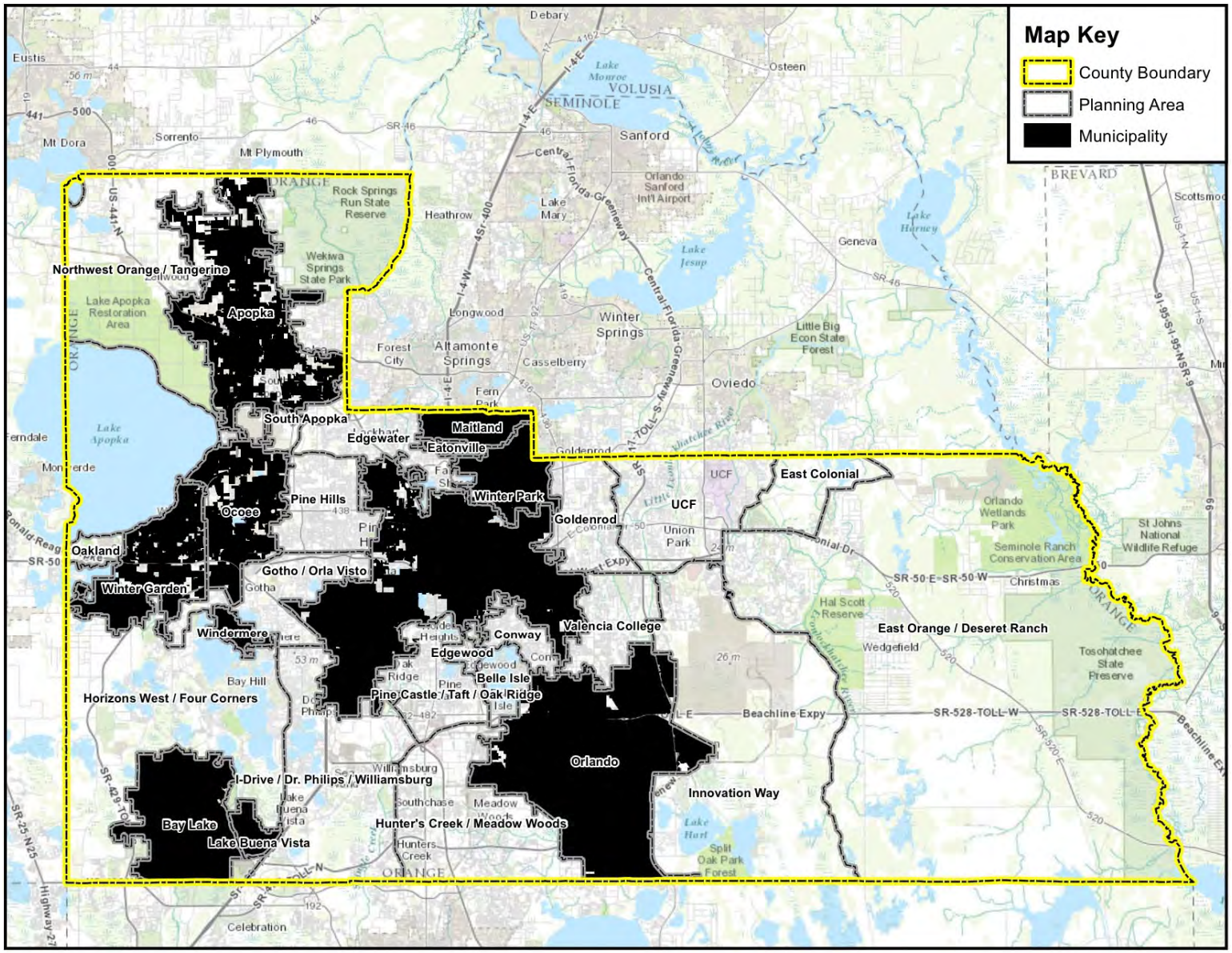
From 2012-2014, 141 annexations with a total land area of almost 2,600 acres of land were approved. Apopka (47) and Winter Garden (36) had the most annexations, though Orlando annexed the most property (1619 acres). The combined annexations from 2012-2014 are significant for the loss in tax revenue ($62 million).[3]

Orlando is the largest municipality, population-wise, in Orange County and has its own fire department. In land area, Apopka and Orlando are the largest. Under contract the OCFRD provides services to Oakland, Belle Isle, and Edgewood, and these communities were considered in the overall station location analysis.

Figure 12 depicts the County planning areas, but with the municipal boundaries blacked out. This map shows visually the difficulty of planning for fire station coverage due to the unevenness of the annexations over many years.

[3] Municipal Annexations, 2012-2014; Annexation Review Group, Orange County Community, Environmental and Development Services, January 29, 2015.

Figure 12. Planning Areas with Blacked Out Jurisdictions



Orange County Population Growth

The population of Orange County has seen extremely rapid growth over the last seven decades. Between 1940 and 2010, the County's population grew by over a million residents, from about 70,000 in 1940 to 1,146,000 in 2010.

The Bureau of Business and Economic Research (BEBR), the state's official demographic source estimated that as of April 1, 2013 Orange County had 1,202,978 residents, of whom 772,657 are in unincorporated Orange County and 430,321 in its 13 cities and towns. This means that unincorporated Orange County has about two-thirds of the entire Orange County population. From 2010-2013, the latest year for which population figures were available, the County's population increased five percent. The split between the increase in the unincorporated and unincorporated areas is about the same, with slightly higher growth in unincorporated Orange County as shown in Table 7.

Table 7. Orange County Population Growth, 2010-2013

	2010	2013	Change	Change %
Total Orange County	1,145,956	1,202,978	57,022	5.0%
Unincorporated County	736,657	772,657	36,000	4.9%
Incorporated County (13 cities)	409,299	430,321	21,022	5.1%

Source: University of Florida, Bureau of Business and Economic Research (BEBR)

Population changes are important for planning emergency services, because medical service demand correlates to resident population, and dominates calls for service.

According to BEBR, all of Orange County will continue to grow through 2040, as presented in Table 8. Over the next 25 years, it is expected that Orange County will grow by 500,000 residents. Of these, almost 400,000 are expected to reside in unincorporated Orange County.

Table 8. Orange County Population Projections, 2020-2040

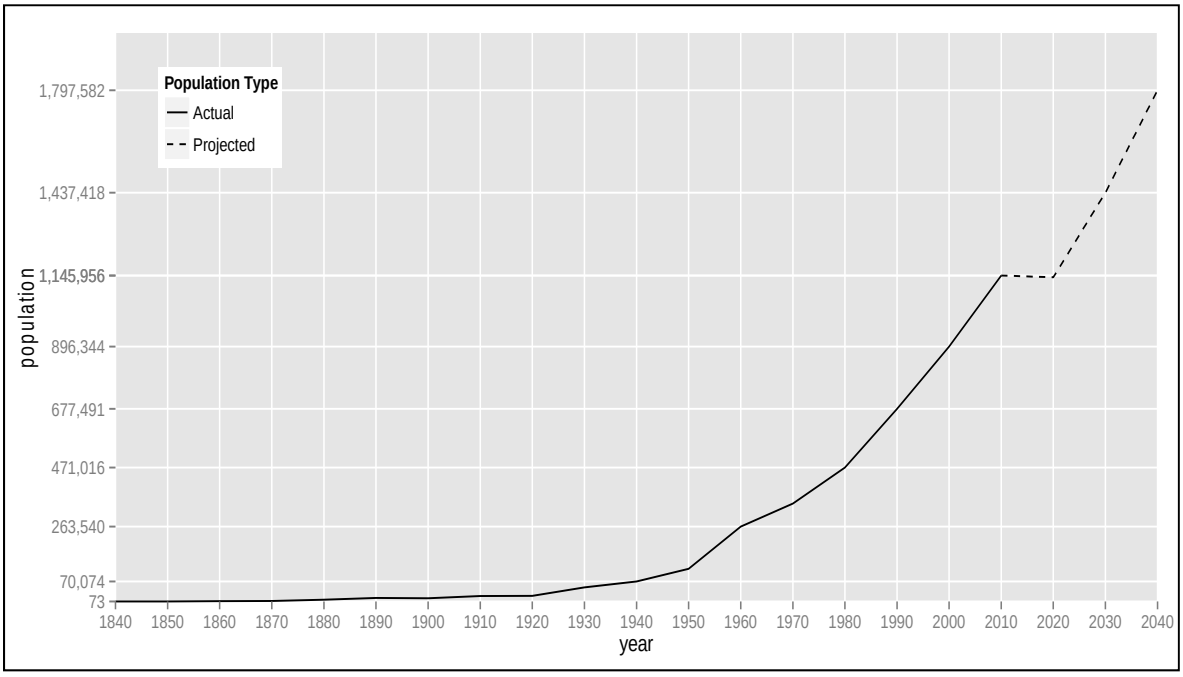
Year	Population	Change
2010	1,145,956	--
2015	1,251,700	9.2%
2020	1,394,800	11.4%
2025	1,525,100	9.3%
2030	1,641,200	7.6%
2035	1,746,300	6.4%
2040	1,840,700	5.4%

Sources: 2010 Census; Projections by BEBR for out years

In addition to its resident population, Orange County has a huge visitor population. The County is one of the top tourist destination in the United States, anchored by Walt Disney World (in Reedy Creek Improvement District), Universal Orlando (in Orlando), and the Orange County Convention Center and Sea World (in unincorporated Orange County). In 2012, 55 million visitors came to Central Florida, which translates to over 1 million visitors each week. It is important to consider this continual influx of visitors as well as the setting (2 million square foot-convention center and multiple high-rise hotels) as future fire station operations and locations are evaluated.

According to the Orange County Planning Division, Research and Economic Development Section, steady visitor growth at about the same rate is expected through 2025 and then slowing slightly through 2040. It is projected that by 2040 the County's population will have reached 1.8 million. Assuming the same ratio of two-thirds of the population residing in unincorporated Orange County, it can be expected that the OCFRD will have a service population of approximately 1.2 million residents by 2040, a substantial 55% increase over the 2013 population of unincorporated Orange County.

Figure 13. Actual and Projected Population of Orange County, 1840-2040



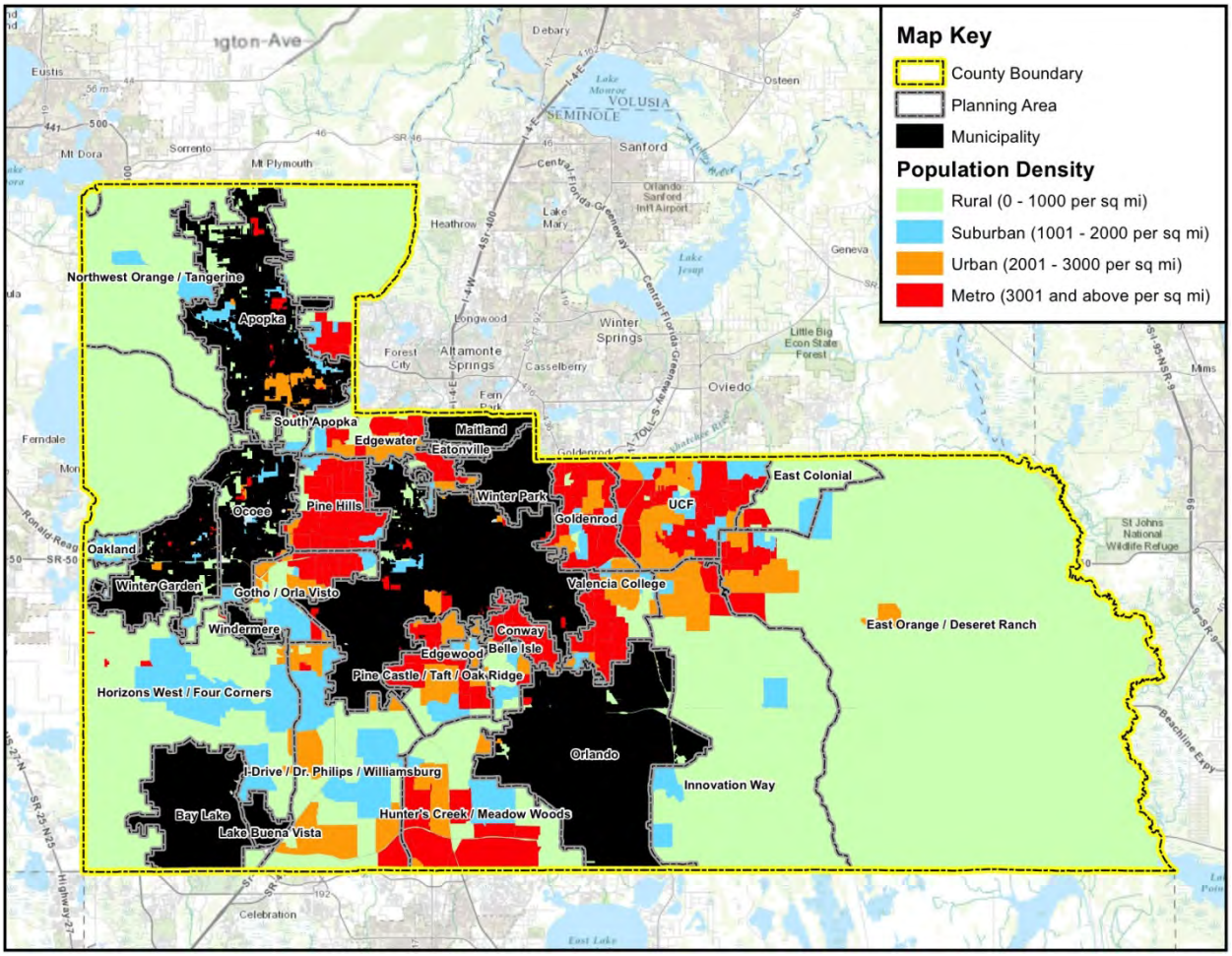
The current population density of Orange County ranges significantly from the eastern and northwestern portions of the County, which are very rural, to metropolitan areas in central Orange County. Understanding the population density and future growth for the various planning areas is important because as these are used as determinants for response-time goals.

Areas classified as metropolitan areas have higher population densities (and typically higher demand), thus faster response times are used as compared to rural areas where population and demand is lower. Urban and suburban populated areas have response-time requirements which fall between rural and metropolitan areas.

Demand for emergency services is driven predominantly by population. The areas with the highest population density generally have the highest per-capita emergency-service demand. Planning areas with metropolitan populations include Pine Hills, Goldenrod, UCF, Conway, and Valencia College. Portions of Pine Castle/ Taft/ Oak Ridge, Hunter's Creek, Meadow Woods, Edgewater, and Northwest Orange/ Tangerine also have some areas where the population is mostly metropolitan.

Figure 14 shows the population density designations for the planning areas in Orange County. While the green-shaded areas cover most of the land area of the County, it is the red and orange-shaded areas where most of the demand for service is located. There are also areas such as Horizons West that is currently designated as suburban, however, the development expected over the next decade or so is expected to change these areas (blue) to urban (orange) and Metropolitan (red).

Figure 14. Orange County Population Density Map, 2013



For this study we also analyzed Traffic Area Zones (TAZ) to evaluate the population projection change expectations for Orange County in five-year increments from 2015 to 2040. The same population-density classifications used in Figure 14 are also used in these maps, which

are provided in Appendix A. Changes in development and population density are also used later in the response time and station location analysis section of this report.

A key consideration was the expected growth and development in Orange County and its impact on planning fire services going forward. As to the areas of Orange County where the most development and population growth is expected to occur, the following areas are of the most concern as to the current and future location of fire stations and resources.

- Horizon West
- Innovation Way
- Kelly Park
- University of Central Florida/Rybolt

An important impact of these developments and countywide population growth is their effect on the response-time requirements. As communities become more densely populated, the standards for response time are also adjusted with urban and metropolitan areas requiring a faster response than suburban or rural areas. In some communities it can be feasible to improve response times in more densely populated areas by moving exiting fire stations as the population changes to provide better coverage. This is not the situation in Orange County, which is already covering very large areas, often with a single fire station and unit.

New developments spring up very fast in Orange County. Fire stations that were properly located before new developments become reality may not be in particularly good locations afterwards, because the new developments often result in significant population increases and thus higher demand. And these changes can occur long before the end of the 40-year expected life of a fire station. This makes the situation of deciding where to locate new stations or relocate older ones, even more difficult.

The station-location recommendations in later chapters of this report take into account expected populations of each planning area going forward. For this project we reviewed the expected population projections for each of the planning areas as well as the changes expected for highways, roads, and other transportation changes.

Of particular importance as it relates to the need to relocate or add fire stations are the following planning area population projections:

- Goldenrod and UCF will have large areas of suburban and urban population density classification transition to metropolitan population density classification,
- Pine Castle/ Taft/ Oak Ridge and Edgewood will see portions of their urban areas converted into metropolitan areas,
- The southern portion of Hunter’s Creek/ Meadow Woods planning area along the border with Osceola County will see transition from suburban to metropolitan, and
- The western portion of I-Drive/ Dr. Philips/ Williamsburg will see a transition from rural and suburban to metropolitan.

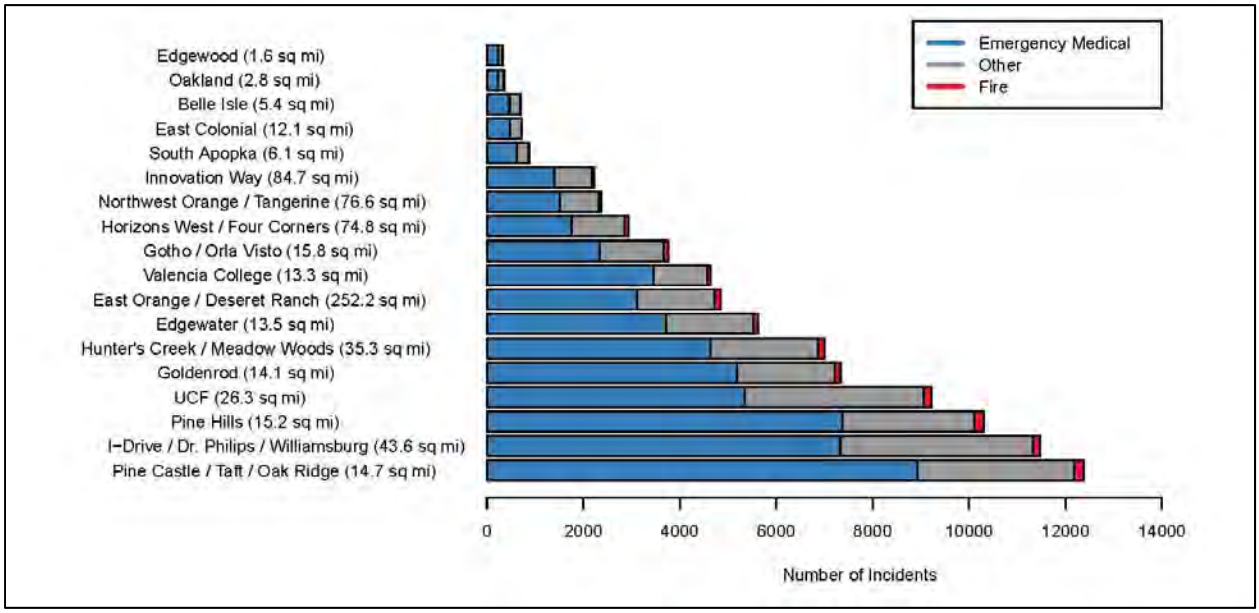
Demand for Fire Rescue Services

Demand is defined as the number of calls to the fire department for emergency and nonemergency services. This section reviews trends for the different incident types, compares emergency-service demand by planning area, and maps fire and EMS delivery hotspots. It concludes by forecasting the total number of calls (or incidents) expected by 2025.

Trends by Incident-type – OCFRD, like most departments nationwide, responds to many more medical calls than other incident types. Approximately seven out of every ten calls handled by the OCFRD is a medical call. Over the past four years (2010-2013), medical calls increased by 40 percent, from 45,014 to 66,055 calls. While medical calls may not continue to increase at the same high rate, OCFRD must prepare for their continued increase, especially as population continues to increase.

Figure 15 shows the incident-types from 2010-2013.

Figure 15. Incident-Types, 2010-2013



As can be seen in Figure 16, while EMS calls increased the most in total number of calls, motor vehicle accident (MVA) responses increased by the highest percentage (53). Because MVAs account for a lesser amount of the total call volume, the percentage increase is not considered significant.

Demand by Planning Area – Considering the entire coverage area of OCFRD, Pine Castle/ Taft/ Oak Ridge, Pine Hills, Goldenrod, Edgewater, Azalea Park, UCF, and Azalea Park have the highest number of calls. These are the areas of higher population density. Figure 16 shows the incident types by planning areas, normalized by land area (i.e. calls per square mile).

Figure 16. Incidents by Planning Area, 2010-2013

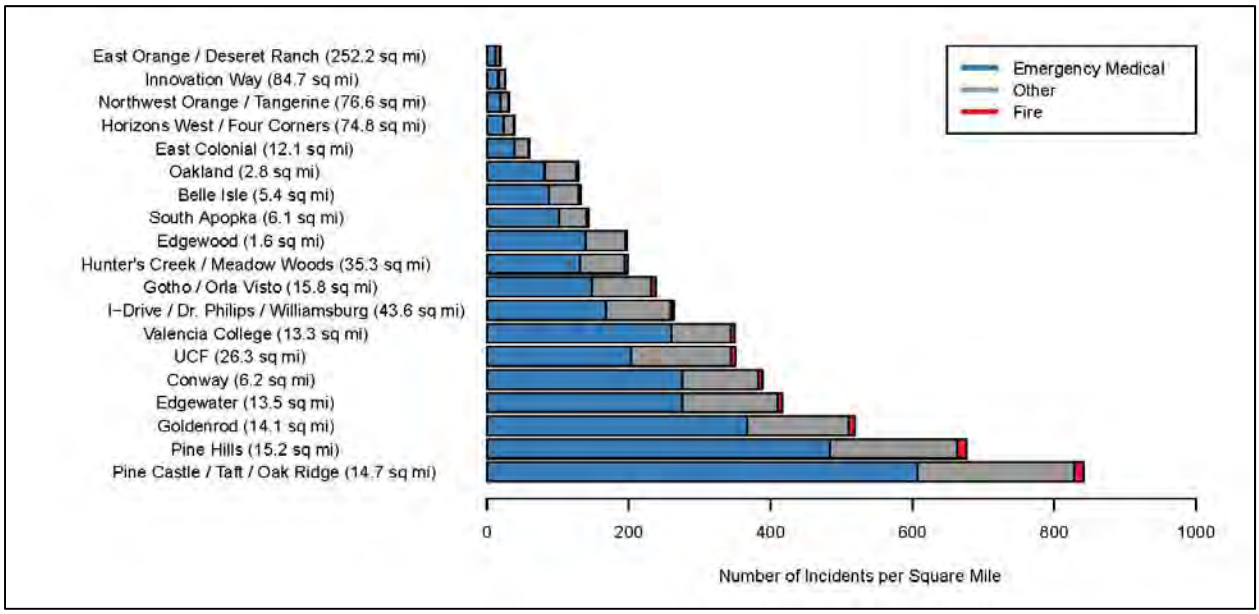
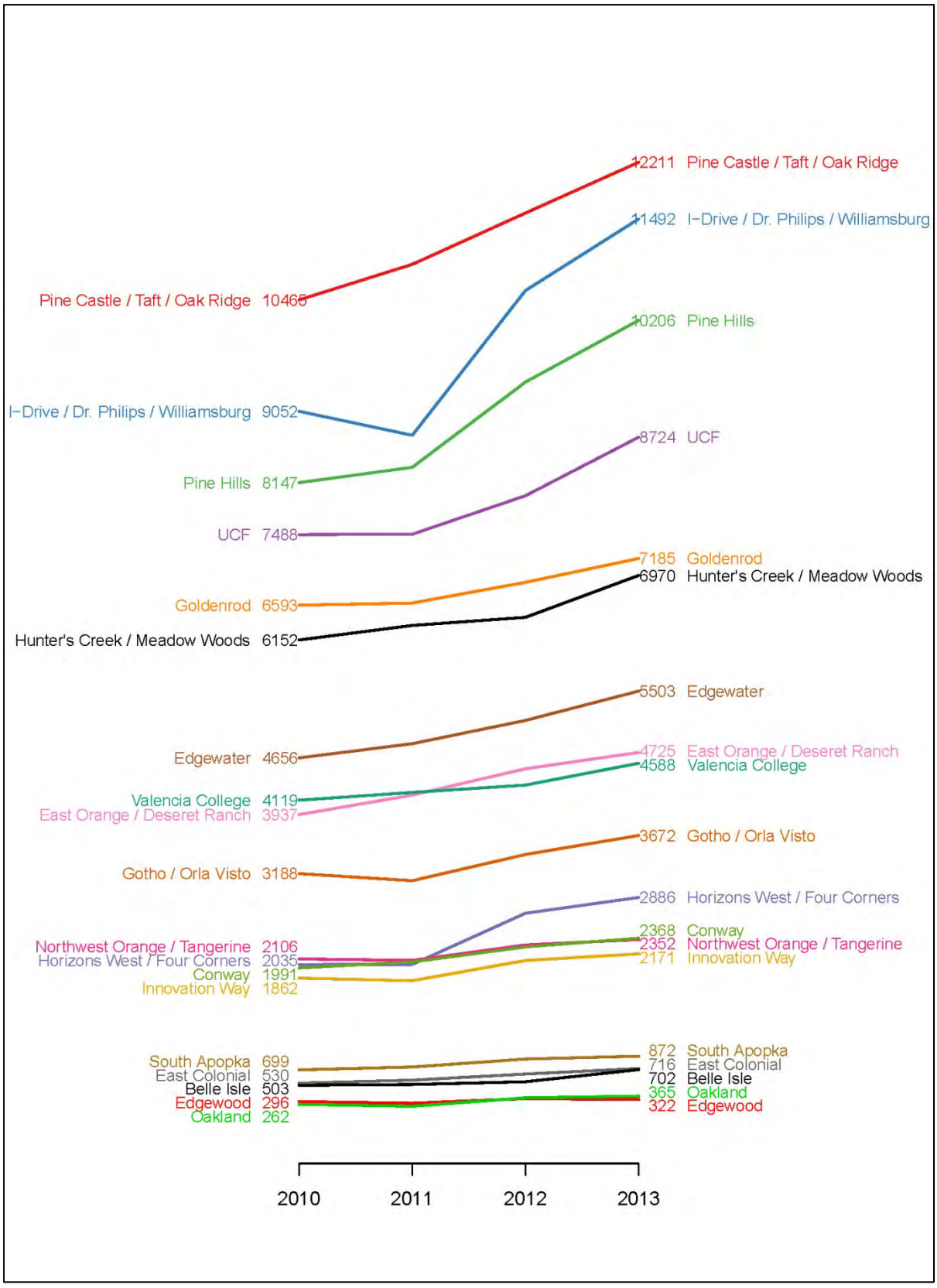


Figure 16 show that Pine Castle, Pine Hills, and Goldenrod have the highest concentration of calls per square mile. Some other areas where the call volume density is not the highest now are increasing at such a high rate that additional services and fire stations will be needed to meet the demand. I-Drive/Dr. Philips/Williamsburg and Horizons West/ Four Corners planning areas are two such areas.

Figure 17 shows the total incidents trend for each of the planning areas over the last four years.

Figure 17. Incident Demand Trends by Planning Area, 2010-2013



From 2010-2013, call volumes in some areas increased substantially. The communities of Oakland and Belle Isle, two municipalities that receive service under contract from OCFRD had high percentage increases. However, the call volumes for these communities are low and the increase is not considered significant. Horizons West and Pine Hills had high call volumes in 2010, so the percentage increases for these areas, 42 and 25% respectively, is considered significant.

Table 9. Call Volume Increases by Planning Area, 2010-2013

Planning Area - Square Miles	Calls 2010	Calls 2013	Percent Increase	Calls/ Sq. Mile/ 2013
Belle Isle – 5 square miles	503	702	40	140
Conway – 62 square miles	1991	2368	19	38
East Colonial – 12 square miles	530	716	35	60
East Orange/ Deseret Ranch – 252 square miles	3937	4725	20	19
Edgewater – 14 square miles	4656	5503	18	393
Edgewood - 2 square miles	296	322	9	161
Goldenrod – 14 square miles	6593	7185	9	513
Gotho/ Orla Visto – 16 square miles	3188	3672	15	230
Horizons West/ Four Corners – 75 square miles	2035	2886	42	38
Hunter's Creek/ Meadow Woods – 35 square miles	6152	6970	13	199
I-Drive/ Dr. Philips/ Williamsburg – 44 square miles	9052	11492	27	261
Innovation Way – 85 square miles	1862	2171	17	26
Northwest Orange/ Tangerine – 77 square miles	2106	2352	12	31
Oakland -3 square miles	262	365	39	122
Pine Castle/ Taft/ Oak Ridge – 15 square miles	10466	12211	17	814
Pine Hills – 15 square miles	8147	10206	25	680
University of Central Florida (UCF) – 26 square miles	7488	8724	17	335
Valencia College – 13 square miles	4119	4588	11	353
South Apopka – 6 square miles	699	872	25	145

Note: Areas listed in italics are municipal governments under contract to OCFRD.

The total and percentage of calls and their increase by planning area only tells part of the story. Understanding the concentration and types of calls is better understood by mapping the calls, and analyzing the loss history and risk of the various planning areas, as will be discussed next.

Geospatial Mapping of Fire and EMS Demand – An efficient way of looking at demand is to map incident densities using Geographic Information System (GIS) software. For this project we analyzed incident data using ArcGIS, a commercially available software package used by many government and commercial entities. The analysis effectively shows the high-demand areas ("hotspots").

The fire incident density map includes all incidents classified as fires in the database of the National Fire Incident Reporting System (NFIRS). This includes structure fires, vehicle fires, and outside fires such as brush fires. The review shows that fire demand also generally follows the population density of the area covered by OCFRD. Population density is a good predictor of not only fires, but all emergency incident types—where there are people, there are emergencies. Despite some differences in the pattern of fire and EMS incident density, both generally follow the residential population densities shown earlier.

Figure 18 and Figure 19 show fire and EMS incident densities, respectively. Municipalities that are not provided service by OCFRD are depicted in black.

Figure 18. Fire Incident Density

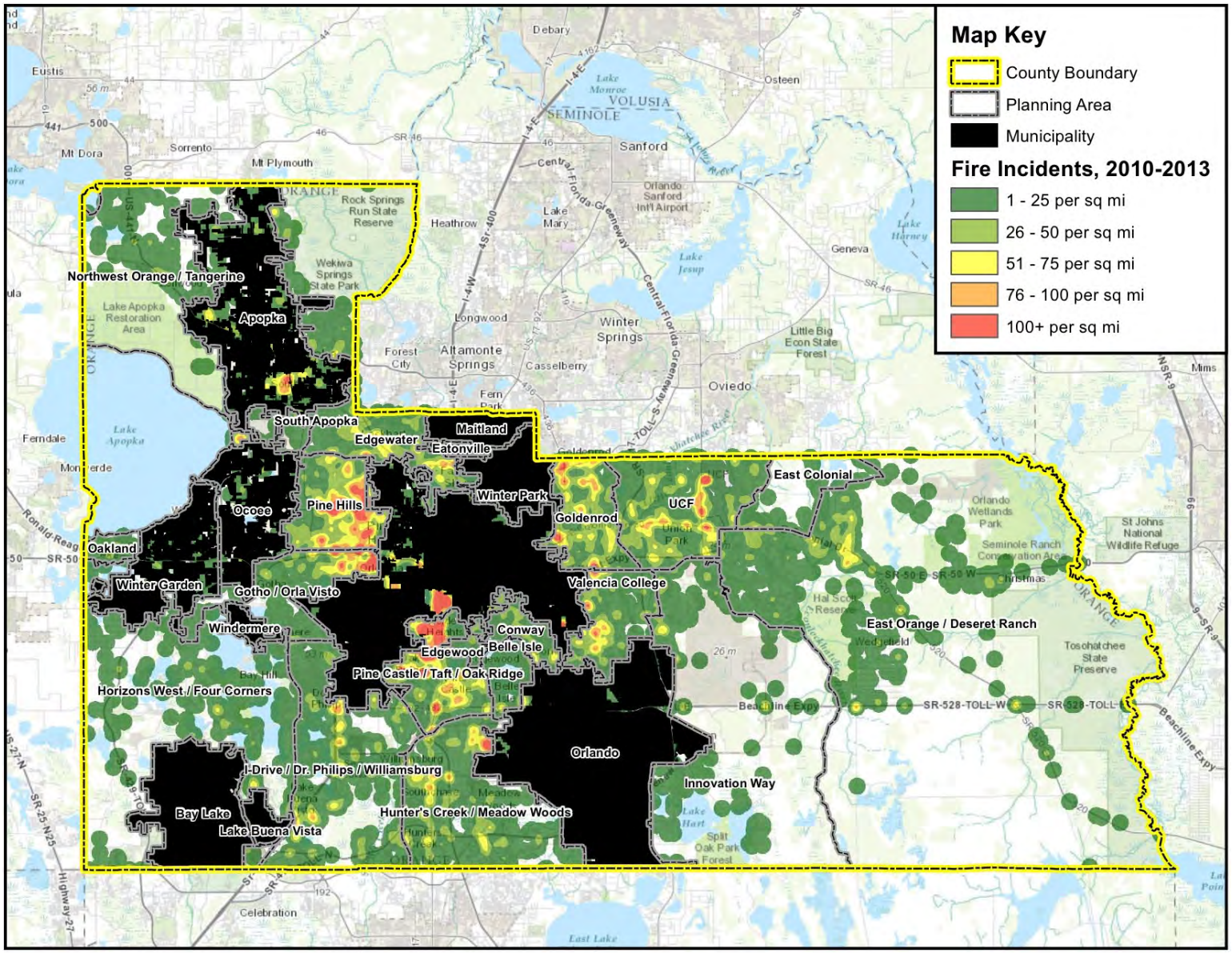
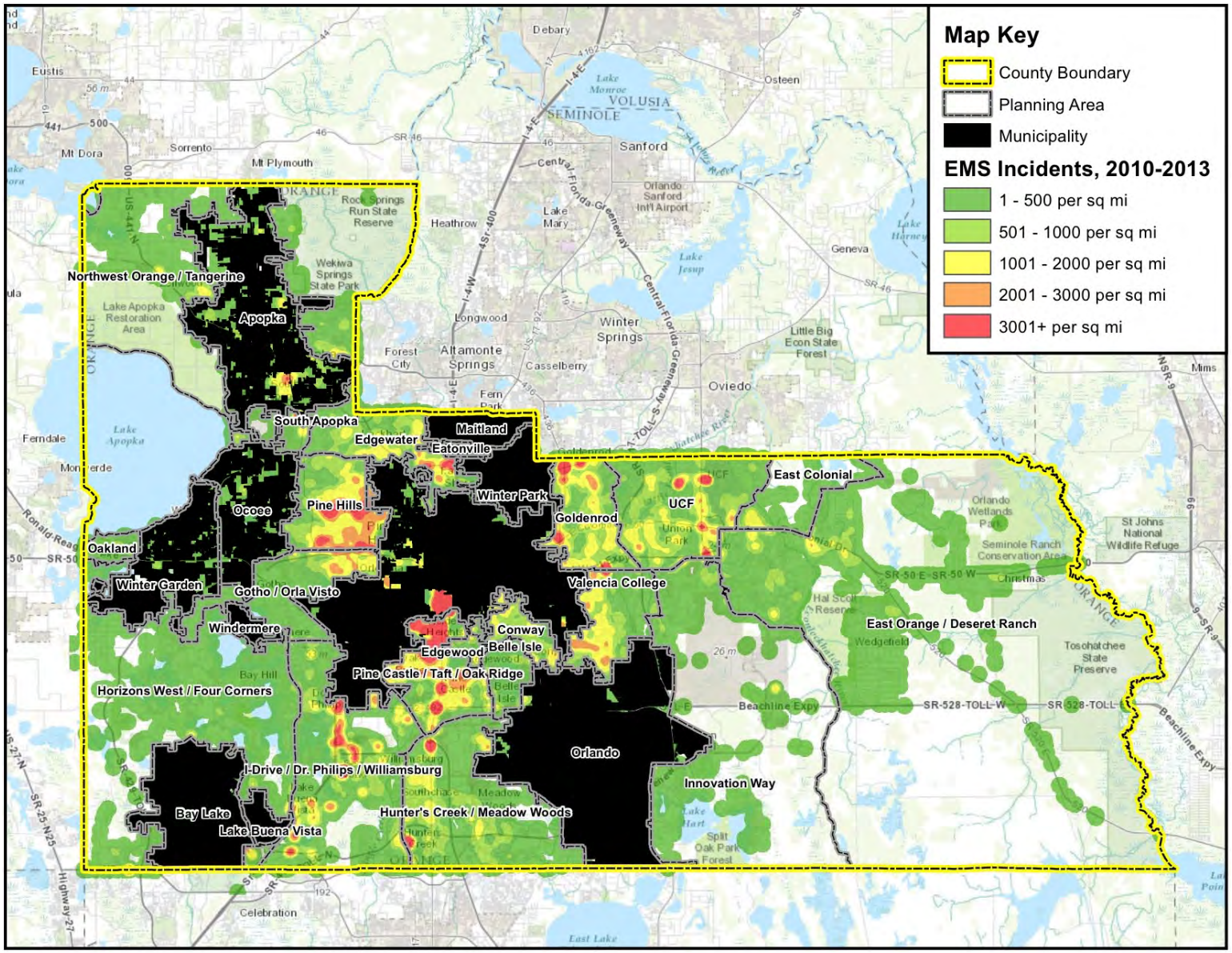


Figure 19. EMS Incident Density



The vast majority of high density fire demand is in the Pine Hills, Gotho/ Orla Vista, and Edgewood planning areas, along the border with Orlando. There are more diffuse hotspots across Goldenrod, UCF, and Valencia College. There are also some hotspots along International Drive and one in the unincorporated Orange County area that is effectively within the Apopka municipality.

EMS incident density (Figure 19) shows a similar hotspot pattern to that of fire density, with the largest concentration of incidents occurring in the same general areas of high fire incident density, except that the EMS incidents are often more concentrated in some more distinct hotspots, particularly in Goldenrod, UCF, and along International Drive.

Demand Projections

Understanding the expected future demand for emergency services, and where that demand is likely to increase, is important for determining the number and location of new fire stations. For Orange County, which has had substantial population growth and increased demand over the past few years, and which is expected to continue to increase, understanding the expected increase in demand is paramount.

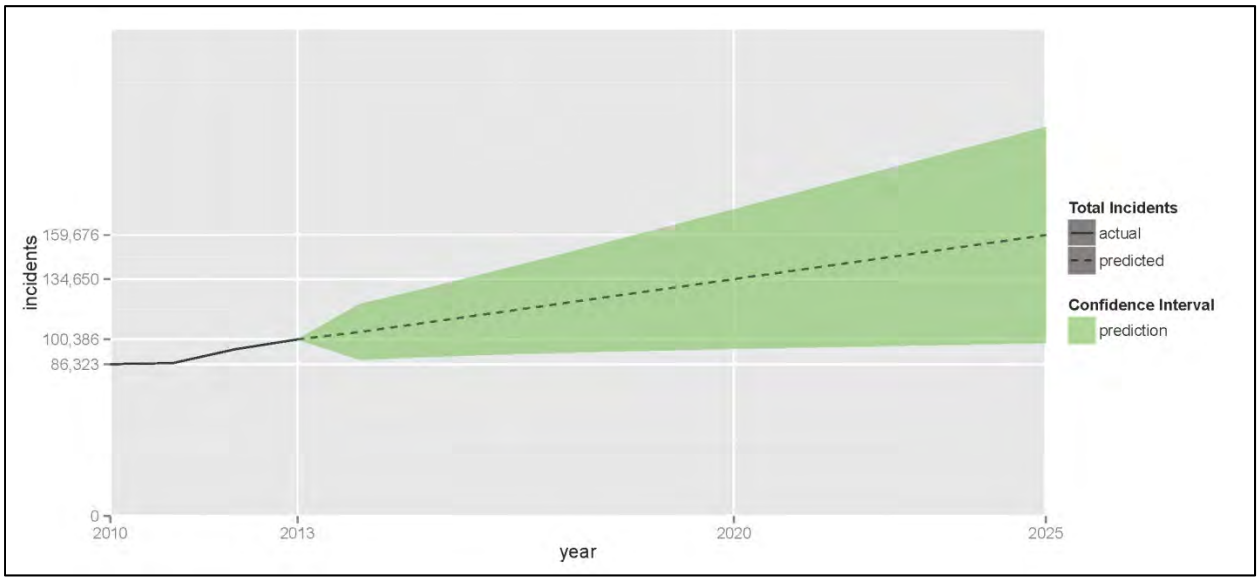
For this study we conducted an analysis of demand two ways. This was done to compare the results and also to estimate optimistic and pessimistic estimate on total demand. A statistical software multi-linear regression process was used to determine the relationship between population growth and demand to estimate the effect of population and incident growth. [45] A follow up analysis was then conducted to analyze the trend in per capita rate of medical calls and then compare the expected future total demand based on the expected population of the OCFD service area.

From 2010-2013, the total number of incidents handled by OCFRD increased by 16% (from 86,323 to 100,386). The statistical regression projects that this trend will continue. In Figure 20, the solid blue line shows the actual emergency incident totals from 2010-2013. The dashed line shows the total emergency-incident projections going forward to 2025. The shaded green area around our projected incident totals shows what is called the “confidence interval,” meaning how certain we are that the incident total will fall within a specific range. The confidence interval shown is 95%--that is, if the current model applies, we expect the demand to fall within the confidence interval with 05% probability—pretty sure. The green area is narrower in the near future because we can predict the number of incidents more accurately in the near future.

[4] Time reflects changes in inclination to use emergency services and factors other than population.

[5] Regression analysis is a method of studying the relationships among variables by plotting them on a graph.

Figure 20. Total Emergency Incident Projections through 2025



The short-term projection forecasts 134,649 incidents by 2020 with an optimistic scenario of 95,055 incidents and a pessimistic scenario of 174,244 incidents. The optimistic and pessimistic scenarios are the lower and upper bounds of the confidence interval in which we are 95% sure the actual incident total will fall. The long-term projection forecasts 159,676 incidents by 2025 with an optimistic scenario of 98,320 incidents and a pessimistic scenario of 221,031 incidents. The analysis results (by year) are provided in Appendix B.

To compare results and get a more accurate estimate of expected future demand, we then analyzed future demand based on the population estimates and the demand per 1,000 population. An assumption that the population in the unincorporated area of the County might increase as new development occurs.

From 2010-2013 OCFRD call demand increased from about 87,000 calls to just fewer than 101,000 calls per year, a 4% annual increase. If, as likely, call volumes increase at the annual rate of .04, it can be expected that the call volume in 2025 would be about 162,000 calls per year. Further analysis was then conducted to estimate the future expected call volume in 2025 by comparing the current call volumes and population growth expectations over the next 10 years, to determine the high and low estimate for demand in 2025. Using that method we determined:

2013 Unincorporated Population = 773,000

Calls per 1,000 = 182

2013 Unincorporated population as percentage of County = .64

Estimated Unincorporated Population in 2025 @ .64 of County = 976,000

Demand @ 182 calls per thousand (976,000) population = 178,000 calls per year in 2025

If, as expected, the population of unincorporated Orange County increases as a percentage of the entire Orange County based on new development, the estimated demand in 2025 is higher.

Estimate of 2025 County population = 1,525,000

Estimate of unincorporated population in 2025 @.7 (due to new development) = 1,067,570

Demand @ 182 calls per thousand (1,067,570) population = 194,000

Based on the various analyses, the estimate for annual call volume in 2025 can be expected to range from about 160,000 calls per year to just fewer than 200,000. A midrange of 177,000 calls per year, or an increase of 76,000 calls per year by 2025 should be expected.

Regression analysis estimate	159,700 calls per year
Four percent annual increase	162,000 calls per year
Population estimate of 976,000	178,000 calls per year
Population estimate of 1,100,000	194,000 calls per year
Midrange	**177,000 calls per year**

The expected increase in call volume over the next 5 to 10 years is important to the consideration of new fire stations. Response travel times are already long and OCFRD is unable to meet accepted standards of response. With each annual increase in demand station workloads will increase and units will be available less of the time, thus response times will increase even more because a unit farther away must handle the call. Maintaining the status-quo by not adding any new stations will only make the situation worse and should not be a consideration, in our opinion.

Fire-risk Analysis

The term “fire risk” refers to two factors: the *probability* that fires will occur and the *consequences* (severity) of fires. Although fires are only a small portion of total emergency-services demand, fire-suppression activities require more personnel than most other emergencies, so it’s important to understand risk trends.

Future fire risk can be forecast by examining the number and consequences of past fires, and any emerging new types of risks. The fire-risk assessment in this section evaluates the overall trend in fires in Orange County, the probability of fires in different planning areas, and the likely severity of fires in those areas. All of these factors are considered for each planning area’s overall fire-protection requirements.

We typically conduct a fairly basic risk analysis. In our experience with determining optimum station locations, it is rare that a more detailed risk analysis leads to different station-location decisions. Understanding the general risk classifications of community areas and deciding whether those areas need additional (or in some cases a lower level of) emergency service is sufficient.

This study compared the local fire-loss statistics to regional and national statistics and for communities of similar size and do a basic review of the number of fires, monetary losses, percentage of fires that spread beyond the room of origin, and casualties for each planning area. Using these results, we rank fire-risk levels by planning area.

Jurisdiction-wide Fire Losses – One of the best indicators of future fire risk is historical fire-loss data. On average, Orange County has about 1900 fires and 5 fire deaths per year. Annual dollar losses from fires are about $15 million dollars. Table 10 shows total fires, dollar loss (defined as both property and contents), and deaths over the last four years. The data includes all types of fires, including structure fires, vehicle fires, and outside fires.

Table 10. Total Fire Loss, 2010-2013

	Total Fires	Dollar Loss	Deaths
2010	1688	$15,423,582	8
2011	1965	$13,622,182	2
2012	1942	$11,173,839	6
2013	1836	$17,617,462	4
(average)	1858	$14,459,266	5

The data from Orange County had significantly fewer fires, dollar loss, and deaths than the national, regional, and comparable sized community averages. Different jurisdictions may collect data in slightly different ways, making comparisons imperfect. Nevertheless, it is of interest to make comparisons between Orange County and other cities and to ask questions about differences found. Table 11 compares Orange County's fire-loss data to regional and national averages. Orange County development probably is newer overall and built to more modern codes than other counties, and also probably has a smaller proportion of low income households, both of which would reduce outcome statistics.

Table 11. Per Capita Fire Loss and Comparison Statistics, 2010-2013

	Total Fires	Dollar Loss	Civilian Deaths
	(per thousand capita)	(per capita)	(per million capita)
United States	4.4	$40.80	9.8
Region: South	4.7	$40.80	10.7
Population: 500,000 to 999,999	3.7	$29.30	8.1
Orange County : 2010	1.7	$15.42	8.0
Orange County : 2011	2.0	$13.62	2.0
Orange County : 2012	1.9	$11.17	6.0
Orange County : 2013	1.8	$17.62	4.0
Orange County : (average)	1.9	$14.46	5.0

OCFRD should review its data (and collection process) to determine that, in fact, its data is correct.

Fire-risk by Planning Area – To better understand the situation regarding fire risk by planning area, an analysis was conducted of the structure fires in each of the 16 planning areas between 2010 and 2013. For this analysis, structure fires were defined as those fires where the fire was reported as "spreading beyond the object of origin". These incidents are typically the most serious (not food on the stove), and get responders from multiple units and stations. They are also often the fires where interior firefighting operations occur and where self-contained breathing apparatus is needed.

For each planning area the total number of fires and the number of fires per square mile was analyzed along with the consequences, e.g., the dollar value of lost property and contents, civilian deaths, and the number of fires that spread beyond the room of origin. To be comparable, consequences were normalized per square mile.[6] For the results if the normalized value falls in the lower 25th percentile of incidents or losses, it is coded green. Values in the upper 25th percentile are coded red. The remaining values are left uncolored. Using this technique, it is possible to show generally those planning areas where the risk is highest for structure fire probability and consequences.

The analysis showed that Conway, Edgewater, Goldenrod, Gotho/ Orla Visto, Pine Castle/ Taft/ Oak Ridge, Pine Hills, and UCF planning areas had the highest number of fires per square mile, and also the highest property and contents losses per square mile. The planning areas where fire-related fatalities occurred were scattered across Edgewater, Horizons West/ Four Corners, I-Drive/ Dr. Philips/ Williamsburg, Northwest Orange/ Tangerine, and Valencia College, just one or a few each.

Based on a combination of looking at the areas that had the highest number of fires per square mile and planning areas that fall in the top quartile (red) of at least two risk classifications, the areas judged to have the highest fire risk were: Edgewater, Pine Hills, Gotho/ Orla Visto, Pine Castle/ Taft/ Oak Ridge, Conway, Goldenrod, and UCF.

Table 12 shows the number and consequences of fires for each planning area for the period 2010-2013. The numbers in these tables do not match exactly those shown earlier in Figure 20 because these tables only include structure fires, rather than all fires.

[6] In statistics "normalization" refers to adjusting different types of data to a common scale so they can be compared more meaningfully.

Table 12. Fire Risk, 2010-2013

	Fires	(per sq mi)	Beyond Room	(% of fires)	Dollar Loss	(per sq mi)	Deaths	(per sq mi)
Belle Isle	6	1.1	0	0	$401,180	$74,840	0	0
Conway	29	4.7	1	3	$1,356,594	$219,103	0	0
East Colonial	5	0.4	0	0	$42,500	$3,511	0	0
East Orange / Deseret Ranch	61	0.2	1	2	$1,736,634	$6,886	0	0
Edgewater	64	4.7	3	5	$1,742,854	$129,329	2	0.1
Edgewood	3	1.8	0	0	$341,002	$207,041	0	0
Goldenrod	112	7.9	2	2	$3,401,914	$240,791	0	0
Gotho / Orla Visto	63	4	1	2	$1,848,876	$116,858	0	0
Horizons West / Four Corners	47	0.6	1	2	$3,737,071	$49,990	1	0
Hunter's Creek / Meadow Woods	87	2.5	2	2	$3,093,481	$87,559	0	0
I-Drive / Dr. Philips / Williamsburg	74	1.7	0	0	$1,907,952	$43,748	3	0.1
Innovation Way	30	0.4	1	3	$1,183,769	$13,982	0	0
Northwest Orange / Tangerine	47	0.6	0	0	$1,371,298	$17,902	1	0
Oakland	5	1.8	0	0	$130,607	$46,259	0	0
Pine Castle / Taft / Oak Ridge	148	9.9	1	1	$6,353,158	$432,110	0	0
Pine Hills	158	10.4	0	0	$3,578,074	$234,943	0	0
South Apopka	11	1.8	0	0	$392,025	$64,089	0	0
UCF	107	4.1	2	2	$2,897,298	$110,081	0	0
Valencia College	52	3.9	0	0	$1,134,350	$85,418	2	0.2

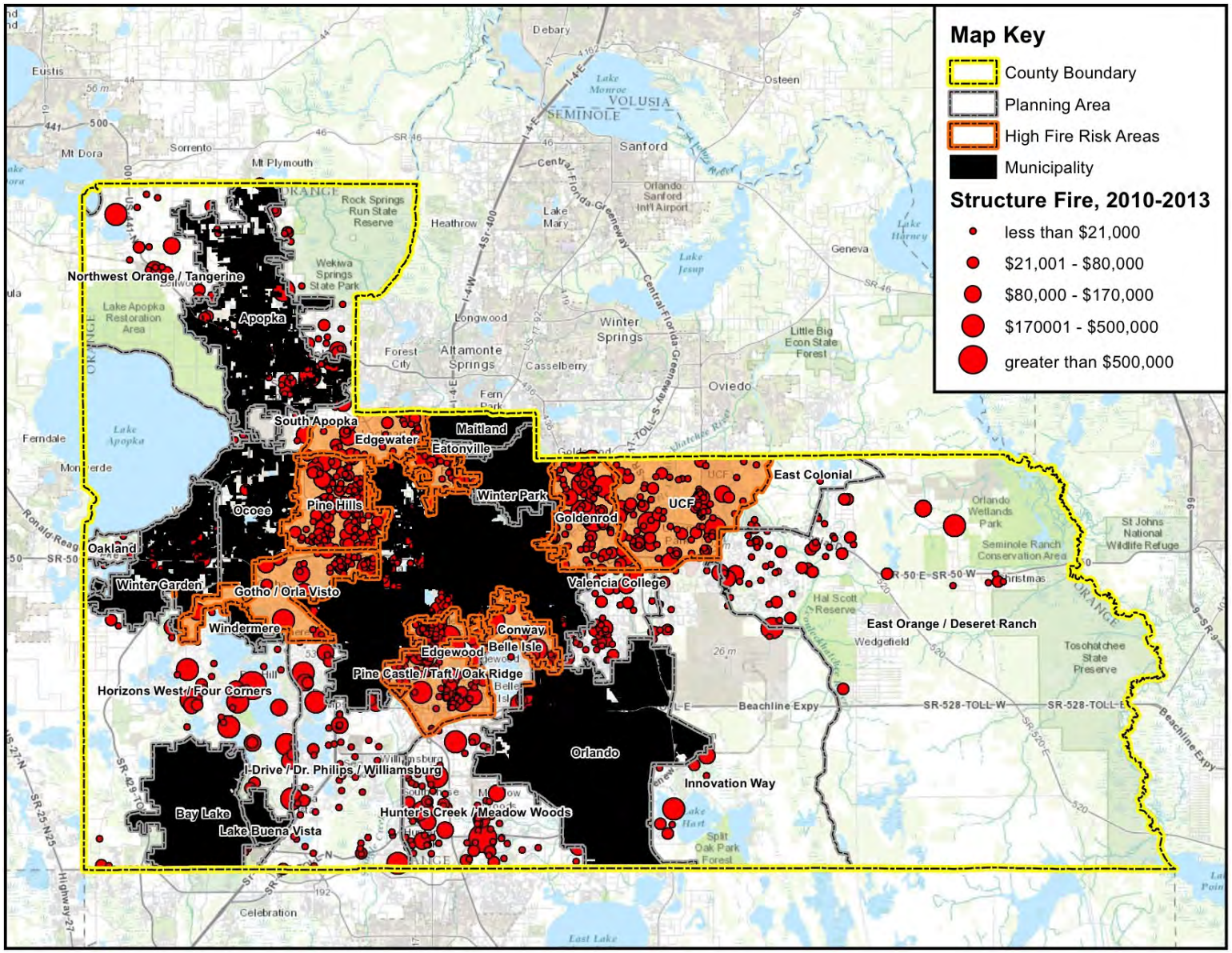
It is important to understand that the analysis of structure fire probability and consequences is only one factor on which to base a decision about the need for a fire station. Response times and the daily demand for services are higher in other planning areas and these were considered too in the analysis of fire stations and resources.

Geospatial Location and Severity of Fire Incidents – To evaluate the number and location of existing fire stations serving Orange County, it is helpful to understand the density of structure fires and the location of high dollar-loss fires. For this review ArcGIS was also used to identify the location and loss of structure fire from 2010-2013.

Comparing the GIS results with the analyses of planning area probability and loss factors, does show significant patterns in the location of structure fires in Orange County, with the larger concentration of structure fires occurring in the core, metropolitan areas. However, high dollar loss structure fires occurred most frequently in suburban and rural areas of the County. It is these areas where fire stations locations are further apart and where initial response travel times are longest. Longer response times for a first-arriving fire unit, or for subsequent units to arrive and assist, are the likely contributors to the higher fire loss in these, mostly rural, areas.

Figure 21 shows the location and severity of Orange County's structure fires, shown by red circles, from 2010-2013. The sizes of the circles are scaled to the dollar amount of fire loss. Along with the risk and demand we used this map to assess the appropriateness of the current fire station locations and any changes to be recommended.

Figure 21. Structure Fire Locations and High-Fire-Risk Areas



CHAPTER IV. RESPONSE TIME AND UNIT WORKLOAD ANALYSIS

In this section the station and unit performance are reviewed. The project analyzed response-time performance (both countywide and by planning areas), current unit workloads, and the relationship between unit availability and response-time performance. These factors were then considered for the station location and unit changes recommended in later chapters.

Response Time Analysis

Response time is the most common performance measurement used by the fire service because it is understood by citizens, easy to compute, and useful in the evaluation of end results. Rapid response is also an aspect of service quality that citizens care about. There have been a few attempts to measure the incremental value of a one-minute faster response time for fires and EMS calls, but there is no definitive study of the incremental benefit. Faster is better, but it is unclear how much better in terms of dollars or lives saved. In place of true measures of outcome, response time is often used as a substitute.

Measurement Methods – Response time is a complex concept that can be examined in several different ways. Response-time performance data can be represented on a distribution graph to show the extent to which a fire department is meeting established goals. This can be done at varying levels of technicality to show performance across periods of time, at certain times of the day, in different areas of a jurisdiction, and so on. However, fire departments don't usually have the capability to conduct such a complex analysis in-house, and interpretation of such an analysis can be difficult. There are some simpler ways to sum up response-time performance. The three most typical are mean, median, and range.

The fire service historically chose to use the mean response time, also called the average. However, using any single number to describe a complex underlying concept risks concealing a vast amount of information. When averages are used for response-time analysis, a small number of very fast responses (e.g., a unit comes upon a car accident and immediately begins attending to the victims, such that the travel time is recorded as zero) can mask many unacceptably long responses. Also, the data may be entered entirely incorrectly for some calls, skewing the averages.

The public is interested in how fast a system responds to most calls, which is better reflected in percentile/threshold times (how often the system responds within the established response-time goal) rather than average times. Departments are increasingly adopting threshold/percentile times for analyzing response times; mostly due to use of this measure in the National Fire Protection Association and CPSE standards. This is a significantly better single-number indicator of response-time performance because it shows whether most responses fall below a specified time, which somewhat eliminates the issue of a few calls skewing the data.

Despite being much better, percentile/threshold times are still not perfect indicators. They still rely on a single number to describe a complex situation. They still mask some long response times, although to a much smaller extent, because the allowed percentage over the threshold is

ignored: if overall performance is below the threshold goal, the response time of incidents that exceed the goal is irrelevant. The most accurate approach is to examine the underlying response-time distribution, but where that is impractical, percentile/threshold times are the best single indicator of response-time performance.

For this study, response-time goals were discussed with OCFRD staff, who agreed with the goals stated in an earlier chapter.

Response-time Goals – The typical standard used to evaluate career fire department response times is NFPA 1710. Rather than provide a single standard for the total response time, NFPA 1710 provides the following standards for individual response-time segments:

- Call-processing time under 60 seconds
- Turnout time under 60 seconds for EMS responses
- Turnout time under 80 seconds for fire responses
- Travel time under four minutes

We recommend that the OCFRD use the above standards for call-processing and turnout times. These goal times are challenging but reasonable. The travel-time goal needs more consideration to adapt it to local conditions. NFPA 1710 applies mostly to urban areas; the standard's four-minute travel-time goal is not realistic for many non-urban areas.

In cities where neighborhoods have similar characteristics of population density, demographics, building construction type and age, and so on, we recommend using the same response-time goal for each individual planning area. However, Orange County is a patchwork of different areas, some very urban and others rural, and many in between. The wide variety of characteristics and population densities, often within the same first-due area for a particular station can make it difficult to set a response-time goal. Even so, because population (and density) drives most of the demand for service (EMS) in Orange County, it makes sense to use response-time goals based on population-density, with better response times in more populated areas and longer response times in less densely populated areas.

Besides NFPA 1710 are other standards for more rural areas:

- **NFPA 1720** is applied to mostly volunteer fire departments. Although the OCFRD is not a volunteer department, this standard takes into account areas of different population density and is appropriate for the wide variety of population densities that the OCFRD protects.
- **CPSE Standards of Cover Manual** includes performance metrics based on population density. The CPSE system is a little different from the NFPA standards in that it provides two performance metrics: a benchmark and a baseline. The benchmark is the goal and the baseline is the minimally acceptable performance. The benchmark times for metropolitan and urban areas are the same as the NFPA 1710 standard. Additional time is allowed for suburban and rural areas.

A comparison of the standards is shown in Table 13. Please note that some conversions had to be made to make the times comparable between the standards. For example, the NFPA 1720 times are specified as a combined turnout and travel time, while NFPA 1710 gives separate times for turnout and travel. In this case we simply added the NFPA 1710 turnout and travel times to make them comparable to the 1720 standard.

Table 13. Comparison of Response Time Standards

Population Density	3000+	2000-3000	1000-2000	500-1000	0-500
NFPA Term	Urban	Urban	Urban	Suburban	Rural
CPSE Term	Metropolitan	Urban	Suburban	Rural	Rural
NFPA 1710	6:20	6:20	6:20	6:20	6:20
NFPA 1720	10:00	10:00	10:00	11:00	15:00
CPSE Baseline	7:32	7:32	8:50	14:20	14:20
CPSE Benchmark	6:20	6:20	7:20	12:20	12:20
OCFRD Baseline	11:28	12:02	12:22	13:33	13:33
TriData Coverage Goal	7:20	8:20	9:20	10:20	11:20
2013 Performance	8:19	8:35	8:59	9:49	9:49
OCFRD Benchmark	6:20	6:20	7:20	12:20	12:20

The final component in setting a response-time goal is taking into account what is realistic for the jurisdiction to achieve. Setting a goal that is not achievable in the foreseeable future is not much better than having no goal. To facilitate a discussion of time goals that would be realistic for the OCFRD, we provided the department with a memo that included current response times by population density, a comparison of the different standards that might be applicable to protecting areas of vastly different population densities, and our recommended response-time goals by population density. Based on this memo and subsequent discussions, the following response-time goals were set:

Table 14. Recommended Goals by Service-Area Designation

Population Density	Travel Time	Total Response Time
Metropolitan	5:20	7:40
Urban	6:00	8:20
Suburban	7:00	9:20
Rural	9:00	11:20

An argument could be made that at least metropolitan areas should meet the NFPA 1710 standard of travel time under four minutes and total response time less than six minutes for EMS incidents and 6:20 for fires. Slightly longer response-time goals for metropolitan areas are recommended because:

- Orange County's unique situation is that most of the metropolitan-designated areas also include segments where population densities are lower and fall within the suburban density classification.
- It is neither cost efficient or effective to comply with the stringent NFPA 1710 four-minute travel-time standard given the varying densities and demand throughout Orange County.
- Most of all, the current level of service is leading to well below average fire losses and fire death rates.

Very few fire departments in uniformly metropolitan areas are actually meeting the NFPA 1710 travel-time standard. In fact most are several minutes above the standard, calling into question whether the standard is realistic for most departments. It may be more helpful to think of NFPA 1710 as a desirable gold standard. It would be difficult for Orange County to meet this standard in all areas of the county given the varying conditions, but the standard might be thought of as an eventual goal for areas of the county that are predominantly metropolitan.

Ultimately each department has to decide for itself what performance standard it wants to try to meet. The response times that we have recommended are a challenging goal given the OCFRD's current response times, reviewed later in this chapter. One can also consider the cost of adding enough stations and units to comply with the most stringent standard, and consider which fires or deaths might have had lower losses with the stricter standards.

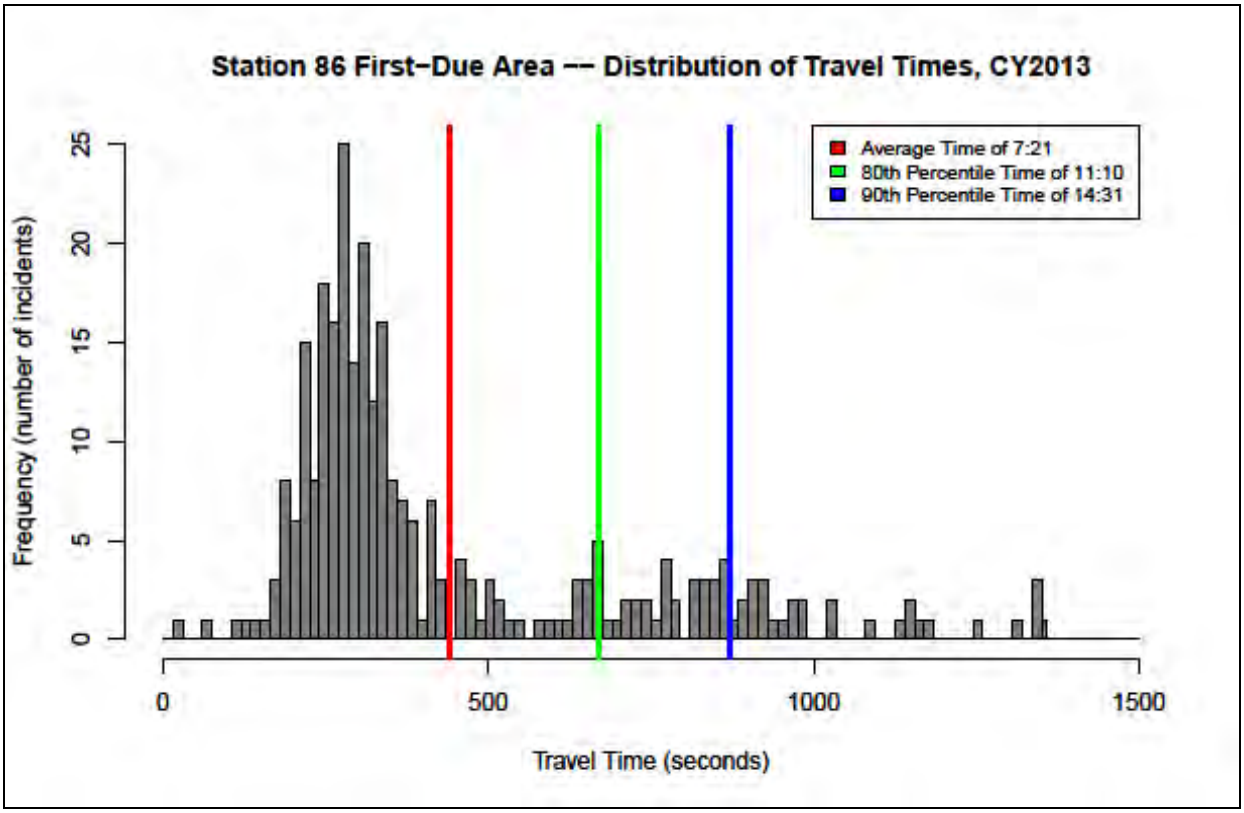
Recommended Compliance Levels – After setting response-time goals the next step is to determine the acceptable compliance level. NFPA 1710 and the CPSE Standards of Cover manual both recommend meeting time goals 90% of the time. NFPA 1720 recommends 90% compliance for urban areas and 80% for suburban and rural areas. None of the standards provide explicit reasons for these specific compliance percentages. A possible reason why most of the standards use 90% is that it results in almost all of the response times being included in the calculation, while only 10% of the times are excluded, giving a more accurate picture of overall compliance. Also, a 90% compliance standard is a positive threshold goal to aim for without being overly stringent.

The 90th percentile compliance often falls on the far right side of the response-time distribution graph, indicating low compliance with response-time goals and a strong influence of data errors and other suspiciously long times. From other studies it has been determined that a compliance standard of 80% better reflects the threshold under which most of the responses fall. Figure 22 shows the response-time distribution for Station 86 as well as times for 80% and 90% compliance.

Unlike a typical bell curve, this distribution would be described as having a long right tail. This long tail can result from data issues or from covering rural areas that have occasional very long response times. In this case, it could be said that 80% compliance would be a better threshold because it effectively provides a better indicator of the time under which most response

times fall. Figure 22 shows the type of travel-time distribution analyses conducted for each of OCFRD stations as part of this study.

Figure 22. Example: Travel Time Distribution Analysis



The question for determining response-time probability distribution requires a decision as to the compliance threshold. A 90% compliance goal is usually not efficient. A system designed for 90% compliance allows only 10% of calls to exceed the response-time goal. Although it is possible to design a system with 90% compliance for all areas of a community it is typically not cost-effective. Urban areas close to several fire stations should have high compliance, but it does not always make sense to dictate such high compliance for suburban or rural areas. NFPA 1710 acknowledges that it would not make sense to apply the same goal times to rural areas. NFPA 1720 also shows that even the standard makers understand that as population density decreases, it makes sense to decrease the compliance level. NFPA 1720 sets the compliance for suburban and rural areas set at 80%.

The value of good call-processing times and the ability to track those times extremely accurately, a compliance goal of 90% for call processing is used. For all other response time segments, 80% compliance goals were established. For turnout time, it is often determined that problems exist with recording the exact time of dispatch and there are often outliers. A goal of 80% compliance seems to better capture the turnout time threshold, rather than measuring the tail.

For the travel-time analysis, the analysis is segmented into incident types and geographic areas (which most departments do not do). Having 90% compliance in each of these subdivided areas would result in higher than 90% compliance countywide. Departments that do not have rigorous data-quality controls will typically have more calls with incorrectly long response times; an 80% compliance standard leaves room for some erroneous data. Finally, almost no departments actually achieve 90% compliance with NFPA 1710. Using 80% compliance for our analysis of turnout, travel, and total response time is also just a realistic application of most fire department's current performance levels.

Our analysis of OCFRD response times included only incidents dispatched as an emergency. Eliminated from the analysis were non-emergency service calls. We included only frontline pumping and aerial apparatus for fire incidents and only first-response-capable units for EMS calls. These criteria were applied to keep the analysis in line with the NFPA 1710 standard. For all time segments, we analyzed one year of data. Although we evaluate response times using the compliance percentages discussed above, for each analysis we show average times, 80% compliance times, and 90% compliance times to give a more complete picture of the response-time distribution.

Call-processing or Alarm-handling Time – According to NFPA 1710, alarm-handling time is "the time interval from the receipt of the alarm at the primary public safety answering point (PSAP) until the beginning of the transmittal of the response information via voice or electronic means to emergency response facilities (ERFs) or the emergency response units (ERUs) in the field."

NFPA 1710 (4.1.2.3.3) specifies that "the fire department shall establish a performance objective of having an alarm processing time of not more than 60 seconds for at least 90% of the alarms and not more than 90 seconds for at least 99% of the alarms, as specified by NFPA 1221."

Figure 23 and Table 15 show the 2013 call-processing times for the Orange County Fire Rescue Department by time of day and incident type. The 90th-percentile call-processing time was 0:55 (zero minutes, 55 seconds) for fire and special operations incidents and 0:47 for EMS incidents. **The overall call-processing time is 13 seconds under the standard**, **which indicates very efficient dispatch center operations.** Although it is extremely important to have good call-processing times, it is rare to see dispatch centers meet or exceed the standard. The red line in Figure 23 shows that even when there are peaks in call volume at the communications center there is no impact on call-processing time. There is no pattern in call-processing time based on time of day.

Figure 23. Call-Processing Time by Hour of the Day, CY2013

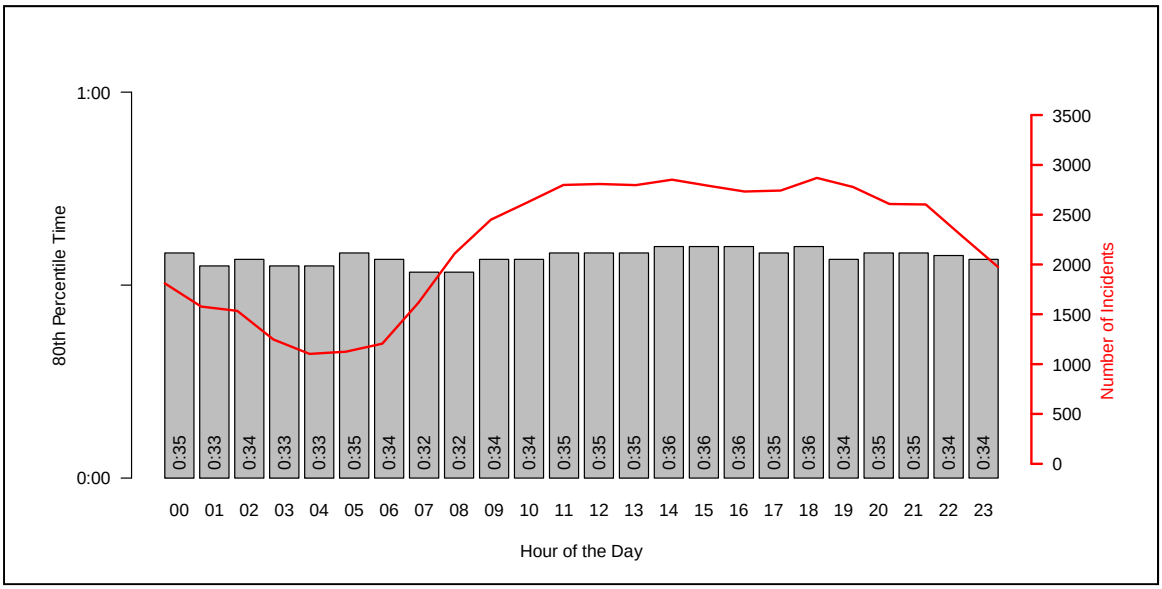


Table 15. Call-Processing Time by Incident Type, CY2013

	Average	80th Percentile	90th Percentile
Emergency Medical Service	0:25	0:34	0:47
Fire & Special Operations	0:29	0:41	0:55
(all)	0:25	0:35	0:47

Turnout (or Reaction) Time – NFPA 1710 defines turnout time as "the time interval that begins when the emergency response facilities (ERFs) and emergency response units (ERUs) notification process begins by either an audible alarm or visual annunciation or both and ends at the beginning point of travel time." The standard specifies an "80 second turnout time for fire and special operations response and [a] 60 second turnout time for EMS response." For reasons discussed earlier, we evaluated the turnout time at the 80th percentile.

The analysis showed OCFRD has adequate turnout times. Fire turnout times are 1:45 and EMS turnout times are 1:32. These times are 25 seconds and 32 seconds above their respective standard. A time that is 20 to 40 seconds over is in line with what most other fire departments are achieving. The standard is very difficult to meet, but efforts should be made to slightly improve turnout times. Because EMS turnouts do not require the donning of turnout gear, they should be faster than fire turnouts, and this is reflected in the data.

Figure 24 shows that turnout times are about 30 seconds faster between 7:00 AM and 9:00 PM than during the overnight hours. Slower nighttime turnouts are common in most fire departments. Firefighters often have to wake up, and sleeping quarters are often located in parts of the station farther away from the apparatus than where they spend the daytime hours. Alerting is less effective at night than during daytime hours, when crews can listen to radio traffic, whereas at night they are dependent on bells or other alerting mechanisms. For future station designs, it is recommended that the station layouts and alerting systems be designed to minimize distances from sleeping quarters to apparatus.

Figure 24. Turnout Time by Hour of the Day, CY2013

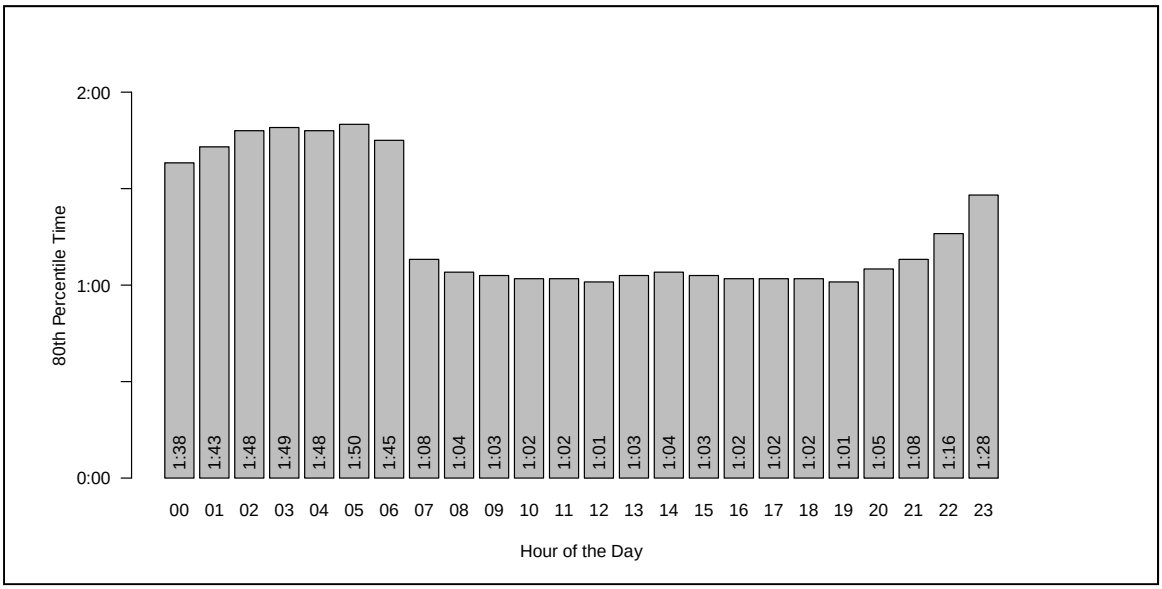


Table 16. Turnout Time by Incident Type, CY2013

	Average	80th Percentile	90th Percentile
Emergency Medical Service	0:51	1:14	1:32
Fire & Special Operations	0:59	1:26	1:45
(all)	0:52	1:15	1:33

Travel Time by Hour of the Day and Incident Type – Travel time is the time interval that begins when a unit is enroute to the emergency incident and ends when the unit arrives at the scene. Travel time is a function of geography, road conditions, traffic congestion, and the number and location of fire stations with respect to the location of incidents. It is also affected by whether the closest unit is not already busy on another call, or training.

The travel-time goals discussed earlier in the chapter are based on population density. To reiterate, the goal is for the first-arriving unit to have a travel time of 5:20 to metropolitan areas, 6:00 to urban areas, 7:00 to suburban areas, and 9:00 to rural areas for 80% of calls. These time goals were evaluated at the 80% compliance level.

The analysis of the OCFRD's travel times showed mixed results. Travel times for metropolitan and urban areas were 6:32 and 6:27 minutes respectively, both slower than the goal. However, suburban and rural times of 6:49 and 7:36 were faster than the respective goals. In the case of rural responses, the times were significantly under the 9:00 goal. This suggests that the more highly populated areas are under covered while the less populated areas are adequately covered and possibly over-covered. Much of the focus in our station-location recommendations therefore was on improving response times in the metropolitan and urban areas of the county

Figure 25 shows travel time for the first-arriving unit by hour of the day and Table 17 shows the travel time by incident type. Travel time for the first-arriving unit is very similar throughout the day.

In addition to reviewing countywide response-time performance, it is also important to look at whether travel times for different areas of Orange County are sufficient for the planning-area risk levels discussed in the previous chapter. Unlike call-processing time and turnout time, which can be addressed somewhat universally, travel time is better addressed area by area. The next section includes a breakdown of total response times and travel times by planning area.

Figure 25. Travel Time (First-arriving Unit) by Hour of the Day, CY2013

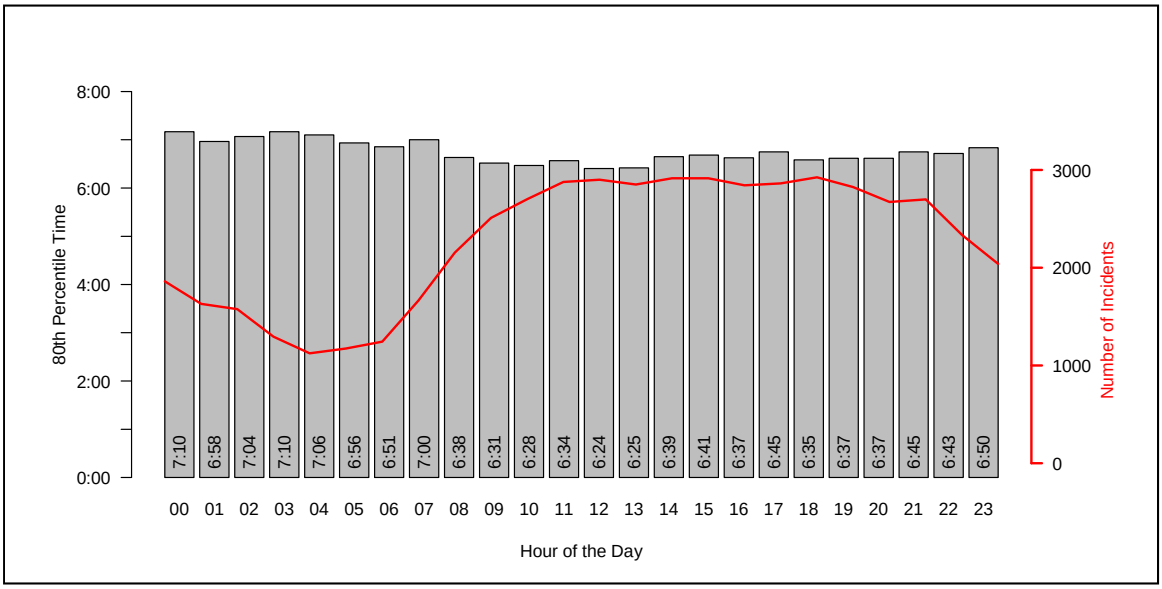


Table 17. Travel Time (First-arriving Unit) by Incident Type, CY2013

	Average	80th Percentile	90th Percentile
Metro	5:05	6:32	7:38
Urban	4:50	6:27	7:34
Suburban	5:22	6:49	7:56
Rural	5:43	7:36	8:55
(all)	5:10	6:43	7:53

Total Response Time – Total response or reflex time is the most important time because it combines all of the previously analyzed time segments and is one of the measures by which the public evaluates the effectiveness of fire and EMS service. The public just cares how fast a unit shows up not whether dispatch or turnout or travel times individually were short or long. The NFPA defines total response time to include three phases: "(1) Phase One—Alarm Handling Time, (2) Phase Two—Turnout Time and Travel Time, and (3) Phase Three—Initiating Action/Intervention Time. But there is no data on the third phase, and so the analysis focused on the first two of these phases. "

Based on adding together the call-processing-time objective (1:00 for all call types), the turnout-time objective (1:00 for EMS incidents and 1:20 for fire and special-operations incidents), and the first-arriving-unit travel-time objectives for each of the different population density classifications, the following goals for overall response times, using the 80th percentile metric, were created:

- Metropolitan 7:40
- Urban 8:20
- Suburban 9:20
- Rural 11:20

The analysis of the OCFRD's total response times against these goal times at the 80th percentile showed good times for urban, suburban, and rural areas. Figure 26 shows the total response time for the first-arriving unit by hour of the day, and Table 18 shows the total response time for the first-arriving unit by incident type. Only the total response time of 8:05 to metropolitan areas was over the 7:40 goal time, by 25 seconds.

The OCFRD has put a lot of attention on reducing both call-processing and turnout times to correct a known issue with slightly longer travel times. The total-response-time analysis shows that these efforts have been effective, and the department should be commended for putting such a strong focus on the most cost-efficient ways of reducing total response time. However, from discussions with department officials, it appears that there is little room for much additional reduction in call-processing and turnout times. Future improvements will need to come from reducing travel times, the main focus of which should be on the urban and metropolitan areas of the county.

Figure 26. Total Response Time (First-arriving Unit) by Hour of the Day, CY2013

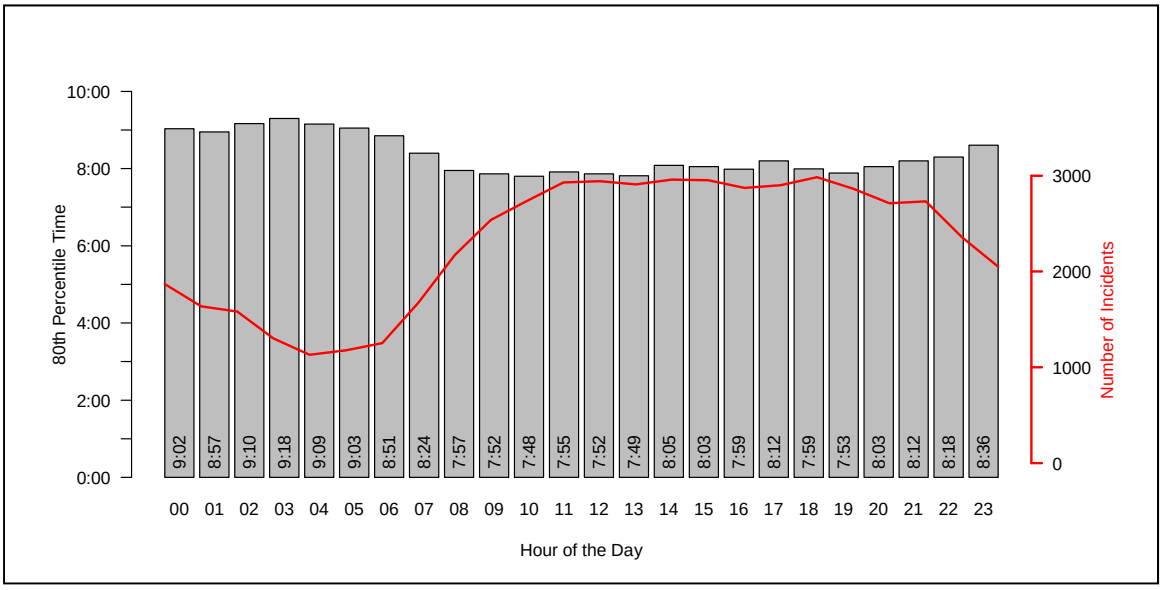


Table 18. Total Response Time (First-arriving Unit) by Incident Type, CY2013

	Average	80th Percentile	90th Percentile
Metro	6:32	8:05	9:15
Urban	6:13	8:01	9:10
Suburban	6:46	8:19	9:32
Rural	7:09	9:11	10:37
(all)	6:35	8:15	9:29

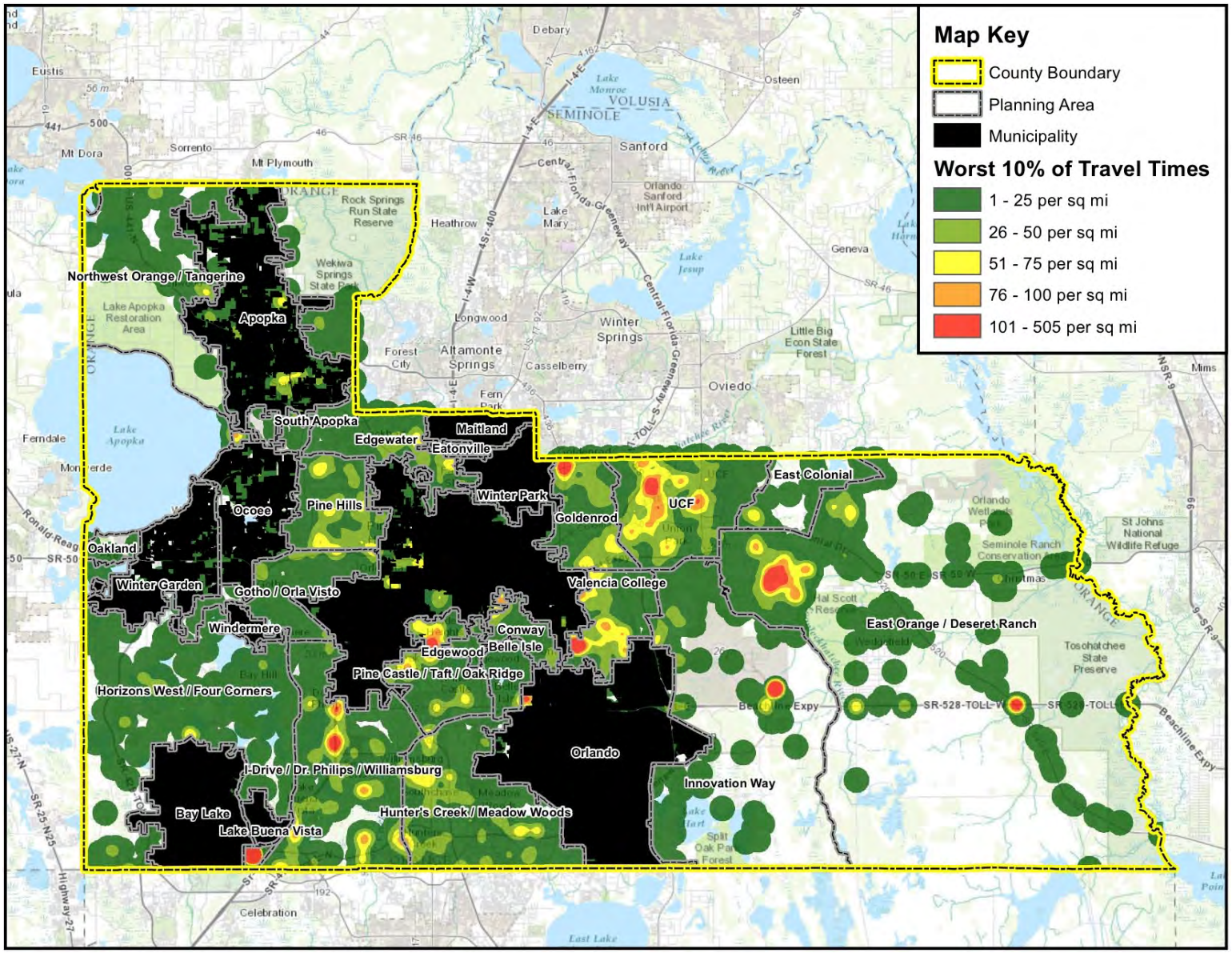
Table 19 shows the average, 80th-percentile, and 90th-percentile response times for each planning area. Total response times for the planning areas range from a low of 7:07 for Edgewood to a high of 10:04 for Horizons West/ Four Corners. The overall 80th-percentile time was 8:15, with most planning areas having a total response time in the seven- to eight-minute range. The areas identified as having a high fire risk in the previous chapter are highlighted in red. Other than UCF, these high-risk areas generally have some of the faster response times. Recommendations in the station-location chapter will address the slow response times to the high-risk and quickly developing UCF area.

Table 19. Response Time by Planning Area, CY2013

	Average	80th Percentile	90th Percentile
Apopka	7:26	8:58	9:59
Bay Lake	8:11	8:50	9:03
Belle Isle	6:33	7:56	8:57
Conway	6:30	8:02	9:09
East Colonial	7:07	8:38	9:36
East Orange / Deseret Ranch	7:38	9:36	11:04
Eatonville	7:51	8:42	9:01
Edgewater	6:11	7:36	8:41
Edgewood	5:52	7:07	8:03
Goldenrod	6:27	8:07	9:12
Gotho / Orla Visto	6:04	7:31	8:42
Horizons West / Four Corners	7:41	10:04	11:23
Hunter's Creek / Meadow Woods	6:38	8:22	9:42
I-Drive / Dr. Philips / Williamsburg	6:30	8:02	9:11
Innovation Way	7:18	9:25	11:34
Lake Buena Vista	5:57	7:06	8:58
Northwest Orange / Tangerine	6:43	8:20	9:49
Oakland	7:54	8:44	10:49
Ocoee	7:27	8:56	10:06
Orlando	6:18	8:14	9:27
Pine Castle / Taft / Oak Ridge	5:50	7:14	8:15
Pine Hills	6:17	7:40	8:39
South Apopka	6:40	8:43	9:56
UCF	7:16	9:00	10:00
Valencia College	7:04	8:54	9:55
Windermere	5:41	5:41	5:41
Winter Garden	6:03	7:22	8:24
Winter Park	6:45	7:34	9:02
(all)	6:35	8:15	9:29

Another way of looking at travel time by area, especially when trying to find problem areas is to identify the highest concentrations of slow travel times. In Figure 27, we show the density of the slowest 10% of travel times.

Figure 27. Longest 10 Percent of Travel Times, CY2013



Workload

Besides response times we analyzed the call types and workload for each OCFRD unit. Unit workloads can affect response-times because as units become busier, they are more often unavailable to respond to calls where they would be first due. Generally, units in high-demand areas with closely spaced stations can get away with higher workloads because other stations can adequately cover their first-due areas. More suburban and rural areas, where fire station coverage areas do not overlap as much, are more susceptible to workload issues, especially during certain portions of the day.

Providing coverage 24 hours a day to all response areas of a county requires a specific minimum number of stations and units. Those numbers only partially depend on the actual number of emergencies—full coverage is needed even when the number of emergencies drops, because the next emergency can be anywhere. If a station has fewer emergencies, it may appear that it is being underutilized, seen statistically as a low workload. This may lead county officials to question the expense of a unit with a low workload. The solution might appear to be to reduce the number of units and increase the workload of each. However, this would result in significant loss of performance (units taking longer to travel longer distances, or being unavailable for concurrent emergencies) and increased risk to lives and property.

Even when stations are optimally positioned, emergencies occupy a small fraction of unit time in most fire departments. A low workload does not indicate inefficient organization of resources—it is simply the nature of the fire service that it must always be ready to respond to emergencies anywhere, even if they are few in number. Additionally, fire crews engage in activities that are not included in workload statistics, including training, fire inspections, and other prevention efforts. Workload analysis is useful for detecting performance issues related to high workload and for making sure that crews are not overworked. A statistically low workload is not necessarily a cause for concern.

Table 20 shows the number of calls (responses) for OCFRD units in CY2013. Figure 28, Figure 29, and Figure 30 show the actual time (unit hours) spent on calls in the same one-year period. Unit types (engines, aerials, squads, ambulances, command, and specialty) are grouped for the sake of comparison. Using hours instead of responses (as is shown in Table 20) is a more precise way of measuring workload because the time spent on calls can vary greatly. Table 21 through Table 25 break the analysis down for each unit type.

Table 20. Responses by Station and Unit Type, CY2013

	Batt Chief	Boat	Captain	Engine	Medic	Quint	Rescue	Specialty	Squad	Tanker	Truck	Woods	(all)
Station 20	–	3	–	1033	–	–	1023	–	–	12	–	24	2095
Station 27	–	–	–	1220	–	–	1269	–	–	–	–	–	2489
Station 28	–	–	–	1702	–	–	2112	–	–	37	–	–	3851
Station 29	–	–	–	630	–	–	706	–	–	–	–	–	1336
Station 30	–	–	–	2995	2059	–	3056	183	–	–	1477	–	9770
Station 31	–	7	–	1780	–	–	1986	–	–	–	–	–	3773
Station 32	–	–	–	663	–	–	–	–	–	–	–	–	663
Station 33	668	8	–	1142	1086	–	–	–	–	–	–	–	2904
Station 34	–	2	–	630	–	–	1418	–	–	25	–	–	2075
Station 35	–	–	70	767	606	–	–	–	–	–	–	30	1473
Station 36	–	–	–	1552	–	–	2247	–	–	–	–	26	3825
Station 37	–	–	–	531	–	–	–	–	–	–	–	18	549
Station 40	–	–	105	–	–	–	2973	–	–	–	–	–	3078
Station 41	800	3	–	–	–	2505	2650	–	–	–	–	–	5958
Station 42	–	–	–	4144	–	–	4174	–	1812	–	–	–	10130
Station 43	–	–	–	2434	–	–	787	–	–	–	–	44	3265
Station 50	–	–	124	6978	2021	–	3397	–	–	–	–	–	12520
Station 51	961	–	–	4032	2192	–	3623	–	–	–	1775	–	12583
Station 52	–	–	–	1750	–	–	2619	–	–	–	–	–	4369
Station 53	–	–	–	2691	–	–	2848	–	–	–	–	–	5539
Station 54	552	–	–	–	–	–	2710	–	2109	–	937	–	6308
Station 55	–	–	–	–	–	1804	1966	–	–	–	–	–	3770
Station 56	–	–	–	1818	2778	–	–	25	–	–	–	–	4621
Station 57	–	–	67	2256	–	–	–	641	–	–	–	–	2964
Station 58	–	–	–	2764	–	–	2560	–	–	–	–	27	5351
Station 63	–	–	–	3782	–	–	3340	–	–	–	–	–	7122
Station 65	–	–	–	2177	–	–	–	–	–	–	–	–	2177
Station 66	–	–	–	2684	1706	–	2194	–	–	–	–	–	6584
Station 70	–	15	–	1866	–	–	2767	–	–	–	–	–	4648
Station 71	–	5	75	2633	–	–	2445	–	–	–	–	47	5205
Station 72	864	–	–	2159	–	–	2414	74	–	–	–	–	5511
Station 73	–	–	–	1482	–	–	–	–	–	–	–	–	1482
Station 76	–	6	–	484	–	–	758	–	–	–	–	39	1287
Station 77	–	–	–	240	–	–	–	–	–	26	–	–	266
Station 80	772	3	–	2759	1758	–	2283	–	–	–	–	57	7632
Station 81	–	–	–	3263	–	–	3194	–	1602	–	–	–	8059
Station 82	–	–	–	1361	–	–	1659	–	–	62	–	24	3106
Station 83	–	–	98	2409	–	–	2767	–	–	–	1219	–	6493
Station 84	–	4	–	310	–	–	605	–	–	–	–	15	934
Station 85	–	–	–	1208	–	–	1453	–	–	–	–	–	2661
Station 86	–	–	–	623	–	–	–	–	–	–	–	29	652

Figure 28. Engine Workload by Unit and Incident Type, CY2013

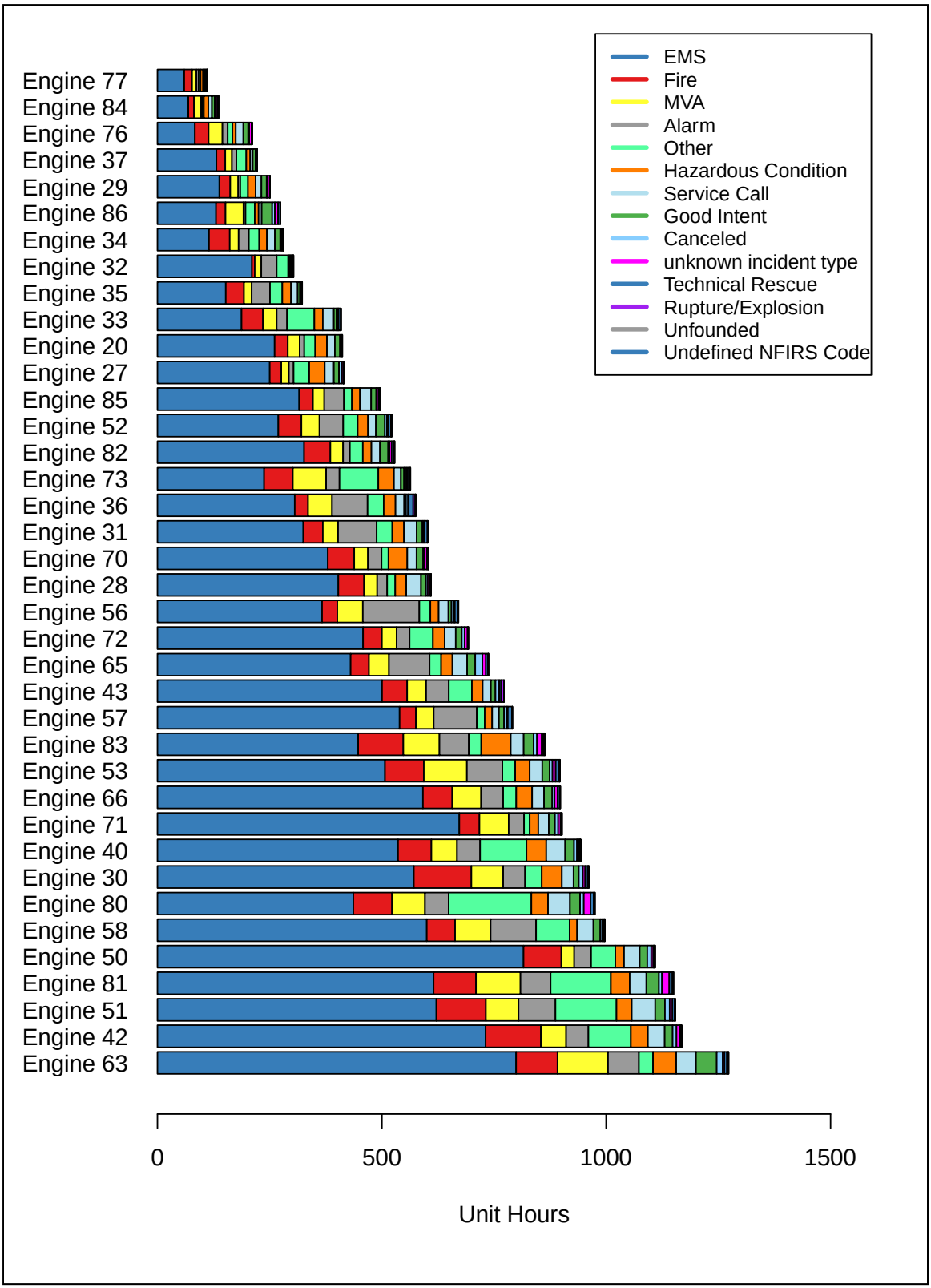
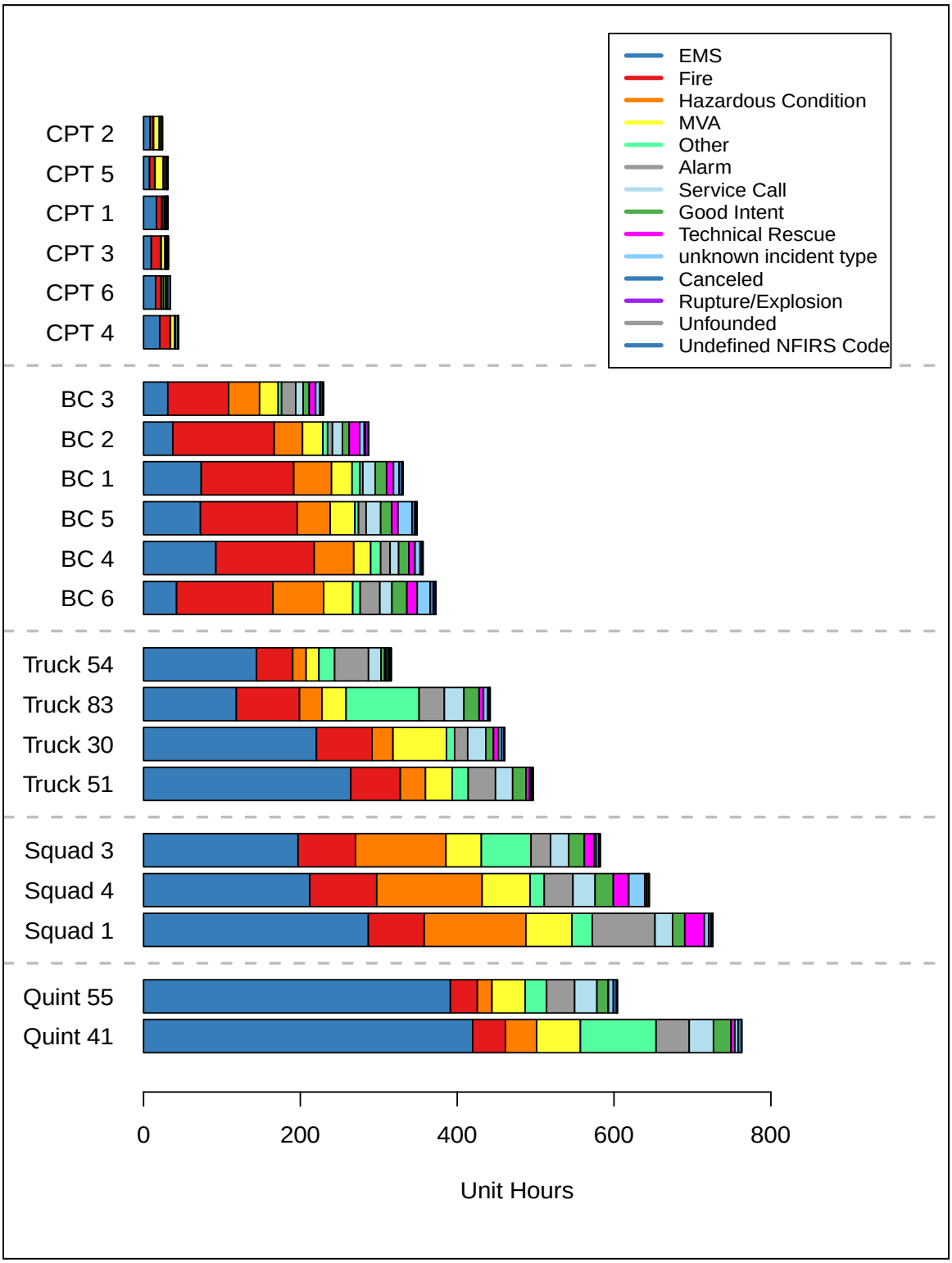
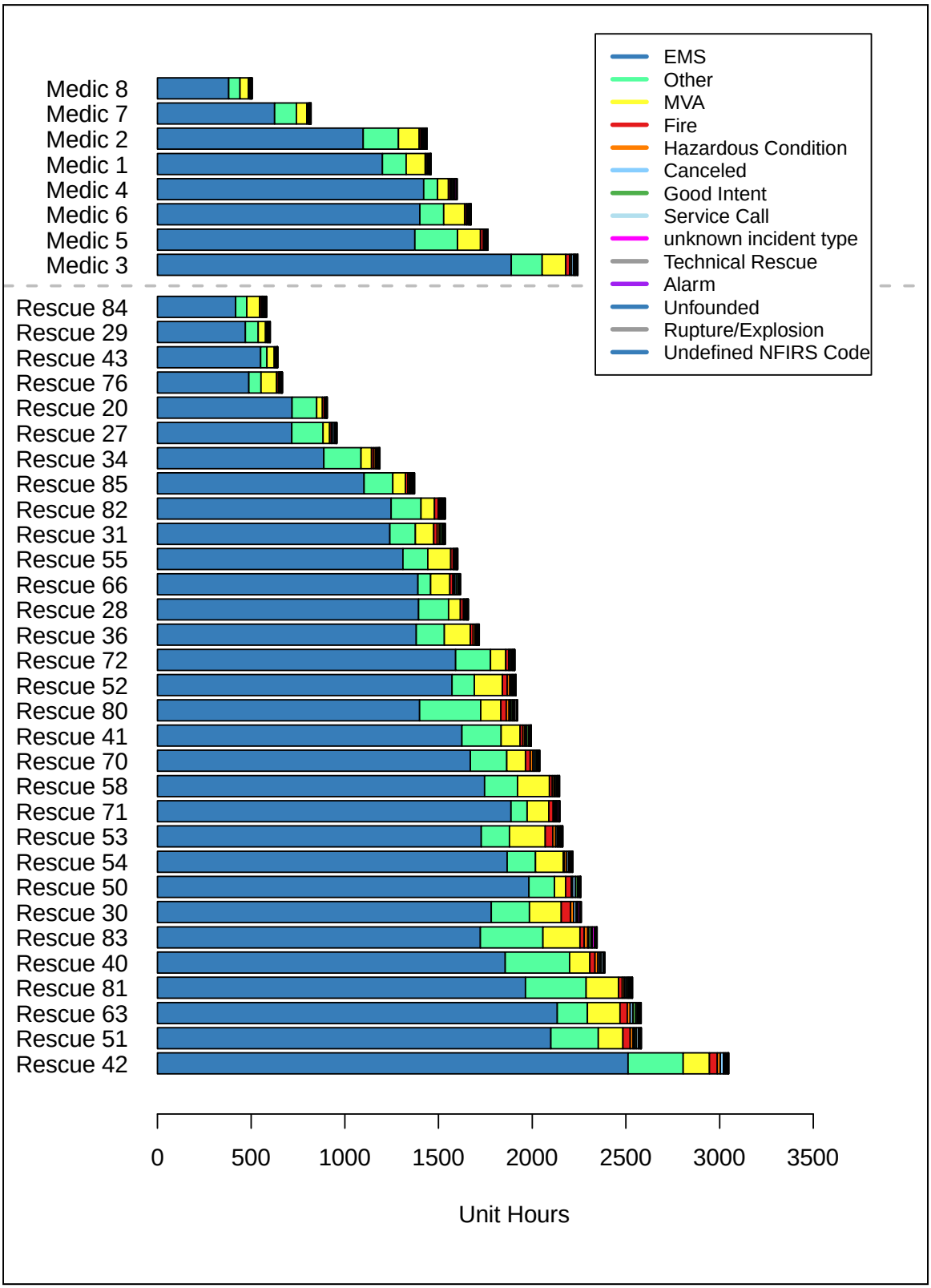


Figure 29. Aerial, Squad, and Command Workload by Unit and Incident Type, CY2013



Note: The position of Captain (CPT) was not in place until the end of 2013, thus their workloads do not reflect a full calendar year of data.

Figure 30. Ambulance Workload by Unit and Incident Type, CY2013



In Orange County, all rescue units are full-time advanced life support (ALS) ambulances. In CY2013 rescue units spent an average of 4.9 hours each day responding to 6.2 incidents (Table 21). Rescue 42 and Rescue 51 had the most responses (4,174 and 3,623 respectively) and Rescue 84 had the fewest responses (605). The average time spent on each medical call was just under 50 minutes (0.79 hours). Rescue 42 was the overall busiest unit, spending 34% of the time responding to emergencies. Rescue 51 and Rescue 10 were tied for second busiest, both spending 29.5% of the day responding to emergencies.

Table 21. Rescue Workloads by Unit, CY2013

	Total Runs	Runs per Day	Total Unit Hours	Unit Hours per Day	Unit Hours per Run	Busy %
Rescue 20	1023	2.8	906	2.5	0.89	10.3
Rescue 27	1269	3.5	957	2.6	0.75	10.9
Rescue 28	2112	5.8	1659	4.5	0.79	18.9
Rescue 29	706	1.9	601	1.6	0.85	6.9
Rescue 30	3056	8.4	2261	6.2	0.74	25.8
Rescue 31	1986	5.4	1535	4.2	0.77	17.5
Rescue 34	1418	3.9	1186	3.3	0.84	13.5
Rescue 36	2247	6.2	1717	4.7	0.76	19.6
Rescue 40	2973	8.1	2386	6.5	0.80	27.2
Rescue 41	2650	7.3	1994	5.5	0.75	22.8
Rescue 42	4174	11.4	3048	8.4	0.73	34.8
Rescue 43	787	2.2	641	1.8	0.81	7.3
Rescue 50	3397	9.3	2259	6.2	0.66	25.8
Rescue 51	3623	9.9	2582	7.1	0.71	29.5
Rescue 52	2619	7.2	1913	5.2	0.73	21.8
Rescue 53	2848	7.8	2163	5.9	0.76	24.7
Rescue 54	2710	7.4	2216	6.1	0.82	25.3
Rescue 55	1966	5.4	1602	4.4	0.81	18.3
Rescue 58	2560	7.0	2146	5.9	0.84	24.5
Rescue 63	3340	9.2	2581	7.1	0.77	29.5
Rescue 66	2194	6.0	1617	4.4	0.74	18.5
Rescue 70	2767	7.6	2039	5.6	0.74	23.3
Rescue 71	2445	6.7	2146	5.9	0.88	24.5
Rescue 72	2414	6.6	1908	5.2	0.79	21.8
Rescue 76	758	2.1	666	1.8	0.88	7.6
Rescue 80	2283	6.3	1921	5.3	0.84	21.9
Rescue 81	3194	8.8	2535	6.9	0.79	28.9
Rescue 82	1659	4.5	1535	4.2	0.93	17.5
Rescue 83	2767	7.6	2346	6.4	0.85	26.8
Rescue 84	605	1.7	582	1.6	0.96	6.6
Rescue 85	1453	4.0	1371	3.8	0.94	15.7
(average)	2258	6.2	1775	4.9	0.79	20.3

In addition to full-time ALS ambulances, Orange County also staffs eight peak-time ALS ambulances called medics. Medics are in service for 12 hours during the hours of highest EMS activity. The only difference between a rescue and medic unit is its hours of operation. Our analysis shows that in CY2013 medic units spent an average of 3.9 unit hours each day responding to 4.9 incidents (Table 22). Medic 3 and Medic 5 had the most responses (2,778 and 2,192 respectively) and Medic 8 had the fewest responses (606). The average time spent on each medical call was about 50 minutes (0.81 hours). For the most part, the medic units have an extremely high workload. Other than Medic 7 and Medic 8, the medic units spend a higher percentage of time responding to emergencies than even the busiest rescue unit. Medic 3 is the busiest unit, spending over 50% of its time responding to emergencies.

Table 22. Medic Workloads by Unit, CY2013

	Total Runs	Runs per Day	Total Unit Hours	Unit Hours per Day	Unit Hours per Run	Busy %
Medic 1	1706	4.7	1460	4.0	0.86	33.3
Medic 2	1758	4.8	1439	3.9	0.82	32.9
Medic 3	2778	7.6	2243	6.1	0.81	51.2
Medic 4	2021	5.5	1599	4.4	0.79	36.5
Medic 5	2192	6.0	1763	4.8	0.80	40.3
Medic 6	2059	5.6	1674	4.6	0.81	38.2
Medic 7	1086	3.0	820	2.2	0.75	18.7
Medic 8	606	1.7	505	1.4	0.83	11.5
(average)	1776	4.9	1438	3.9	0.81	32.8

Aerial units include both ladder trucks and quints. OCFRD aerial units (Table 23) averaged 1.4 unit hours responding to 4.4 incidents per day in CY2013. Quint 41 had the most responses (2,505) and Truck 54 had the fewest (937). The average time spent on each call for ladder trucks was about 20 minutes (0.32 hours). The aerial units were all busy less than 10% of the time.

Table 23. Aerial Workloads by Unit, CY2013

	Total Runs	Runs per Day	Total Unit Hours	Unit Hours per Day	Unit Hours per Run	Busy %
Quint 41	2505	6.9	763	2.1	0.30	8.7
Quint 55	1804	4.9	604	1.7	0.34	6.9
Truck 30	1477	4.0	461	1.3	0.31	5.3
Truck 51	1775	4.9	497	1.4	0.28	5.7
Truck 54	937	2.6	316	0.9	0.34	3.6
Truck 83	1219	3.3	442	1.2	0.36	5.0
(average)	1620	4.4	514	1.4	0.32	5.9

Engines (Table 24) averaged 1.8 unit hours responding to 5.3 calls each day. Engine 42 had the most responses (4144), followed closely by Engine 50 (4,098) and Engine 51 (4,032). Engine 77 had the fewest responses (240). Other units with low number of responses include Engine 29 (630), Engine 32 (663), Engine 34 (630), Engine 35 (767), Engine 37 (531), Engine 76 (484), Engine 84 (310), and Engine 86 (623). Within the engines, there is a large variance in the percentage of time they are busy on emergency calls, ranging from 1.3% (Engine 77) to 14.5% (Engine 63).

Table 24. Engine Workloads by Unit, CY2013

	Total Runs	Runs per Day	Total Unit Hours	Unit Hours per Day	Unit Hours per Run	Busy %
Engine 20	1033	2.8	412	1.1	0.40	4.7
Engine 27	1220	3.3	415	1.1	0.34	4.7
Engine 28	1702	4.7	610	1.7	0.36	7.0
Engine 29	630	1.7	251	0.7	0.40	2.9
Engine 30	2995	8.2	961	2.6	0.32	11.0
Engine 31	1780	4.9	602	1.7	0.34	6.9
Engine 32	663	1.8	303	0.8	0.46	3.5
Engine 33	1142	3.1	409	1.1	0.36	4.7
Engine 34	630	1.7	281	0.8	0.45	3.2
Engine 35	767	2.1	323	0.9	0.42	3.7
Engine 36	1552	4.3	576	1.6	0.37	6.6
Engine 37	531	1.5	222	0.6	0.42	2.5
Engine 40	2880	7.9	943	2.6	0.33	10.8
Engine 42	4144	11.4	1168	3.2	0.28	13.3
Engine 43	2434	6.7	772	2.1	0.32	8.8
Engine 50	4098	11.2	1109	3.0	0.27	12.7
Engine 51	4032	11.0	1154	3.2	0.29	13.2
Engine 52	1750	4.8	522	1.4	0.30	6.0
Engine 53	2691	7.4	897	2.5	0.33	10.2
Engine 56	1818	5.0	671	1.8	0.37	7.7
Engine 57	2256	6.2	791	2.2	0.35	9.0
Engine 58	2764	7.6	997	2.7	0.36	11.4
Engine 63	3782	10.4	1273	3.5	0.34	14.5
Engine 65	2177	6.0	737	2.0	0.34	8.4
Engine 66	2684	7.4	898	2.5	0.33	10.3
Engine 70	1866	5.1	604	1.7	0.32	6.9
Engine 71	2633	7.2	902	2.5	0.34	10.3
Engine 72	2159	5.9	693	1.9	0.32	7.9
Engine 73	1482	4.1	564	1.5	0.38	6.4
Engine 76	484	1.3	211	0.6	0.44	2.4
Engine 77	240	0.7	111	0.3	0.46	1.3
Engine 80	2759	7.6	975	2.7	0.35	11.1
Engine 81	3263	8.9	1150	3.2	0.35	13.1
Engine 82	1361	3.7	529	1.4	0.39	6.0
Engine 83	2409	6.6	864	2.4	0.36	9.9
Engine 84	310	0.8	136	0.4	0.44	1.6
Engine 85	1208	3.3	496	1.4	0.41	5.7
Engine 86	623	1.7	274	0.7	0.44	3.1
(average)	1920	5.3	653	1.8	0.34	7.5

Command units, including both battalion chiefs and captains (Table 25), averaged 0.5 unit hours responding to 1.2 calls each day. Battalion Chiefs 4 and 5 had the most responses (961 and 864 respectively). Captain 3 had the lowest number of responses (67). The average time spent on each call for command units was about 25 minutes (0.41 hours). All of the command units were busy less than 5% of the time.

Table 25. Command Workloads by Unit, CY2013

	Total Runs	Runs per Day	Total Unit Hours	Unit Hours per Day	Unit Hours per Run	Busy %
BC 1	800	2.2	331	0.9	0.41	3.8
BC 2	668	1.8	287	0.8	0.43	3.3
BC 3	552	1.5	230	0.6	0.42	2.6
BC 4	961	2.6	356	1.0	0.37	4.1
BC 5	864	2.4	349	1.0	0.40	4.0
BC 6	772	2.1	373	1.0	0.48	4.3
CPT 1	105	0.3	31	0.1	0.29	0.4
CPT 2	70	0.2	24	0.1	0.35	0.3
CPT 3	67	0.2	31	0.1	0.47	0.4
CPT 4	124	0.3	45	0.1	0.36	0.5
CPT 5	75	0.2	31	0.1	0.41	0.4
CPT 6	98	0.3	34	0.1	0.35	0.4
(average)	430	1.2	177	0.5	0.41	2.0

Overall, the workload of OCFRD units varies from very low to extremely high, depending on the particular unit. As Orange County's population increases, demand and workloads will also increase for most units. As it stands, emergency workloads vary with Rescues having the highest average demand of the primary response unit types operated by OCFRD, which are engines, ladders, rescues, medics, and battalion chiefs. For calendar 2013:

- 31 Rescue Units – low to very high workloads
- 8 Medic Units - low to extremely high workloads
- 4 Ladder Trucks/ 2 Quints - low to high workloads
- 38 Engines - low to extremely high workloads
- 6 Battalion Chiefs/ 6 Captains - very low to low workloads (does not include administrative and planning responsibilities)

Appendix E, Evaluating Unit Workloads, provides more information on call volumes and unit workloads.

Unit Availability and Performance

In order to ensure effective emergency coverage, it is necessary to evaluate current performance reliability of fire stations and to predict how performance might change as specific conditions change, such as an increase in calls due to growth and development.

The Center for Public Safety Excellence (CPSE) has devised a method of performance evaluation based on studying the interaction between *unit availability* (how often the intended closest unit is available to handle calls) and *performance* (how often the travel time is within the desired response time). This method is based on the observation that as the availability of the first-due unit declines (due to system overload), response times increase because other than the first due units have to respond, from farther away. At some point the response times fall below an acceptable performance standard. By graphing those two factors we can assess current system performance and monitor it over time, predict the point at which performance falls below an certain level (sometimes referred to as the *trigger point* as it triggers a review of station layout

and other factors that impact performance), and evaluate possible changes to avoid overload in workload-sensitive stations.

Areas that have fewer units available or are farther from neighboring stations are more impacted than others by an increase in emergency calls. They have greater *workload sensitivity*– – as the workload increases their ability to meet the demand decreases. Stations with more units or that are closer to other stations have lower workload sensitivity, as might be found in a downtown area. This close spacing of stations allows other units to provide effective response times even if an intended first-due unit is not available in the area. As a result, these stations are not as sensitive to high workload and low unit availability because other stations can handle their calls with relatively high performance.

The CPSE Standards of Cover manual does not specifically address how to evaluate fire stations that are each meeting several different response-time criteria based on population density. In the typical execution of this analysis, it is necessary to set a response-time goal for each station or first-due area. For this study, we developed an analysis algorithm (mathematical formula) specifically for Orange County.

The performance vs. unit availability graphs in the next section for each battalion do not show any specific times, but rather the percentage of incidents in which the time goal was achieved. With this approach, it is possible to measure whether each response met the response-time goal based on the population density response-time metric for the area where the incident occurred. In this way it is still possible to create a single performance line on the graph for each station or first-due area that can be compared to several other stations on the same graph. This single performance line takes into account the different population density areas that a station covers. Having this single performance line also means a single performance trigger point for each station (e.g., falling under the 80th-percentile compliance threshold). We recommend that a tentative 80th-percentile trigger be used to first prompt a closer look at the station-specific analysis.

As explained above, we have established a performance standard of 80%, meaning that units should travel to calls within the defined response-time goal for the appropriate population density classification 80% of the time.

Service Reliability (by Battalion)

As in most departments fire stations in Orange County are organized into Battalions. OCFRD has six battalions, five of which have seven stations and one with six. For this study we analyzed the stations by battalion to determine which stations, if any, were critically low in reliability. That an area covered by a particular station is unable to meet a prescribed response-time goal can often be attributed to high workloads, not location.

The graphs and tables below analyze unit availability versus performance for each of the six battalions. Of particular interest on a graph is the occurrence of a depressed line falling below the 80% compliance standard for response time, indicating possible station-location issues. The reason for concluding that there is a possible station location issue is that even when only

looking at the subset of incidents where a unit from the correct station arrived first (representing the fastest possible travel time compared to out-of-area units), in many cases the performance goals were still met less than 80% of the time.

Based on the current travel-time performance level, the graphs below can be used to determine which stations have additional workload capacity (because response-time performance can be decreased without falling below 80% compliance), which stations need to minimize additional workload (because they are already close to the 80% goal), and which stations would benefit from reducing current workload levels (because it would bring their performance above 80%). Note however that although unit availability can be improved, in some cases even 100% unit availability would not bring performance up to 80% compliance because of station-location problems.

Some of the graphs below show a strong correlation between a drop in unit availability and a drop in travel-time performance, indicating high workload sensitivity. To the extent possible, it is important to minimize the workload of units at these stations to keep them more available because their availability has a direct impact on travel-time performance.

Battalion 1 – Of the seven stations in Battalion 1, only two stations meet (or above) the 80% response-time standard. Five stations have depressed performance lines: 20, 28, 40, 41, and 42. Other than Station 40, all stations in this area have high workload sensitivity. Station 40 appears to have an inverse relationship between unit availability and travel time performance: as unit availability decreases the travel time performance actually increases. This is contrary to the typical relationship and indicates either incorrectly drawn first-due boundaries or errors in the data.

Figure 31. Unit Availability vs. Performance Analysis, Battalion 1, CY2013

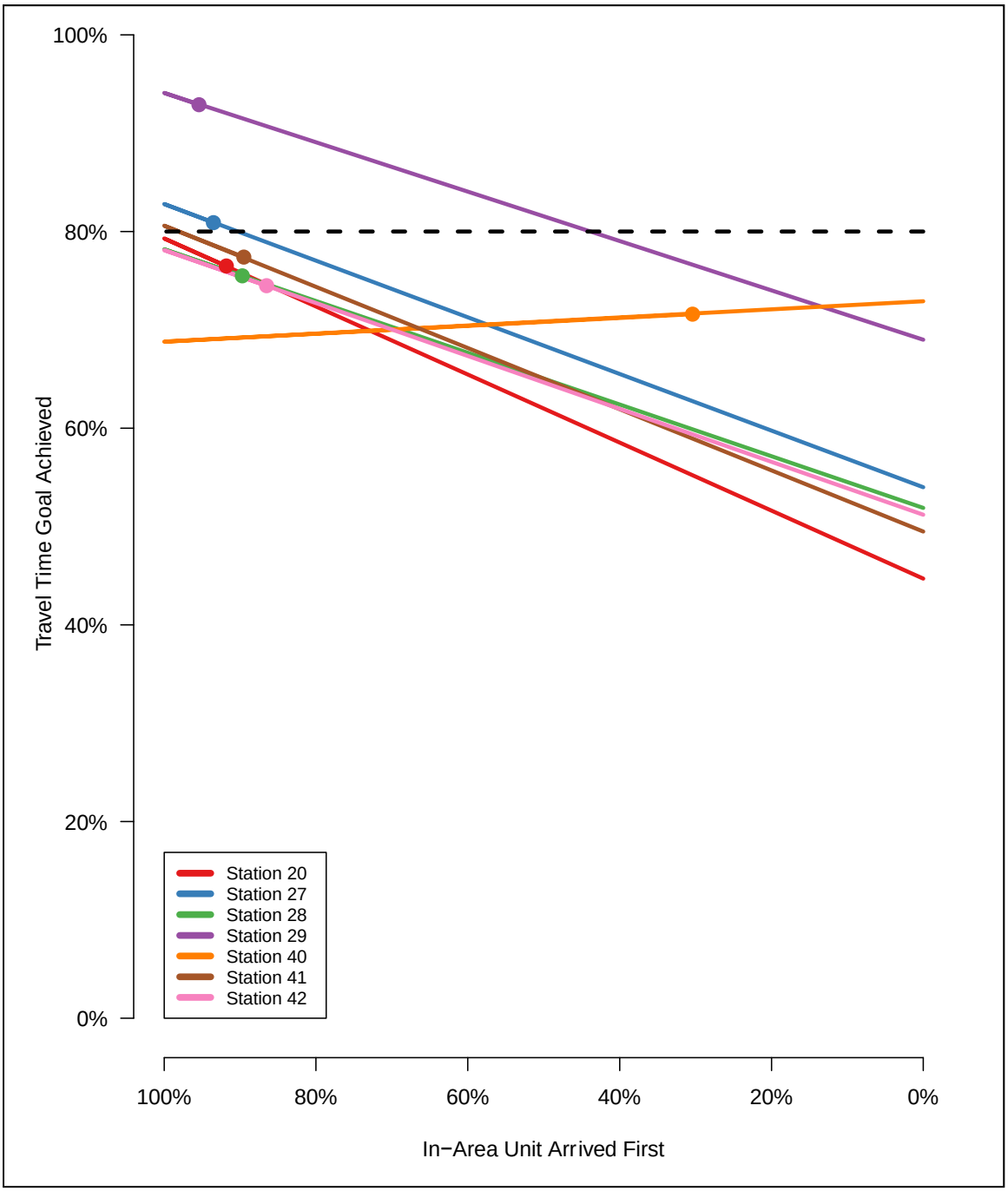


Table 26. Unit Availability vs. Performance Analysis, Battalion 1, CY2013

	All Units	In-Area Units Only	Out-of-Area Units Only
Station 20 (92% in-area units)	76.5 %	79.3 %	44.7 %
Station 27 (94% in-area units)	80.9 %	82.8 %	54.0 %
Station 28 (90% in-area units)	75.5 %	78.2 %	51.9 %
Station 29 (95% in-area units)	92.9 %	94.1 %	69.0 %
Station 40 (30% in-area units)	71.6 %	68.8 %	72.9 %
Station 41 (90% in-area units)	77.4 %	80.6 %	49.5 %
Station 42 (86% in-area units)	74.5 %	78.1 %	51.2 %

Battalion 2 – Of the seven stations in Battalion 2, only three stations are above the $80^{\%}$ response-time standard. Four stations have depressed performance lines: 30, 33, 34, and 43. All stations in this battalion have a moderate level of workload sensitivity. Stations 35 and 37 do have the capacity for additional workload. The workload for Station 31 should be lowered so as to maintain the performance in this area near the $80^{\%\ goal}$. The other stations (30, 33, 34, and 43) would see increased performance as unit availability increases, but even 100% unit availability would not bring performance up to 80%.

Figure 32. Unit Availability vs. Performance Analysis, Battalion 2, CY2013

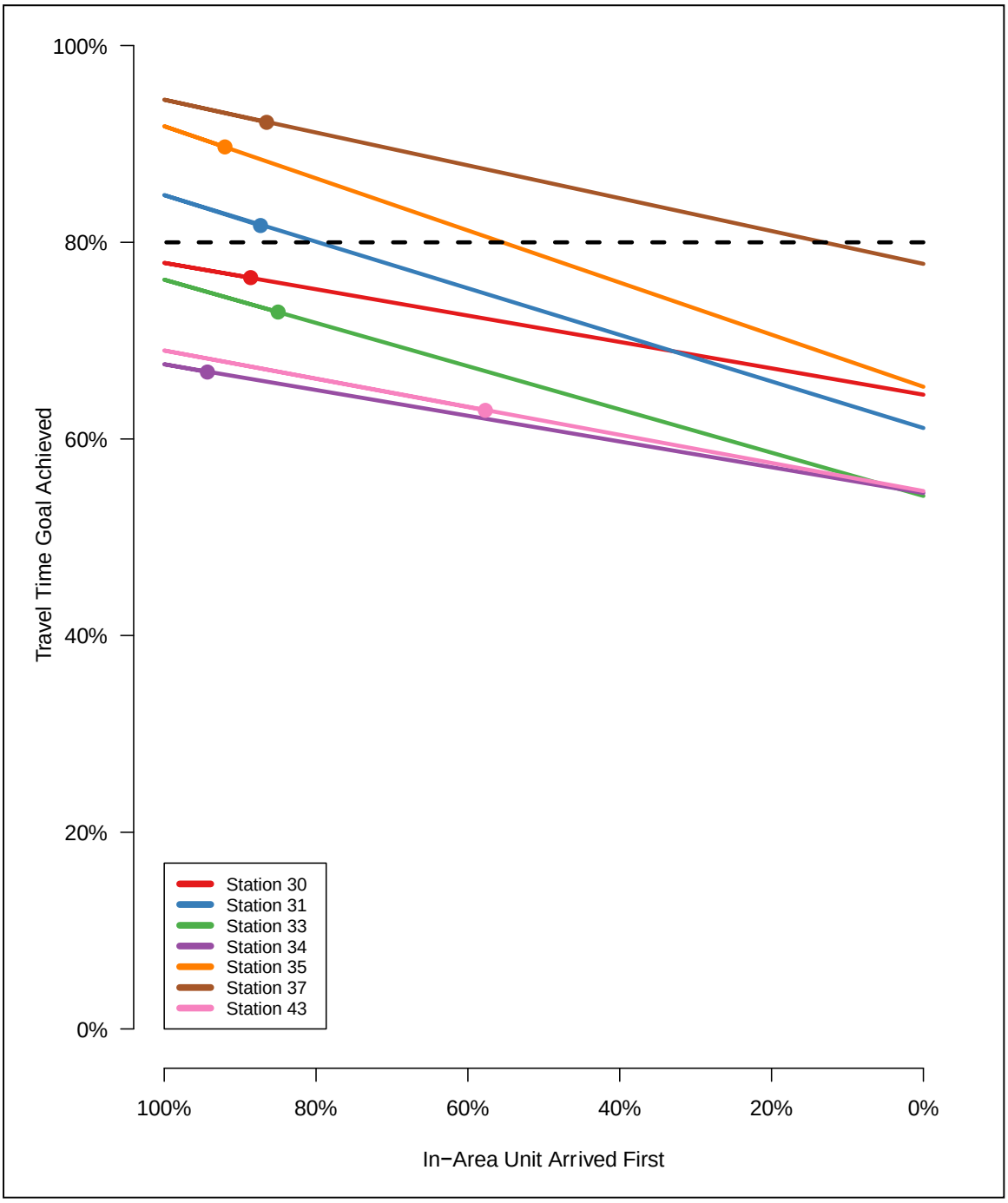


Table 27. Unit Availability vs. Performance Analysis, Battalion 2, CY2013

	All Units	In-Area Units Only	Out-of-Area Units Only
Station 30 (89% in-area units)	76.4 %	77.9 %	64.5 %
Station 31 (87% in-area units)	81.7 %	84.8 %	61.1 %
Station 33 (85% in-area units)	72.9 %	76.2 %	54.2 %
Station 34 (94% in-area units)	66.8 %	67.6 %	54.5 %
Station 35 (92% in-area units)	89.7 %	91.8 %	65.3 %
Station 37 (86% in-area units)	92.2 %	94.5 %	77.8 %
Station 43 (58% in-area units)	62.9 %	69.0 %	54.7 %

Battalion 3 – Of the six stations in Battalion 3, only two are above the 80% response-time. Three stations have depressed performance lines: 36, 54, and 58. Station 32 has high workload sensitivity. Although Station 32 is currently well above the 80% goal, even a small amount of additional workload will quickly decrease its travel-time performance, so this station's workload should be minimized.

The remaining stations in this battalion have moderate workload sensitivity. Station 56 has a small amount of additional workload capacity and Station 57 might be brought above the 80% goal if unit availability at this station were slightly increased. The other stations (36, 54, and 58) would see increased performance as unit availability increases, but even 100% availability would not bring performance above 80%.

Figure 33. Unit Availability vs. Performance Analysis, Battalion 3, CY2013

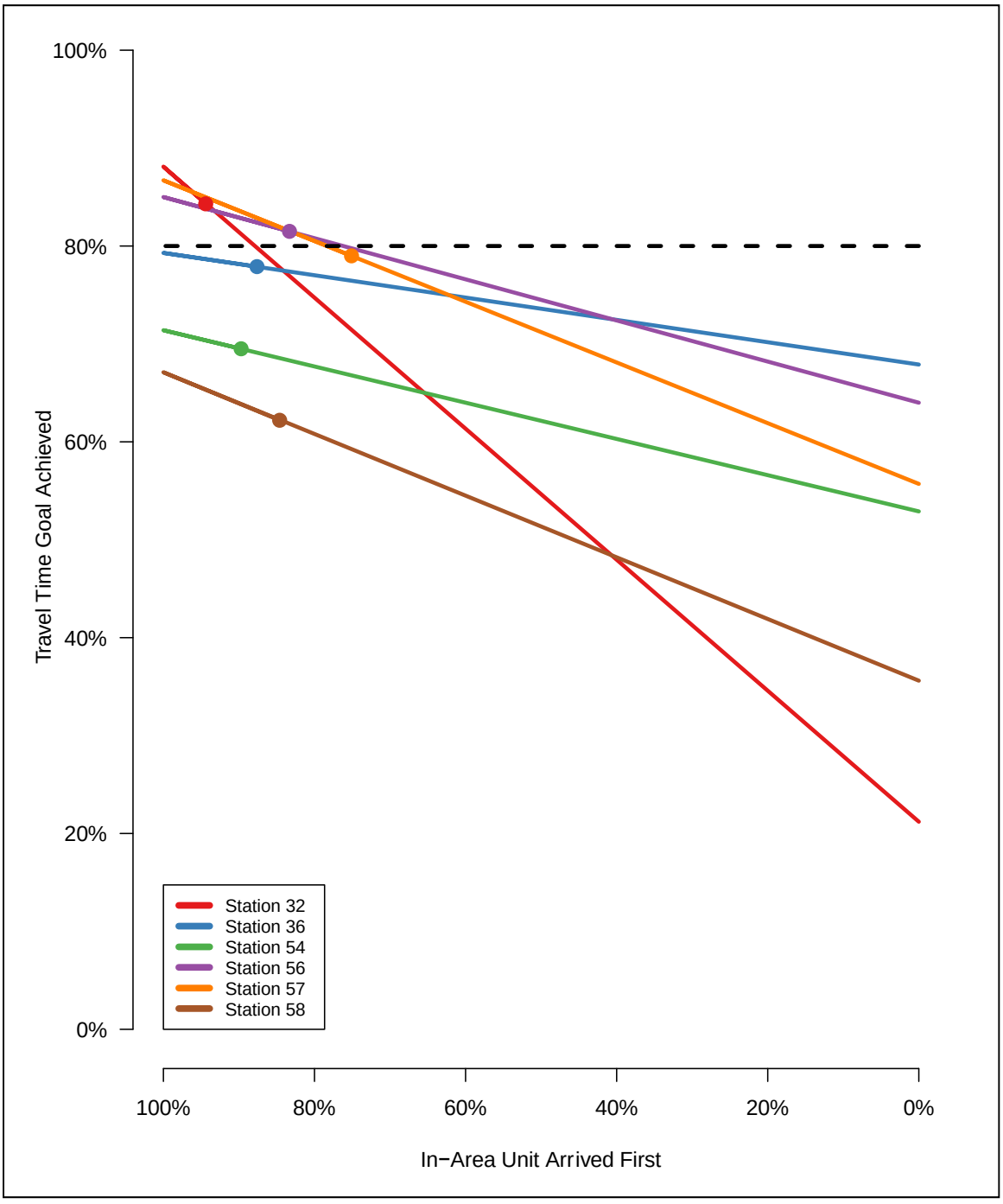


Table 28. Unit Availability vs. Performance Analysis, Battalion 3, CY2013

	All Units	In-Area Units Only	Out-of-Area Units Only
Station 32 (94% in-area units)	84.3 %	88.1 %	21.2 %
Station 36 (88% in-area units)	77.9 %	79.3 %	67.9 %
Station 54 (90% in-area units)	69.5 %	71.4 %	52.9 %
Station 56 (83% in-area units)	81.5 %	85.0 %	64.0 %
Station 57 (75% in-area units)	79.0 %	86.7 %	55.7 %
Station 58 (85% in-area units)	62.2 %	67.1 %	35.6 %

Battalion 4 – Of the seven stations in Battalion 4, four stations are above the 80% response-time standard. Two stations have depressed performance lines: 51 and 55. Other than Station 53, all stations in this area have moderate workload sensitivity. Stations 50, 52, and 73 have some additional workload capacity and Station 70 might be brought above the 80% goal if unit availability at this station were increased. The other stations (51 and 55) would see increased performance as unit availability increases, but even 100% unit availability would not bring the station performance up to 80%. Station 53 has very little workload sensitivity, as shown by the nearly horizontal performance line.

Figure 34. Unit Availability vs. Performance Analysis, Battalion 4, CY2013

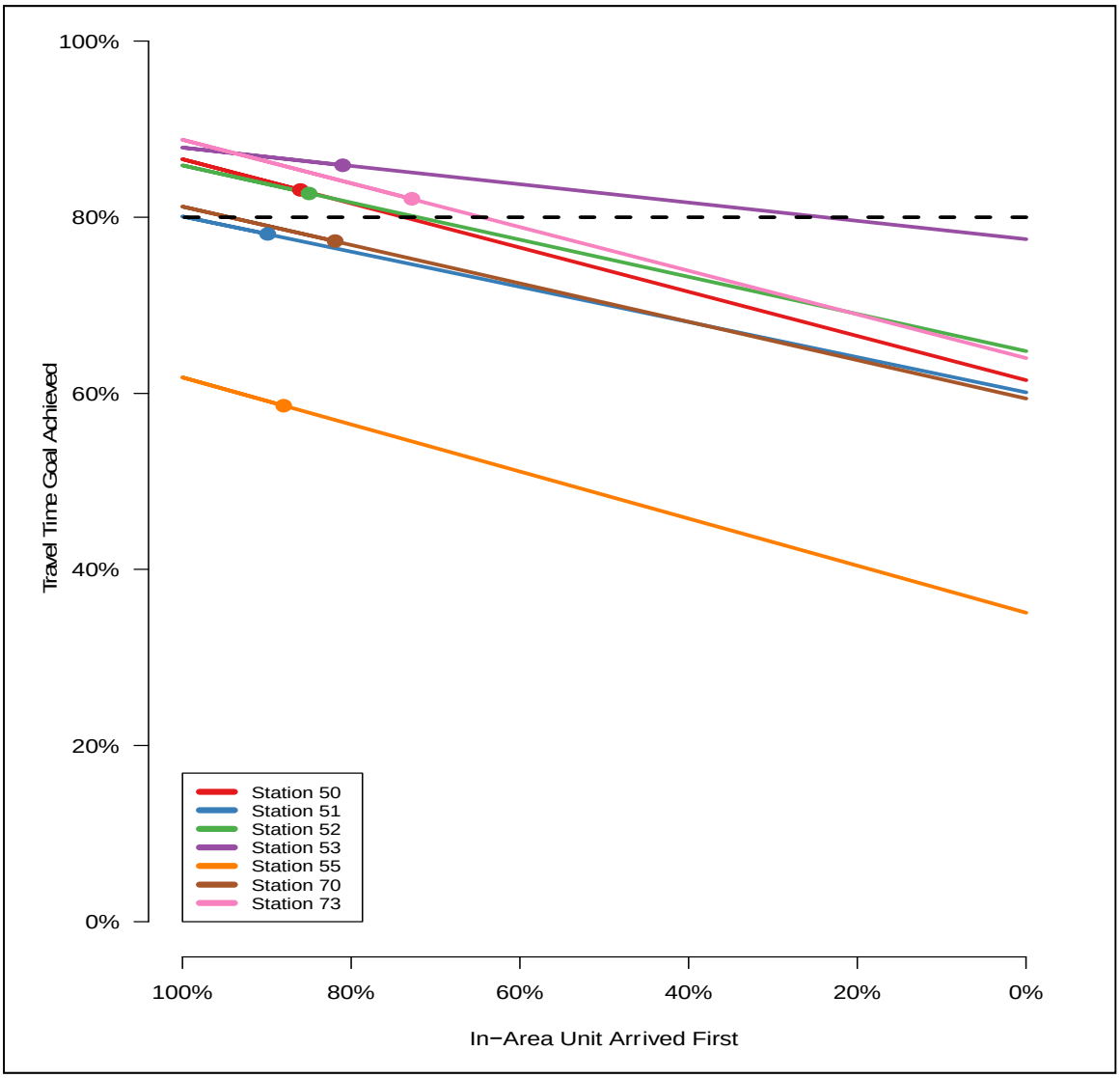


Table 29. Unit Availability vs. Performance Analysis, Battalion 4, CY2013

	All Units	In-Area Units Only	Out-of-Area Units Only
Station 50 (86% in-area units)	83.1 %	86.6 %	61.5 %
Station 51 (90% in-area units)	78.1 %	80.1 %	60.1 %
Station 52 (85% in-area units)	82.7 %	85.9 %	64.8 %
Station 53 (81% in-area units)	85.9 %	87.9 %	77.5 %
Station 55 (88% in-area units)	58.6 %	61.8 %	35.1 %
Station 70 (82% in-area units)	77.3 %	81.2 %	59.4 %
Station 73 (73% in-area units)	82.1 %	88.8 %	64.0 %

Battalion 5 – Of the seven stations in Battalion 5, only one station is above the 80% response-time standard. Other than Station 77, all stations in Battalion 5 have depressed performance lines. Other than Station 76, all stations in this area have moderate workload sensitivity. Figure 35 show that Station 77 has significant additional workload capacity. The other stations (63, 66, 71, 72, and 81) would see increased performance as unit availability increases, but even 100% unit availability would not bring the station performance up to the 80% goal.

Station 76 appears to have an inverse relationship between unit availability and travel time performance, indicating either incorrectly drawn first-due boundaries or errors in the data.

Figure 35. Unit Availability vs. Performance Analysis, Battalion 5, CY2013

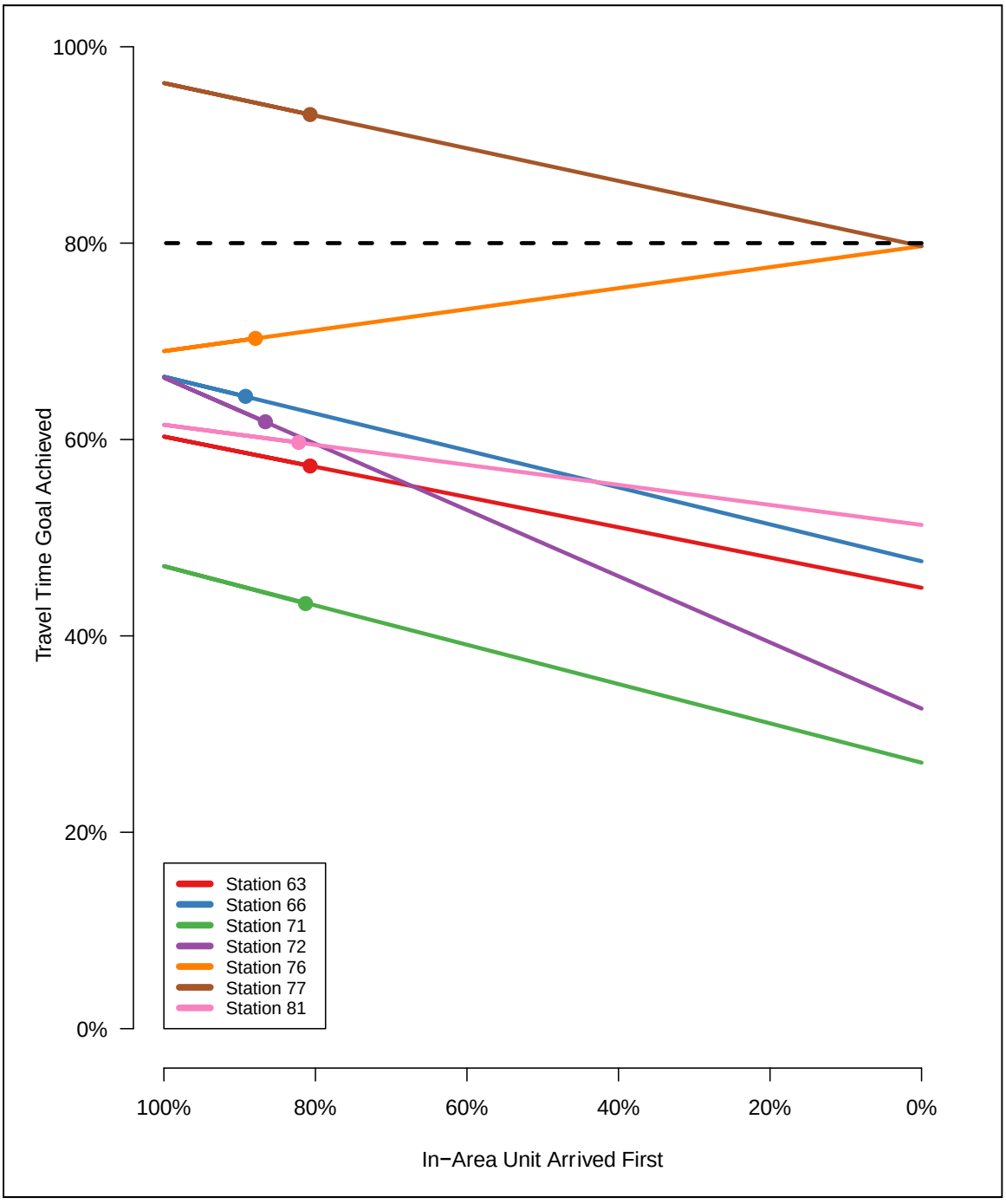


Table 30. Unit Availability vs. Performance Analysis, Battalion 5, CY2013

	All Units	In-Area Units Only	Out-of-Area Units Only
Station 63 (81% in-area units)	57.3 %	60.3 %	44.9 %
Station 66 (89% in-area units)	64.4 %	66.4 %	47.6 %
Station 71 (81% in-area units)	43.3 %	47.1 %	27.1 %
Station 72 (87% in-area units)	61.8 %	66.3 %	32.6 %
Station 76 (88% in-area units)	70.3 %	69.0 %	79.7 %
Station 77 (81% in-area units)	93.1 %	96.3 %	79.7 %
Station 81 (82% in-area units)	59.7 %	61.5 %	51.3 %

Battalion 6 – Only two of the seven stations in Battalion 6 are above the 80% response-time standard. Five stations have depressed performance lines: 65, 80, 83, 85, and 86. Other than Station 83, all stations in this area have moderate level workload sensitivity. The figure shows that Stations 82 and 84 have additional workload capacity. The other stations (65, 80, 85, and 86) would see increased performance as unit availability increases, but even 100% unit availability would not bring the station performance up to the 80% goal.

Station 83 has almost no workload sensitivity, as shown by the nearly horizontal performance line. Usually stations that are not affected by workload and unit availability (and display a horizontal performance line) have a high level of performance. However, in the case of Station 83, the performance level is low regardless of unit availability. Additional research needs to be done to understand the cause of this anomaly.

Figure 36. Unit Availability vs. Performance Analysis, Battalion 6, CY2013

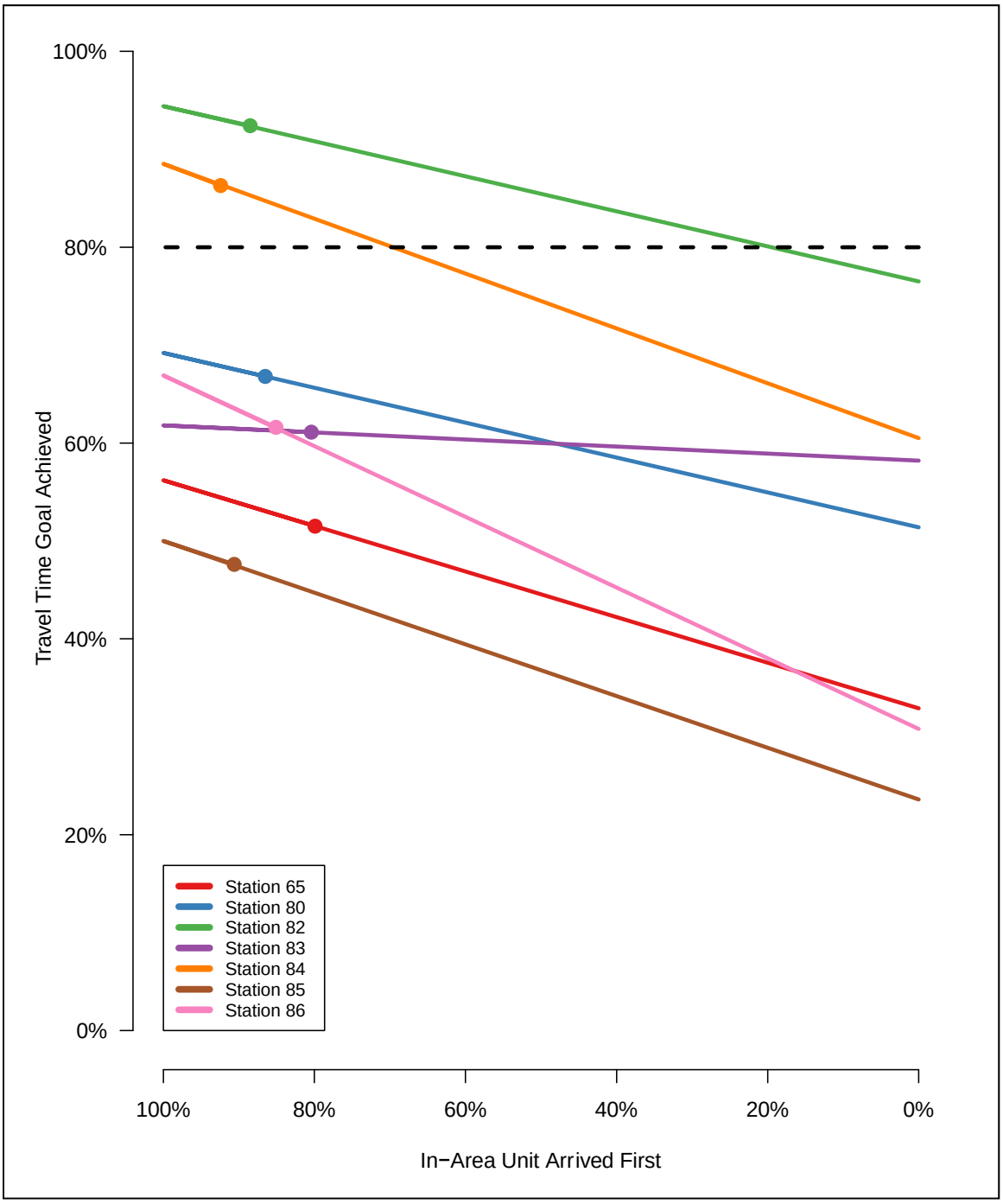


Table 31. Unit Availability vs. Performance Analysis, Battalion 6, CY2013

	All Units	In-Area Units Only	Out-of-Area Units Only
Station 65 (80% in-area units)	51.5 %	56.2 %	32.9 %
Station 80 (86% in-area units)	66.8 %	69.2 %	51.4 %
Station 82 (88% in-area units)	92.4 %	94.4 %	76.5 %
Station 83 (80% in-area units)	61.1 %	61.8 %	58.2 %
Station 84 (92% in-area units)	86.3 %	88.5 %	60.5 %
Station 85 (91% in-area units)	47.6 %	50.0 %	23.6 %
Station 86 (85% in-area units)	61.6 %	66.9 %	30.8 %

From the analysis there appear to be some issues with the data and this may have resulted in some unusual performance lines. Appendix F, Unit Availability vs. Response Time Performance, provides information on the typical data problems found in a performance versus unit availability analysis and ways the OCFRD can improve its data collection process for even better results. Despite minor data issues, the results of this study are still useful. The major finding is that very few OCFRD stations or first-due areas are above the response-time goal compliance of 80%.

Recommendation 2: OCFRD should continue to refine its performance goals and CPSE performance versus unit availability analysis and trigger points for determining the need for a new station or unit.

CHAPTER V. STATION LOCATION ANALYSIS AND RECOMMENDED CHANGES

This chapter presents a station location plan going into the future, based on all the analysis that has been done, and professional judgment. It includes our recommendations for new stations and for relocation and consolidation of some stations. As the development situation for Orange County is and will remain fluid, decisions about the timing of new stations must be revisited yearly.

For ease of comprehension, the analysis provided here is divided into three regions of the County: northwest, southwest, and east. The planning areas included in each region are:

East	Northwest	Southwest
• East Colonial • East Orange/ Deseret Ranch • Goldenrod • Innovation Way • University of Central Florida (UCF) • Valencia College	• Edgewater • Pine Hills • Northwest Orange/ Tangerine • South Apopka	• Belle Isle • Conway • Edgewood • Gotho/ Orla Visto • Horizon West/ Four Corners • Hunter's Creek/ Meadow Woods • I-Drive/ Dr. Philips/ Williamsburg • Pine Castle/ Taft/ Oak Ridge

Information about the population growth, expected development, and future demand of each planning area was provided earlier.

Response Travel Time and Coverage

The response travel time and coverage from OCFRD stations was analyzed from the current 41 stations along with the overlapping coverage necessary when demand requires more than one station to cover a particularly busy area. The coverage analysis maps in this section are shown using five, seven, and nine-minute travel-time increments.

In addition to meeting reasonable travel-time coverage for each station and the first-due unit/s in them, coverage overlap is often required to maintain reliability in areas of high demand (e.g. the fire and EMS hotspots discussed earlier). High-demand areas are more likely to have concurrent emergencies and require the proximity of several units and/or stations. The overlap analysis shows the number of fire stations that can reach areas of the region within six minutes. Six minutes was selected because the intent is not to show how many stations can reach an area within the 5:20 metropolitan travel-time goal, for example, but rather how many stations can reach an area in nearly that time if the first-due unit is not available.

The most significant issue is not coverage overlap from multiple stations but rather filling coverage gaps for large areas that presently are uncovered by even a single station. For this reason the primary focus of this analysis was to determine the most critical needs now, and then those expected based on future development. Also considered were the age and condition of current stations (those needing replacement can be considered for relocation), potential of annexation, and the possibility to improve coverage by increasing regional mutual aid, including from incorporated areas to the unincorporated areas.

The suggested timing of new stations is presented as immediate priorities (0-5 years), moderate priorities (5-10 years), and long-term needs (10 years, plus).

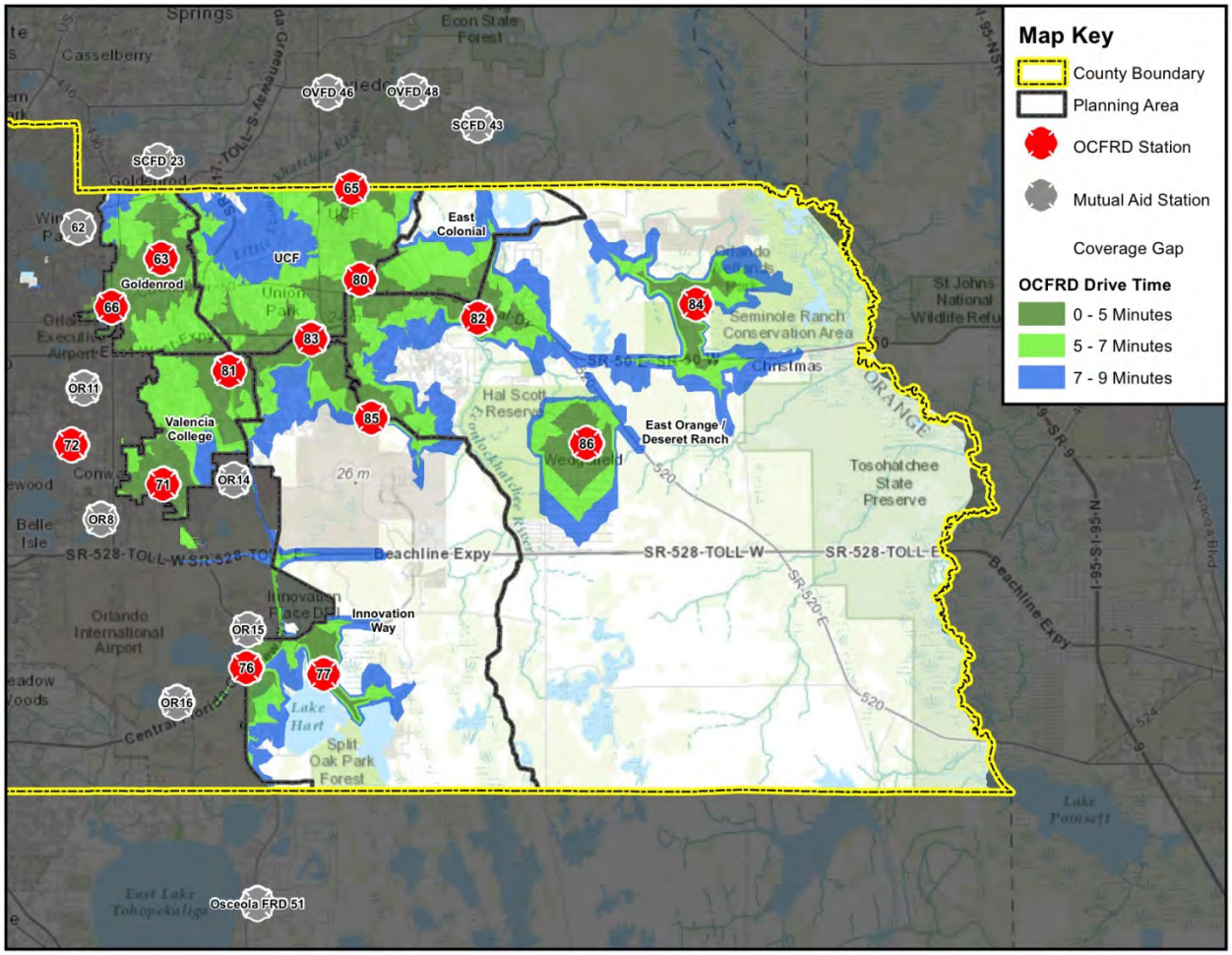
East

Although most of eastern Orange County is extremely rural, the northeastern portion (Goldenrod, UCF, and Valencia College) has the most urban population densities. This portion of the eastern region should be covered with uniform 5:20 travel times. Unlike other parts of Orange County where fire station coverage will be needed based on future development, this region already has poor coverage relative to the current population density and demand. Figure 37 shows the current coverage for the eastern portion of Orange County. Coverage is generally poor, with some areas well outside of coverage by even a single station.

The gaps (indicated by orange circles) include:

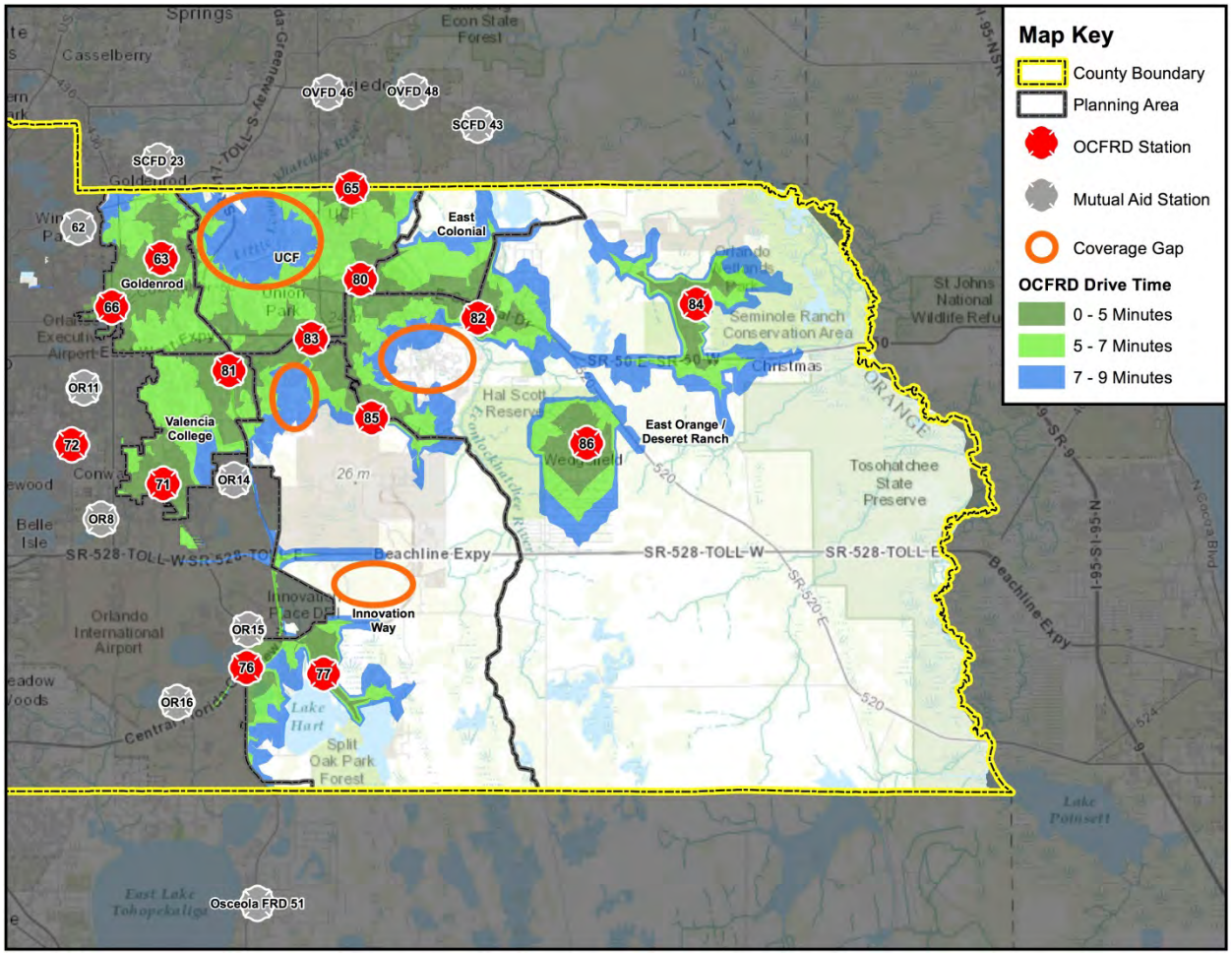
- Area around the intersection of University Boulevard and North Dean Road: This area is almost exclusively metropolitan and urban and should be covered with a 5:20 travel time. This is one of the largest gaps in the county between expected service (based on population density) and current service level. Further development is expected in the area, which will exacerbate the problem. **Reducing the coverage gap here should be one of the top priorities for the OCFRD.**
- South Avalon Park Boulevard between Waterford Chase Parkway and Tanja King Boulevard: This area has a similar situation to the UCF coverage gap. The area is already mostly metropolitan and urban, yet travel times are often longer than nine minutes. The area is expected to continue to develop, and the OCFRD needs to move quickly to fill this coverage gap too.
- Cypress Springs and Andover Lakes: This area currently has an urban population density that should be covered within a six-minute travel time. By 2040, the area will be metropolitan.
- Starwood DRI (development of regional impact): This area is not currently a coverage gap, but is expected to grow to suburban population density by 2040. At that time, an additional station will likely be needed in this area.

Figure 37. Current Fire Station Coverage, East Orange County



Besides the gap problem, the current station coverage in the East has little overlap, as shown in Figure 38. The metropolitan population density and high demand in the Goldenrod, UCF, and Valencia College planning areas especially require more coverage overlap than exists. Metropolitan areas with fire and EMS hotspots in other parts of Orange County do have coverage overlaps that are consistent with the need in high demand areas, but this is not the case in the UCF area.

Figure 38. Current Fire Station Overlap, East Orange County



New Stations for UCF planning Area – The UCF planning area is classified as mostly metropolitan and it is expected that further development and population increase will occur in this area. Unlike other parts of Orange County, where there may be small pockets of metropolitan areas, this area (including the neighboring planning areas Goldenrod and Valencia College) is almost uniformly metropolitan. It is this area, too, where travel-time goals should more closely follow the NFPA 1710 standard. However, our analysis found large coverage gaps in the middle of the UCF area, with travel times potentially over nine minutes. The analysis of travel times explained in an earlier chapter confirms the problem as the longest 10% of response times occur were in this area.

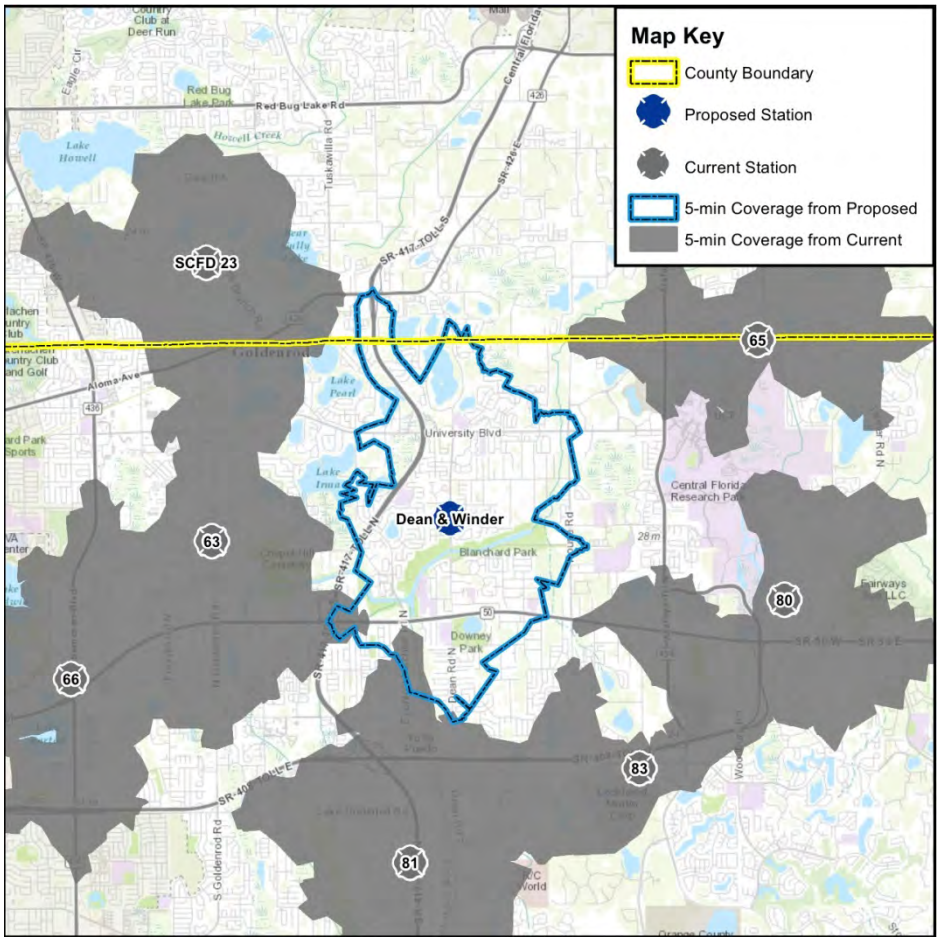
The UCF area has an extremely large hotspot of medium emergency-service demand and several smaller hotspots. Because the UCF area has a high number of student residences and the number of structure fires per square mile is in the top quartile for the county, we considered this area a high fire risk.

All of the stations surrounding the UCF coverage-gap area currently have high workload, with stations 81, 63, and 80 being the 2nd, 4th, and 7th busiest respectively. All of these stations have a moderate to strong relationship between unit availability and travel-time performance,

and would benefit from the decreased workload that would result from building additional stations in the area. New stations would both correct the huge coverage gap and increase unit availability and improve response times at the existing stations.

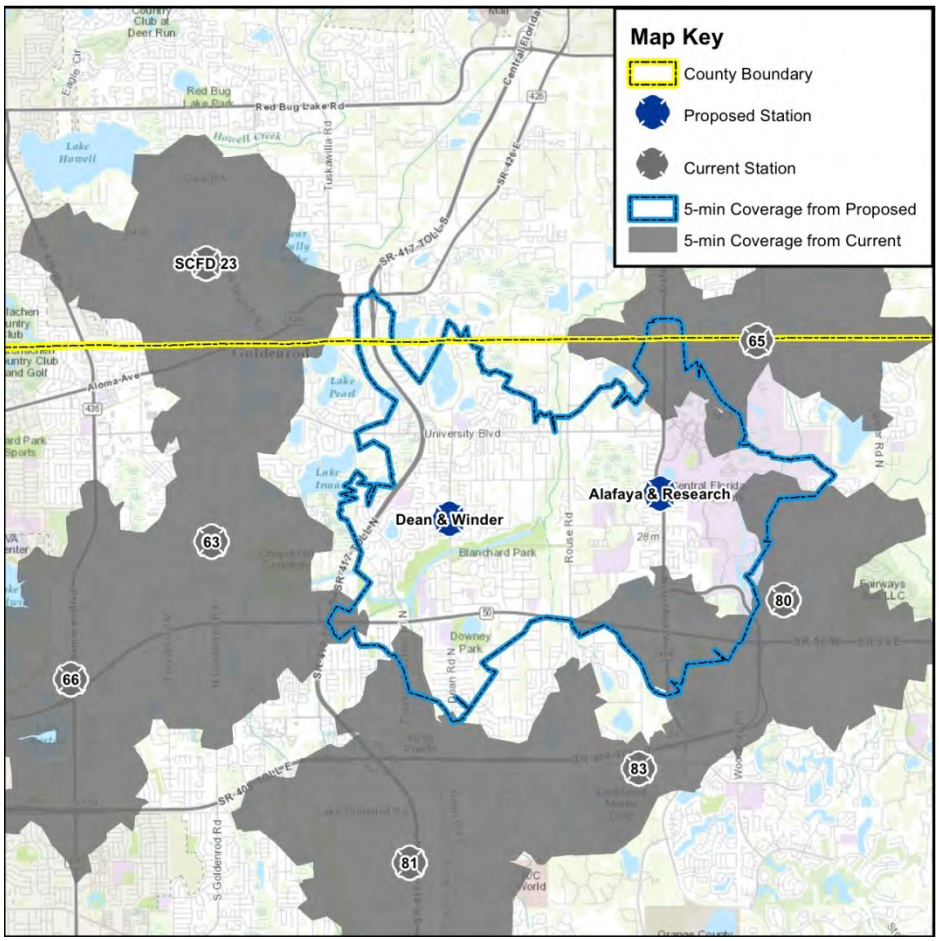
Fortuitously, Orange County owns property at the intersection of North Dean Road and Winder Trail, as shown in Figure 39. The site is considered buildable for a new fire station and the analysis shows that this would be an excellent location, but still leaves a large coverage gap to its east.

Figure 39. Coverage from Potential Station at Dean and Winder



The 5:20 travel- time goal cannot be achieved from one new station in the UCF planning area. A second station near the intersection of North Alafaya Trail and Research Parkway is also needed. The resulting coverage is shown in Figure 40.

Figure 40. Dean and Winder Station and Alfaya and Research Station



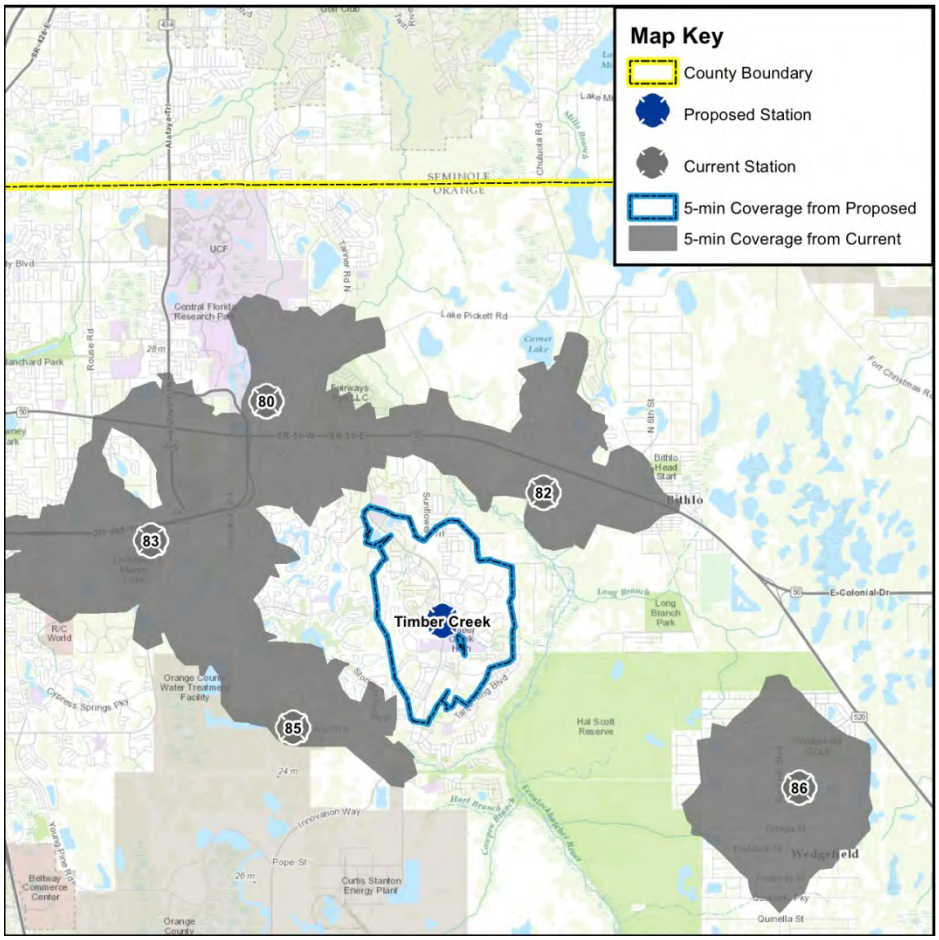
A new east-west connector road from North Alafaya Trail and Research Parkway to Tanner Road North is planned, which will help this station along with the Dean and Winder station would provide the required coverage for the region, which is expected to be almost entirely metropolitan by the time the road is built.

Recommendation 3: Construct a new station at North Dean Road and Winder Trail, followed by a second station near the intersection of North Alafaya Trail and Research Parkway. Construction of the Dean and Winder station should begin as soon as possible. Construction of the Alafaya and Research station should coincide with the completion of the east-west road extension to Tanner Road North (2015-2020).

East Orange/ Deseret Ranch – The community of Timber Creek is located in the western portion of the East Orange/ Deseret Ranch planning area. Although most of this area is extremely rural, this particular portion is a mix of urban and metropolitan population densities. Presently served by Stations 80, 82, 83, and 85, this area has a travel time between seven and nine minutes. Although portions of this area are already heavily developed, the addition of new development west of Timber Creek High School will increase demand as the entire area transitions from an urban/metropolitan to mostly metropolitan over the next few years.

The travel-time performance versus unit-availability analysis detected station location issues with Stations 80, 83, and 85, most likely because of the long travel times needed to get to this community. The addition of a new Timber Creek station will improve response times for first due units, and also will improve reliability for the existing stations; responses. At present there are no significant fire or EMS hotspots in this area, but it is expected that EMS service demand will increase with the expected increase in population. As Figure 41 shows, the Timber Creek commmunity currently is not covered within the 5:20 travel-time goal, and would be much improved with a new station.

Figure 41. Coverage from Proposed Timber Creek Station



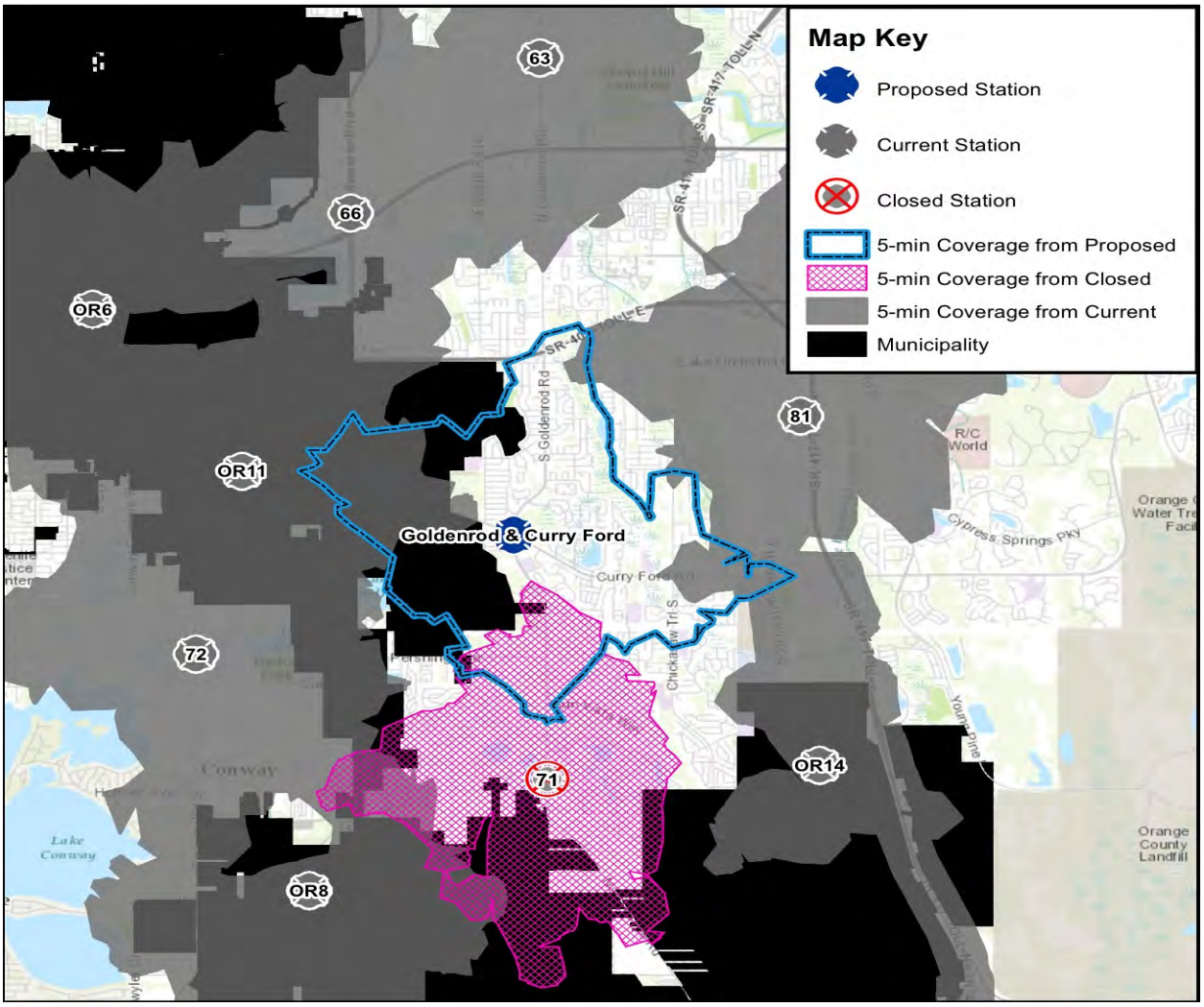
Recommendation 4: Construct a new station near Avalon Park South Boulevard. A variety of locations were considered, and the best one appears to be near Avalon Park South Boulevard near the C3 church (just north of Timber Creek High School). Completion of the station should occur with the next five years (2015-2020).

Relocate Station 71 – Station 71 is located in the southern portion of the Valencia College planning area and very close to the city of Orlando. Most of the Goldenrod Road area north of Station 71 is already designated metropolitan population density, and further new development is expected.

Response travel times from Station 71 are good to Curry Ford Road, but all areas north of that along Goldenrod Road have response travel times well exceeding the prescribed goal. Orlando Stations 8 and 14 are nearby to OCFRD Station 71 and the effective reach for Station 71 from its present location is well into Orlando. With any new annexation from Orlando into Goldenrod, Station 71 would be in a less advantageous location than at its present site.

To improve response times and coverage to Goldenrod/ Valencia College, Station 71 should be relocated to a site near South Goldenrod Road and Pershing Avenue. The areas outside of Station 71's coverage area are already designated as metropolitan. Constructed in in 1976, it can be expected that Station 71 reaches its 40-year life in 2016, and will need to be modernized in the near future, so this is the time to consider its relocation.

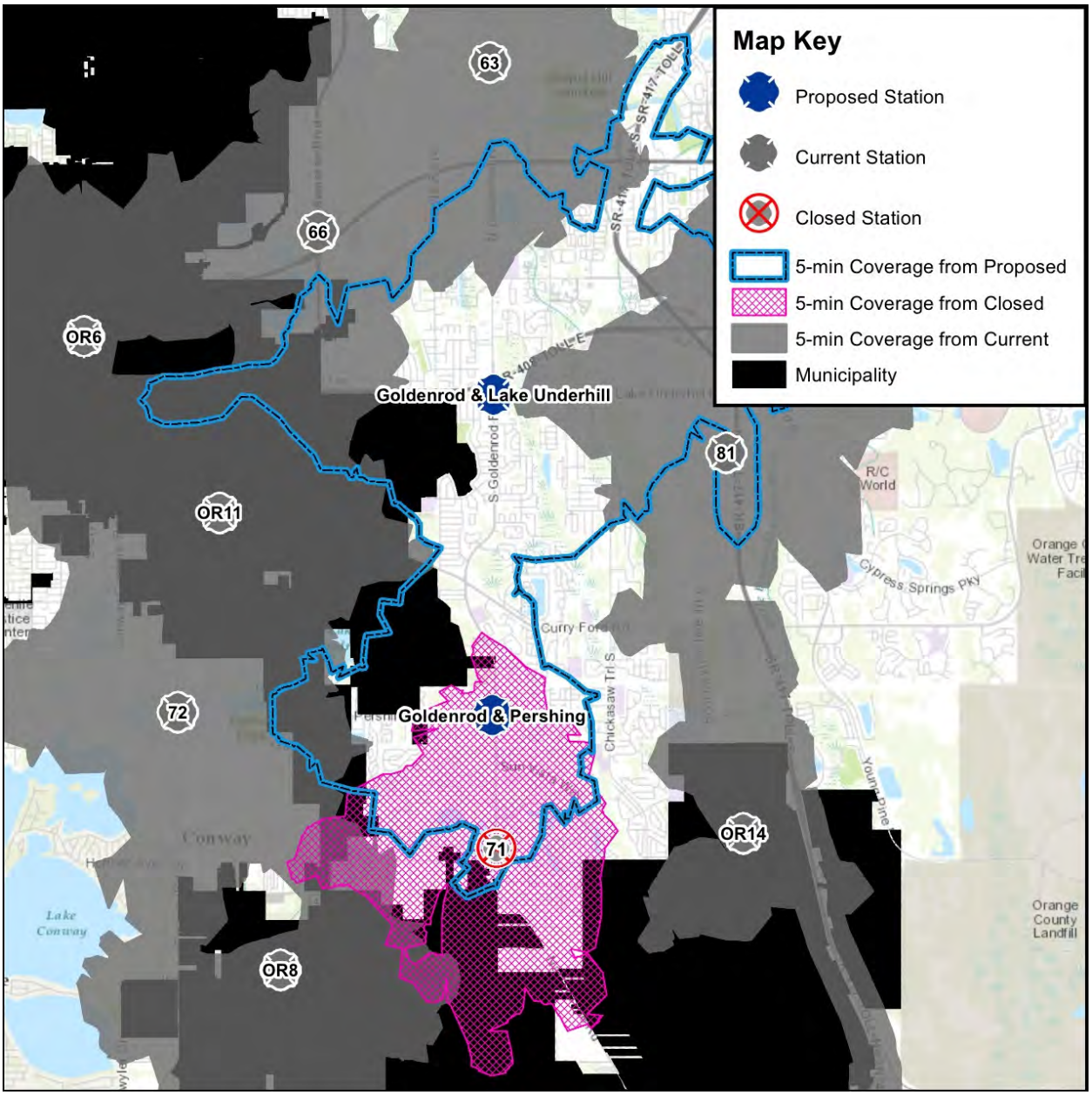
Figure 42. Coverage from moving Station 71 to Goldenrod Road and Curry Ford Road



Build New Station Between Goldenrod and Valencia College – Merely moving Station 71 does not entirely address the coverage problem in the Goldenrod/ Valencia College planning area. Besides the relocation, a new station is needed near the intersection of Goldenrod Road and Lake Underhill Road. The immediate priority is to build the new station and then relocate Station

71. Figure 43 shows the coverage of Goldenrod/ Valencia College with the relocation of Station 71 and a new station.

Figure 43. Goldenrod and Lake Underhill Station and Goldenrod and Pershing Station



Recommendation 5: Construct a new station near South Goldenrod Road and Lake Underhill Road within the next five years (2015-2020).

Recommendation 6: Relocate Station 71 near South Goldenrod Road and Pershing Avenue. The suggested timing for Station 71 to be relocated is long-term, 2025 and beyond.

Southwest

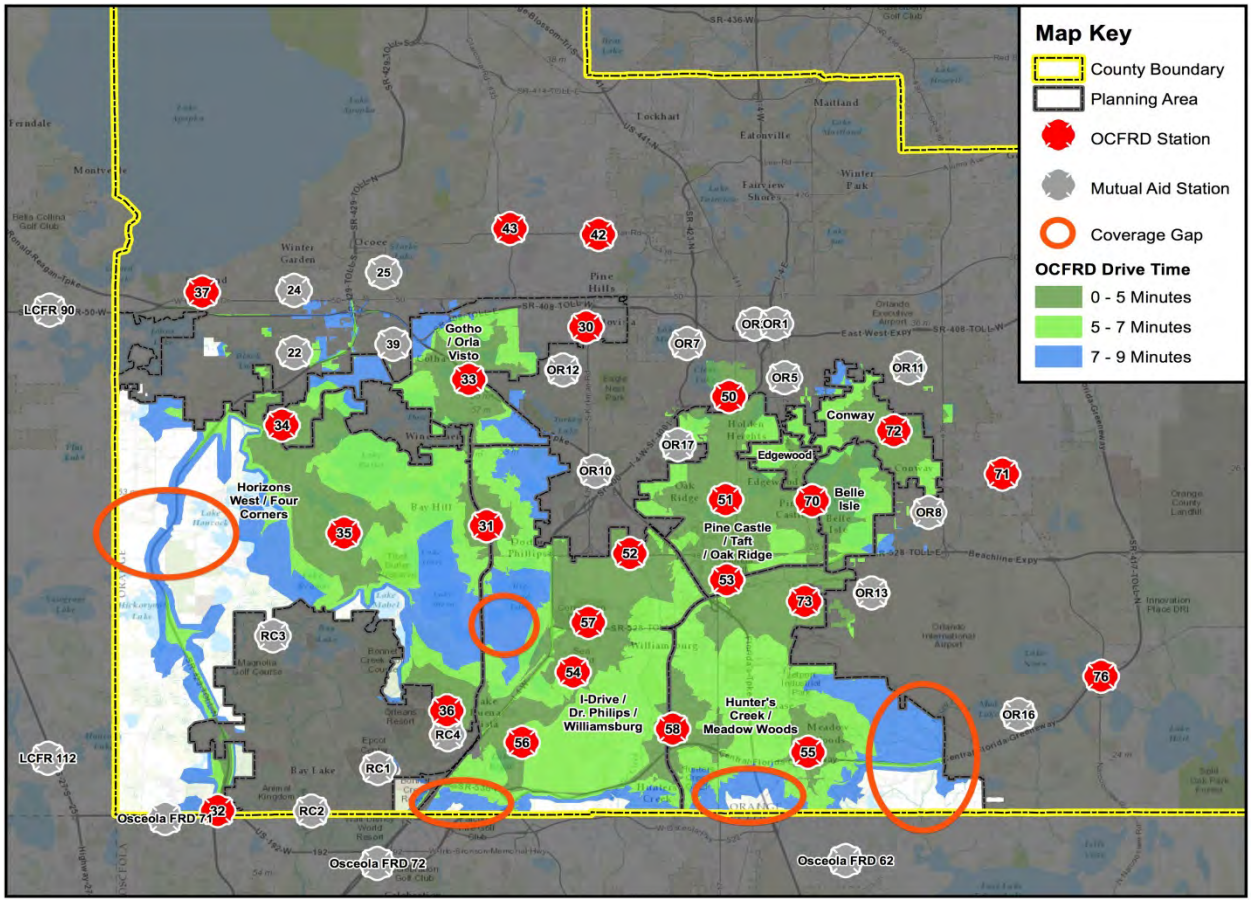
This region is experiencing particularly high development, which is expected to continue, especially in the Horizon West area and along the southern edge of the County bordering Osceola County. Whereas in eastern Orange County where the issues are immediate, the response time and coverage concerns in southwest Orange are more long term as development and population increase. It is expected that many areas of southwest Orange County will transition from rural to suburban and urban to metropolitan. Figure 44 shows the current coverage for the southwestern portion of Orange County.

Areas of particular concern and their situation are:

- **Horizon West** – Although not a coverage gap at the moment because of still limited population density, the area west of Station 35 is expected to have the highest population density in the Horizon West area with a mix of metropolitan, urban, and suburban.
- **The Estates at Phillips Landing and Sand Lake Cove** – This area is currently urban and should be covered with a six-minute travel time. Much of the area is expected to turn metropolitan over the next ten years.
- **International Drive South** – This area is expected to grow from suburban to urban in ten years and metropolitan in 15 years. The travel time to this area, given the arrangement of stations, is not sufficient even for current needs.
- **Area south of West Town Center Boulevard and west of Florida's Turnpike** – This area currently has a metropolitan population density and should be covered with a 5:20 travel time.
- **Wyndham Lakes and Beacon Park Area** – This is currently a rural area but over the next 25 years it will change to urban and metropolitan. Depending on how the road network is constructed, Station 55 and, to a lesser extent, Orlando Station 16, will be able to provide some coverage, though at some point an additional station will be needed in this area.

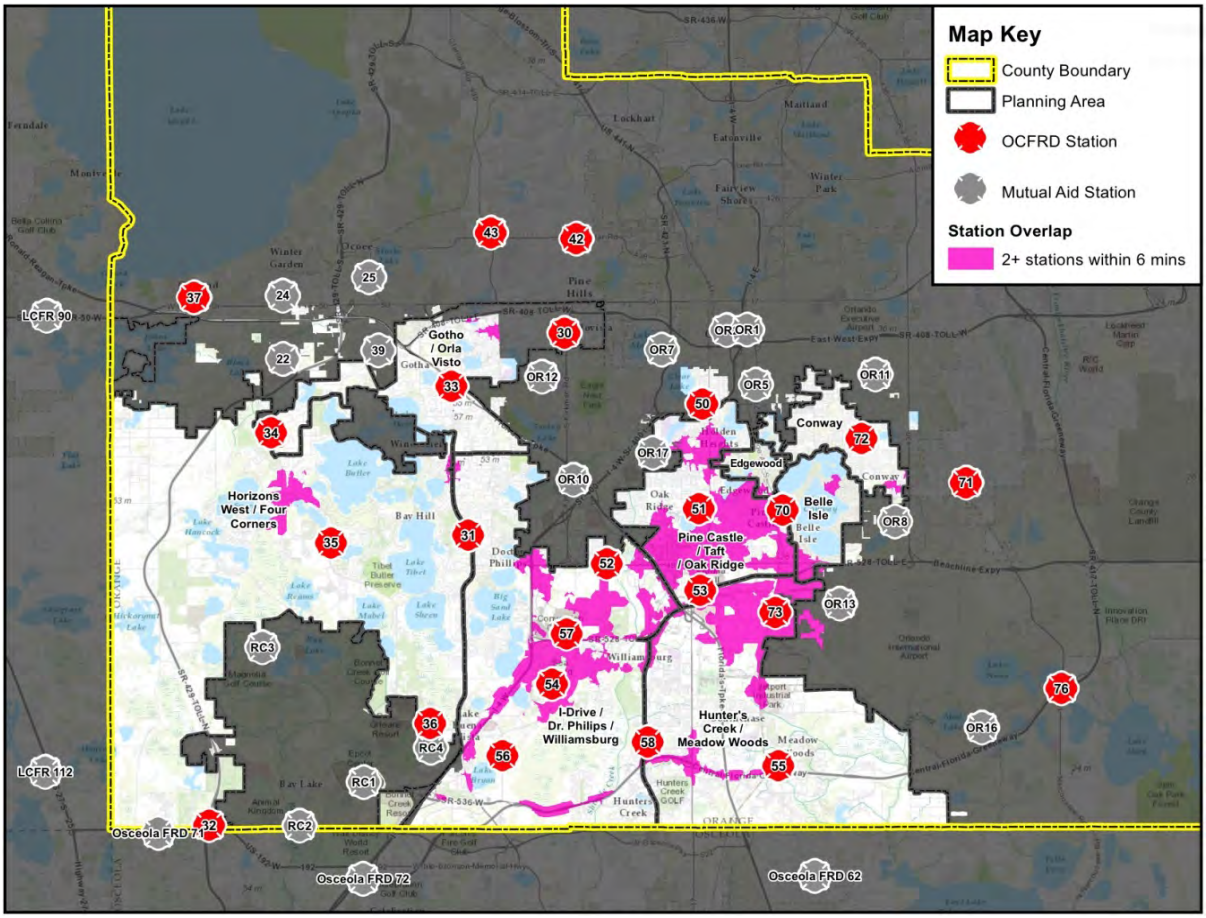
Southwest Orange County also has a coverage gap around the intersection of Hiawassee Road South and Conroy Windermere Road. It currently has both urban and metropolitan population densities, but it takes at least seven minutes to reach this area from the nearest OCFRD station (Station 31). However, this area was not circled as an identified coverage gap because much of this area can be covered within five to seven minutes from Orlando Station 10.

Figure 44. Current Fire Station Coverage, Southwest Orange County



As the risk analysis showed earlier, there are some areas here with significant fire and EMS hotspots. Fortunately, Southwest Orange County has the best overall station-coverage redunadnacy, particularly where emergency services demand is highest. The Pine Castle/ Taft/ Oak Ridge planning areas and International Drive have the best coverage overlap in this region, which is where it is most needed.

Figure 45. Current Fire Station Overlap, Southwest Orange County



New Stations for Horizon West – Horizon West area is divided into six villages, which were all approved at different times and are in different stages of development. Lakeside was the first village approved, in 1997, followed by Bridgewater in 1999. Both of these areas have significant development and are suburban in population density. As discussed previously in this report, Horizon West is expected to have the most significant development in Orange County. In the near and long term, this area will transition from its former rural population density areas to urban and then metropolitan.

Lakeside Village: Lakeside Village has adequate coverage from Station 35 for its currently suburban population density other than the far west side of the village along Ficquette Road. Lakeside Village is not expected to grow beyond suburban population density. Bridgewater Village has good coverage in the north from Station 34, but the southern end of the village is not adequately covered within the seven-minute travel-time goal. Unlike Lakeside, Bridgewater is experiencing enough development to change its population classification; it is expected to become almost entirely urban in the next couple of years, which will necessitate six-minute travel-time coverage. The most urgent priority is to build a station at Summerlake Boulevard and Ficquette Road, which would cover both southern Bridgewater Village and western Lakeside Village. Planning for this station should begin immediately. By 2025, the

southern end of Bridgewater is expected to be metropolitan and a station at this location needs to be completed by that time.

Recommendation 7: Construct a new station near Summerlake Boulevard and Ficquette Road. Suggested timing for the station is 5 to 10 years.

Town Center Village: By 2025, the western half of the Town Center Village is expected to have a suburban population density. There is no Orange County or neighboring Lake County stations anywhere close to this development area and a station at the intersection of Avalon Road and Horizon Boulevard should be planned for some time in the 2025 to 2030 time period. By 2040, this additional area on the eastern side of Town Center Village is expected to grow from rural to suburban and the eastern half will see continued development and become an urban area.

Recommendation 8: Construct a new station near Avalon Road and Horizon Boulevard to improve coverage to Town Center Village. Suggested timing for the new station is long term (10+ years).

Village F and H: Village F and H were approved between 2006 and 2008, and no corresponding change from rural population density has been factored into the Traffic Area Zone population-density predictions. The station at the intersection of Avalon Road and Seidel Road is a long-term goal, although Orange County should begin looking for available land in the area. This will prevent the problem of finding a suitable site once development escalates.

Recommendation 9: Construct a new station near Avalon Road and Seidel Road to cover Village F and Village H. Suggested timing for the new station is long term (10+ years).

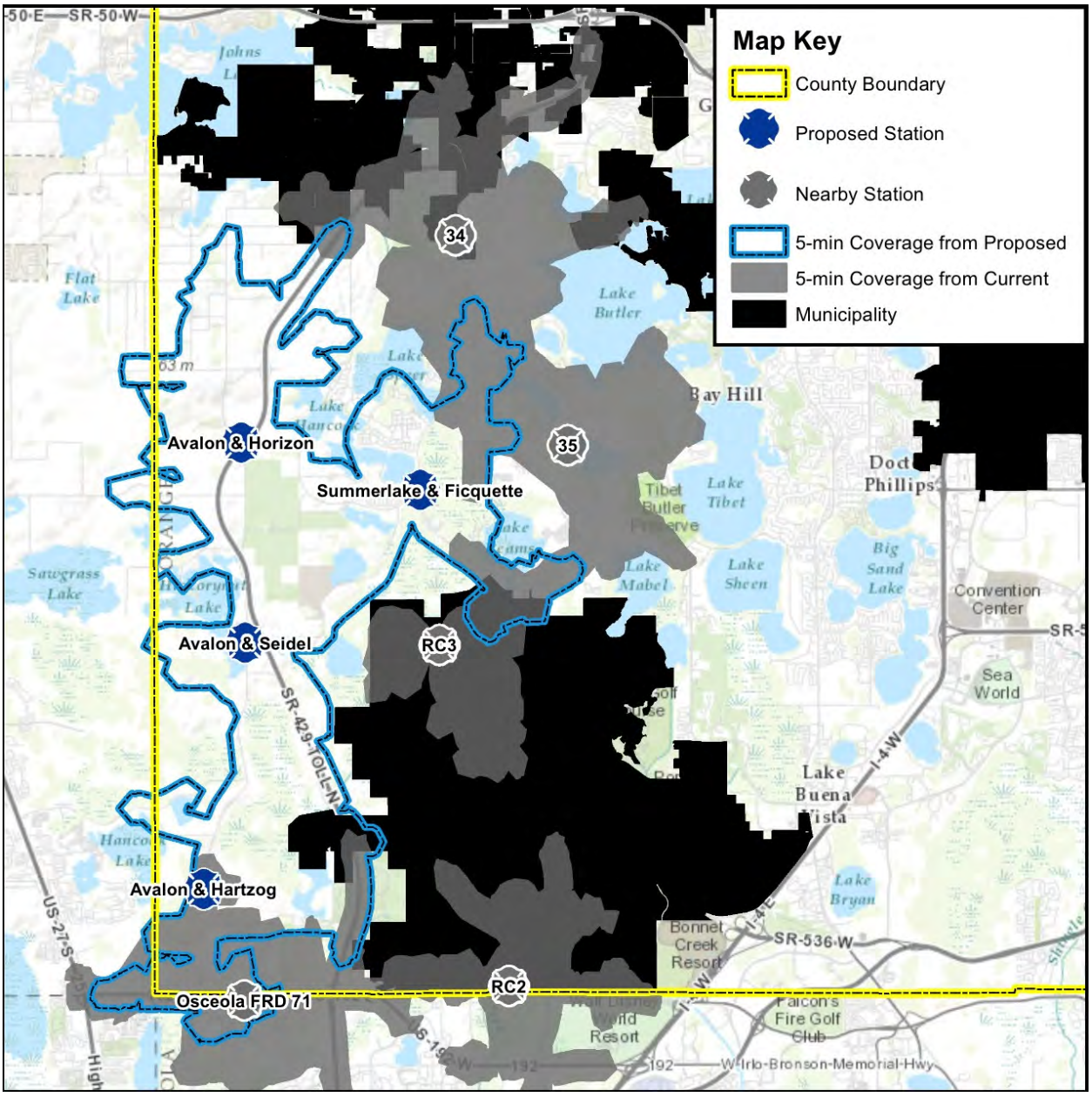
Village I: To provide better coverage to Village I while still maintaining coverage to the areas covered by Station 32, it is recommended to relocate Station 32 to Avalon Road and Hartzog Road. This is a long-term goal and the exact timing should be made on how quickly this area develops. When Station 32 is moved, there may be somewhat of a coverage gap where Station 32 is currently located in a shopping center at 14932 E. Orange Lake Blvd., though Osceola Station 71 should be able to provide good coverage to this area under the already present mutual-aid agreement.

Recommendation 10: Relocate temporary Station 32 to a permanent location near Avalon Road and Hartzog Road to improve coverage for Village I. Suggested timing for the new facility is long term (10+ years).

In summary for Horizon West, existing and expected development imply the need for new stations near or at the following locations:

- Summerlake Boulevard and Ficquette Road (covers Bridgewater Village)
- Avalon Road and Horizon Boulevard (covers Town Center Village)
- Avalon Road and Seidel Road (covers Village F and Village H)
- Avalon Road and Hartzog Road (by moving Station 32 from temporary quarters) to improve coverage to Village I.

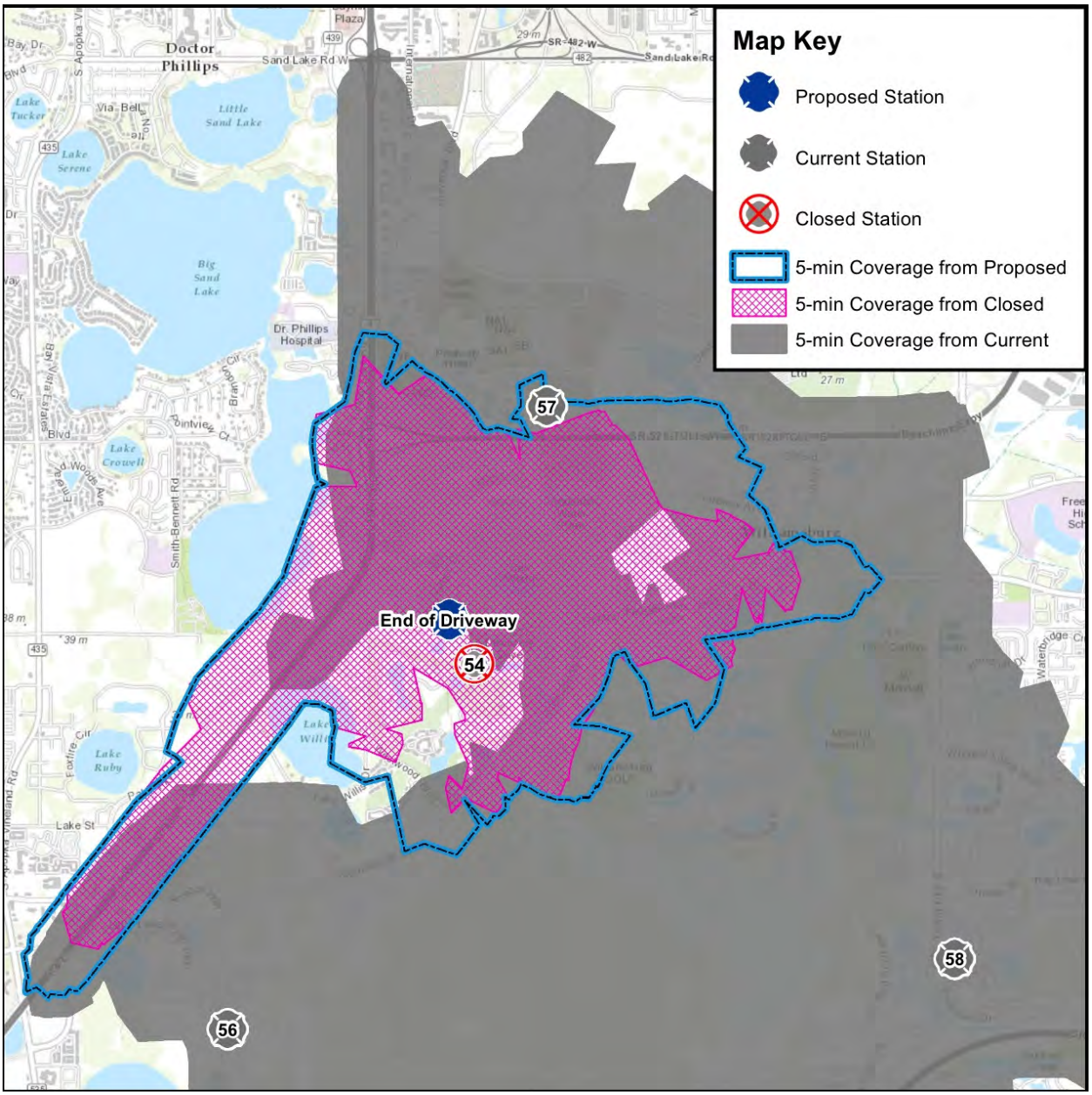
Figure 46. Horizon West Stations



Station 54: Station 54 was built in 1999 and has quite a few additional years left, according to Orange County's station life expectancy of 40 years. However, Station 54 has an extremely long driveway (a third of a mile) that adds approximately 30 seconds to every response at a travel speed of 35 mph, which limits its coverage within response time goals.

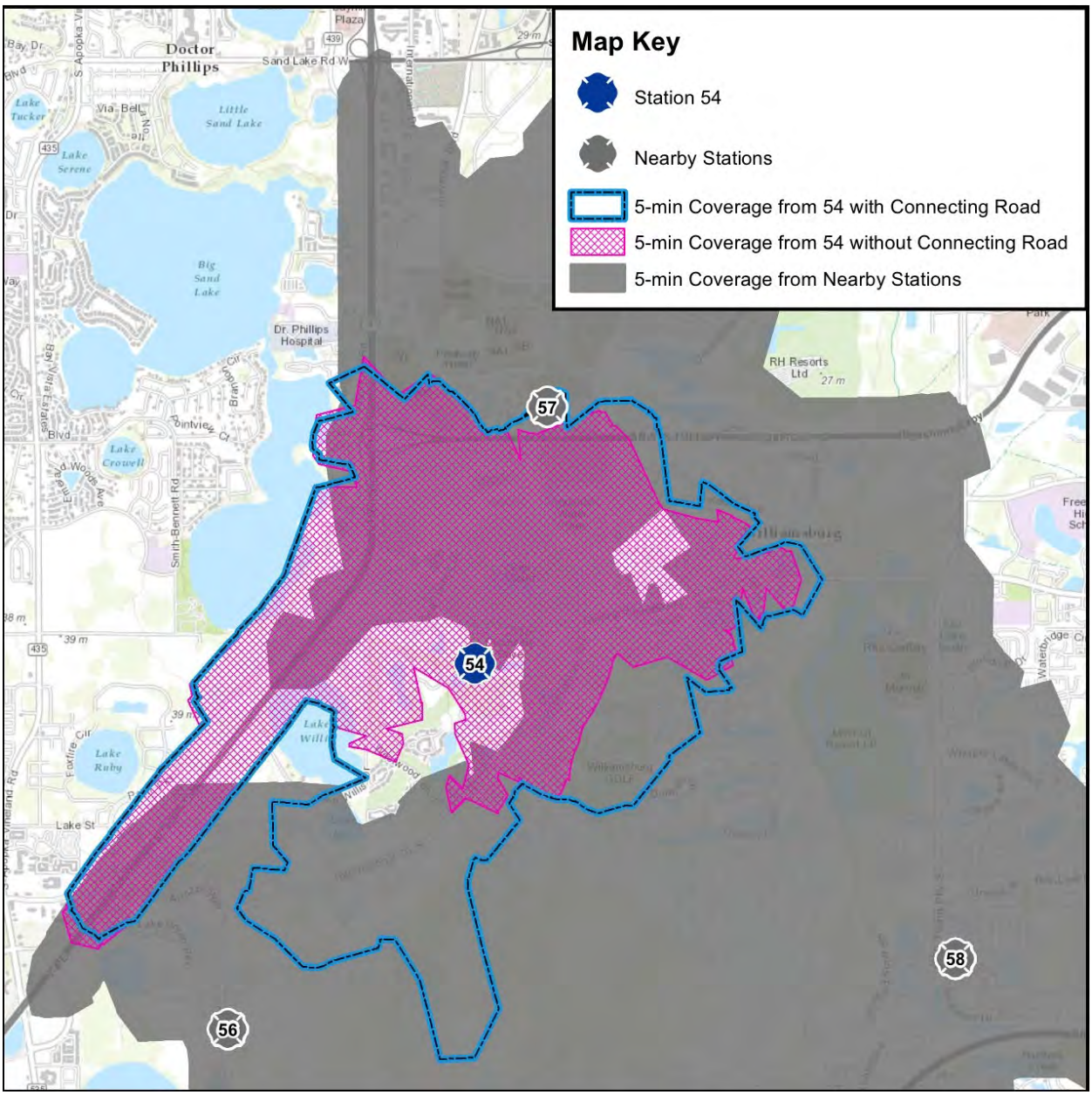
Units must travel the driveway, turn right on the Central Florida Parkway, and then make another right turn on International Drive South, with significant time being lost. While there is no coverage problem in the area covered by Station 54 now, it is expected that by 2040 this area will be urban, requiring lower travel-time goals. Figure 47 shows the additional coverage that would be gained.

Figure 47. Coverage Gain if Station 54 Moved to End of Driveway



Another alternative for Station 54 is to consider a connecting fire department road from the station directly to International Drive South. It appears that land is currently available, but a small bridge would need to be built. This is not a high priority, but Figure 48 shows that such a road would significantly increase the station's travel reach and negate the issue with the long driveway.

Figure 48. Station 54 with Connecting Road to International Drive South

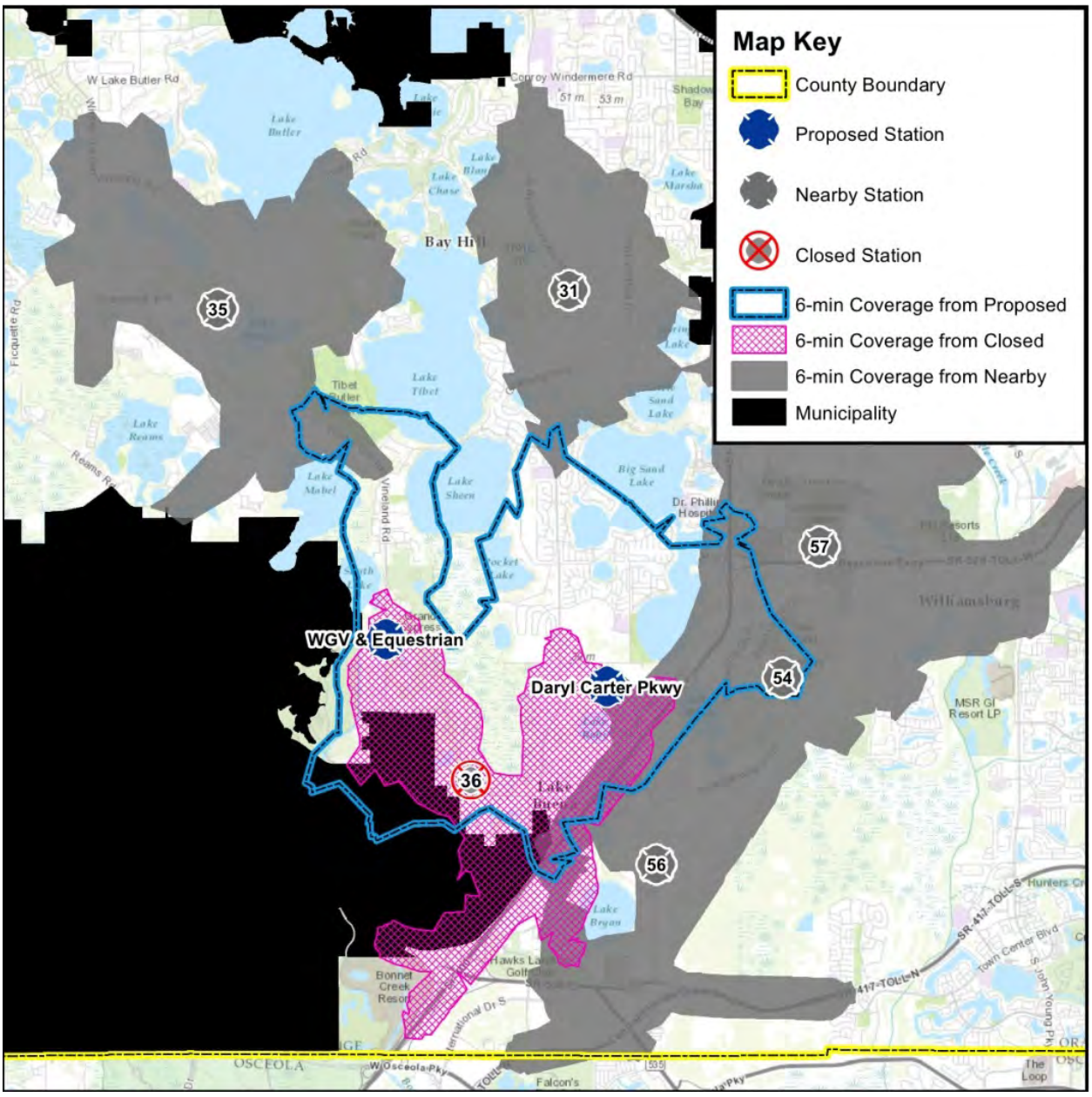


New Station in I-Drive/ Dr. Philips/ Williamsburg: The Palm Parkway area is experiencing significant development. It is expected to become urban by 2020 and metropolitan by 2025. There is a large amount of approved commercial development in this area including hotels. Some of these commercial approvals are being traded in for residential development projects, so it is now a mix of commercial and residential development. This all may require a new station. A new station also would close some existing service-level gaps, especially those in the Estates at Phillips Landing and Sand Lake Cove areas. These communities are already designated as urban population density but it can take up to nine minutes to reach them at present from the closest stations (Stations 31 and 36).

The planned Daryl Carter Parkway extension would provide a very good station location to serve both South Apopka-Vineland Road and Palm Parkway. That extension will connect the two roads. Development is already underway on Palm Parkway. A new station would allow Station 36 to be moved northwest along Winter Garden-Vineland Road to improve coverage to the entire area.

Move Station 36 Northwest: The location of Station 36 (12252 State Road 535) is generally good for traveling northwest along Winter Garden-Vineland Road. However, there is a considerable distance between Station 36 and Station 35 (12144 Chase Road), with significant residential development underway between the two stations. As was discussed in the previous section, Station 36 is poorly located to respond to South Apopka-Vineland Road or Palm Parkway. A new station located on the Daryl Carter Parkway Extension would allow Station 36 to eventually be moved somewhat northwest. Figure 49 compares the current and proposed station coverage if Station 36 is moved northward along Winter Garden-Vineland Road and a new station is built on the Daryl Carter Parkway extension.

Figure 49. WGV and Equestrian Station and Daryl Carter Parkway Station



A potential issue of moving Station 36 is that its present location does cover the very southern portion of the current area where the Waldorf Astoria and several timeshares are located. However, this area can still be covered by Reedy Creek (Station 4), which is located very close to the current Station 36.

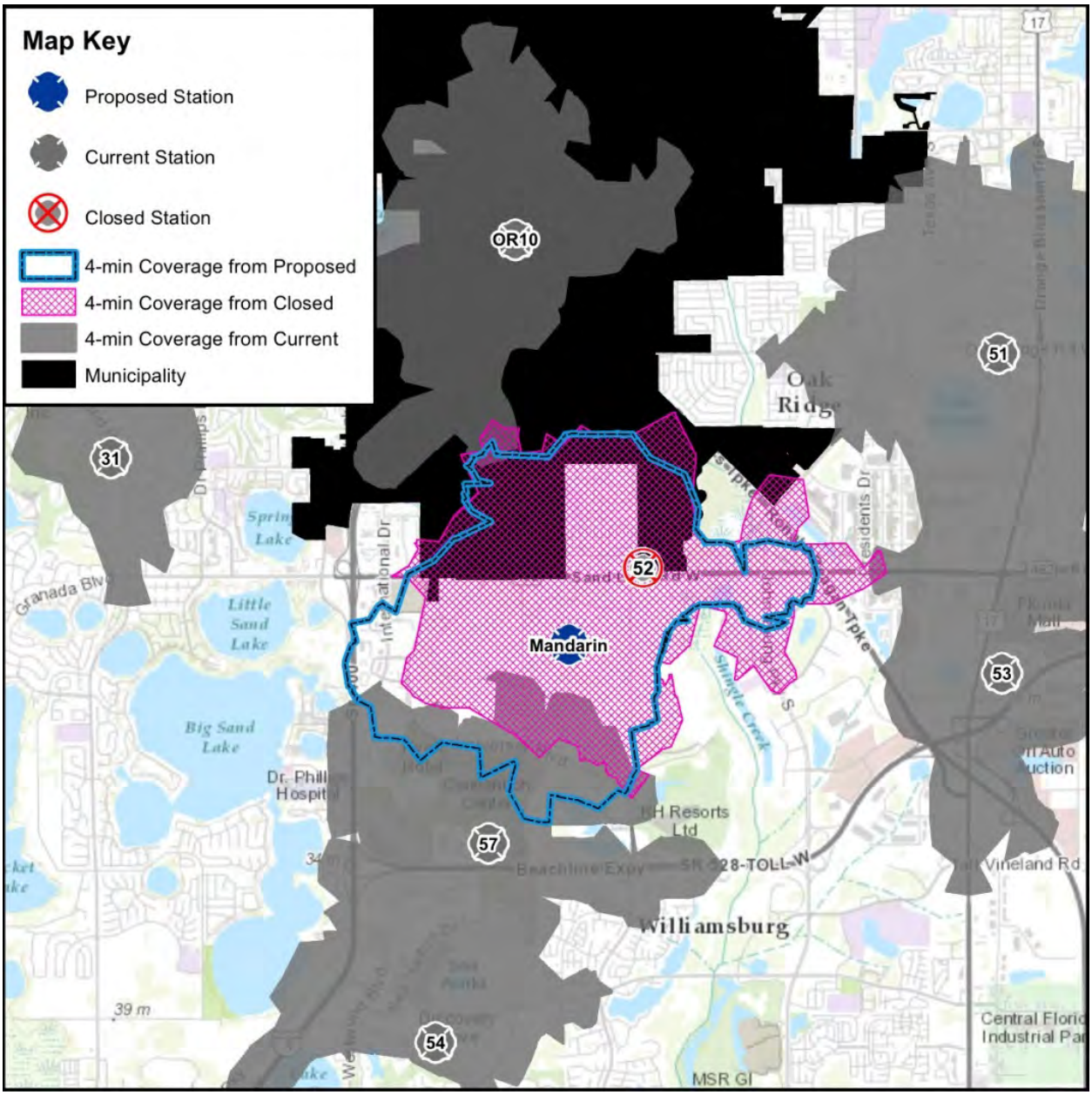
Recommendation 11: Construct a new station near the intersection of Palm Parkway and Daryl Carter Parkway within the next five years (2015-2020). Then move Station 36 to a location near Winter Garden-Vineland Road and Equestrian Drive (2025).

Move Station 52 South: Station 52 (4765 Sandlake Drive) has very inefficient coverage because of its location on the boundary with Orlando. Its primary coverage area of Tangelo Park is metropolitan and has very high demand. Two connecting roads are being constructed through the Lockheed-Martin property directly south of the station. Moving the station southwest near the intersection of these roads will improve overall coverage and at the same time maintain excellent travel times to Tangelo Park.

Plans call for Mandarin Drive to be extended southwest from Tangelo Park beyond Sand Lake Road West to Universal Boulevard, and there is a planned north-south Kirkman Road extension that will ultimately connect Sand Lake Road West and Destination Parkway. Moving Station 52 near the intersection of the Mandarin Drive and Kirkman Road extensions (Figure 50) will improve the station's coverage. The change would also benefit International Drive, where many high-rise structures are located and additional time is needed to get to a fire or a medical patient on the upper floors.

Station 52 was constructed in 1980 and its age likely means that its replacement should be considered in the next 10-20 years.

Figure 50. Mandarin Station 52

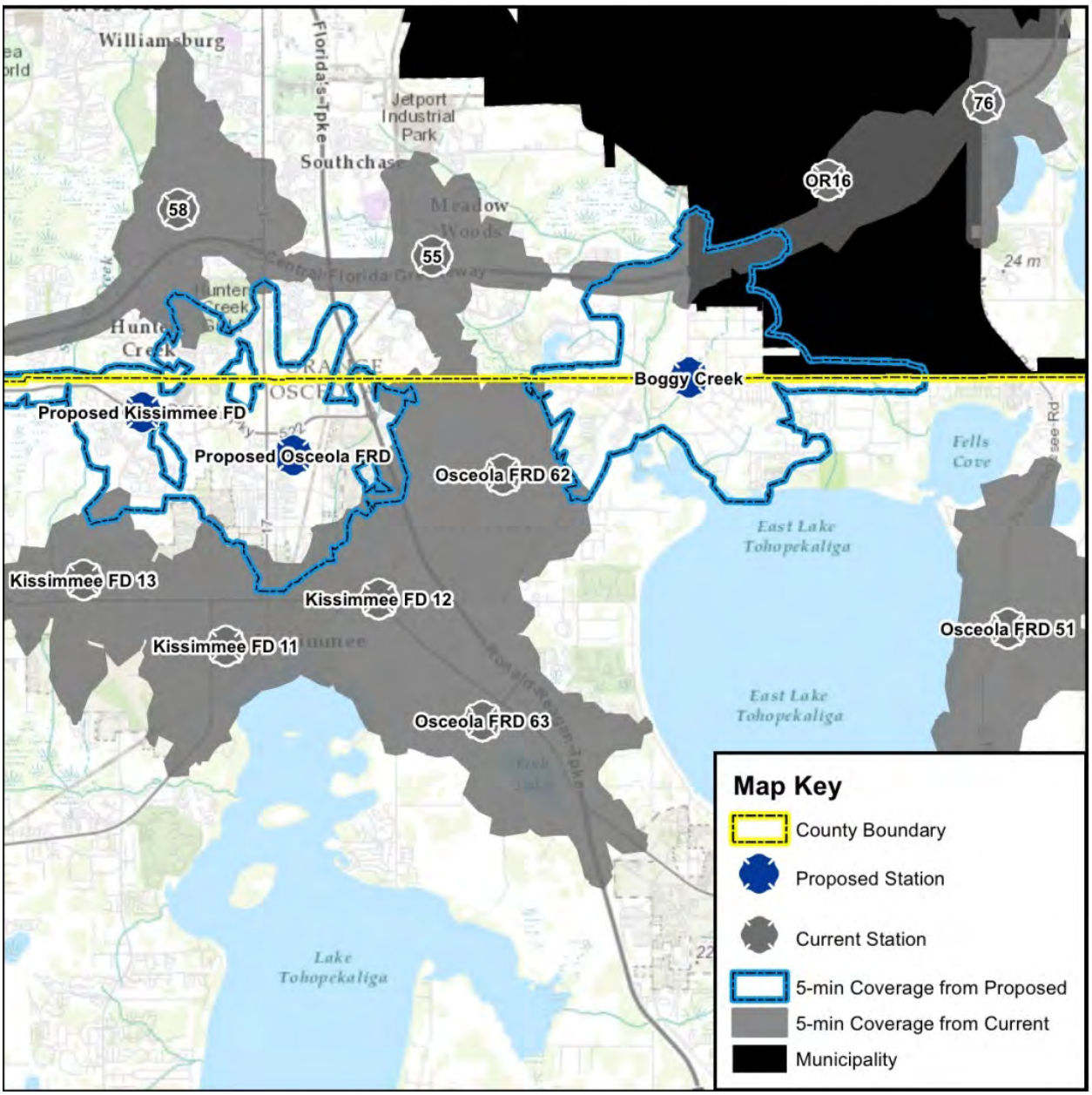


Recommendation 12: Relocate Station 52 to a site near the Mandarin Drive and Kirkman Road Extensions. The suggested timing is long term (10+ years).

New Station in Hunter's Creek/ Meadow Woods: Although currently rural, the Wyndham Lakes and Beacon Park area will see continued development and population growth based on the Traffic Area Zone population projections. There are no current OCFRD stations that will be able to provide the necessary coverage as these areas become urban and metropolitan over the next 25 years. Depending on how the road network is constructed, Station 55 and, to a lesser extent, Orlando's Station 16 would be able to provide some coverage. However, at some point an additional station will likely need to be built in this area. It appears that Osceola County

also has a coverage gap in this area south of the county boundary, with no stations that can provide good coverage to the area just north of East Lake Tohopekaliga and west of Fells Cove. The OCFRD may be able to build a jointly operated station in this area, potentially somewhere along Boggy Creek Road (Figure 51). That could serve the needs of both counties. Orange County already owns property at Caneel Bay Blvd. south of Wyndham Lakes Blvd. Orlando also does not have good coverage in this area and might also benefit from a jointly operated facility.

Figure 51. Potential Boggy Creek Station



Recommendation 13: Consider a cooperative arrangement for a new Boggy Creek station, which could serve Osceola and Orange Counties and the city of Orlando equally well. The suggested timing for a station in Boggy Creek is long term, 10+ years.

Work with Mutual Aid Partners for Southern Border Coverage: Along the southern and southwestern border between Orange County and Osceola County there are station coverage problem areas and more are expected with continued development and population growth. Some of the coverage issues can be addressed by improving automatic aid, primarily with Osceola County but also with the City of Kissimmee. New stations are being planned for Osceola County and Kissimmee; thus coverage improvements can be made if the already good relations with Osceola and Kissimmee are maintained.

Following are the areas that would benefit from improved cooperation along the County's southwestern border:

- **International Drive South** – The International Drive South coverage gap can be covered from Osceola Station 72. This area is expected to change from suburban to urban in 10 years and to metropolitan in 15 years. The OCFRD should work with Osceola County officials to ensure that they can continue providing service to this area in the future.
- **West Town Center** – The area south of West Town Center Boulevard and west of Florida's Turnpike currently has a metropolitan population density and should be covered within a 5:20 travel time. It does not appear that this coverage is possible from Station 55 or Station 58. It is possible that two stations currently planned in Osceola County and Kissimmee could serve this area, though the OCFRD must work with these jurisdictions to make this a reality. Without an agreement, a new station would likely be needed to provide coverage.

Recommendation 14: Increase efforts for regional cooperation of service delivery such as by expanding automatic-aid agreements to improve coverage on the borders with Osceola County, Kissimmee, and Orlando.

Northwest

Coverage in the northwestern portion of Orange County (Figure 52) is generally good and population-density-based response-time goals are being met in most areas. Two areas that already have metropolitan designated population need to be addressed:

- Northern portion of Pine Hills, particularly areas along Clarcona Ocoee Road between Apopka-Vineland Road and North Pine Hills Road: This area should meet a 5:20 travel-time goal but travel times of seven minutes and longer are occurring. As call volumes increase, travel times are likely to increase even more.
- Areas around the intersection of Hiawassee Road and Balboa Drive: This area, which is already developed and has a metropolitan population density, has travel times much longer than the 5:20 goal.

Similar to southwestern Orange County, services to the northwestern region can also be improved by expanding automatic mutual aid:

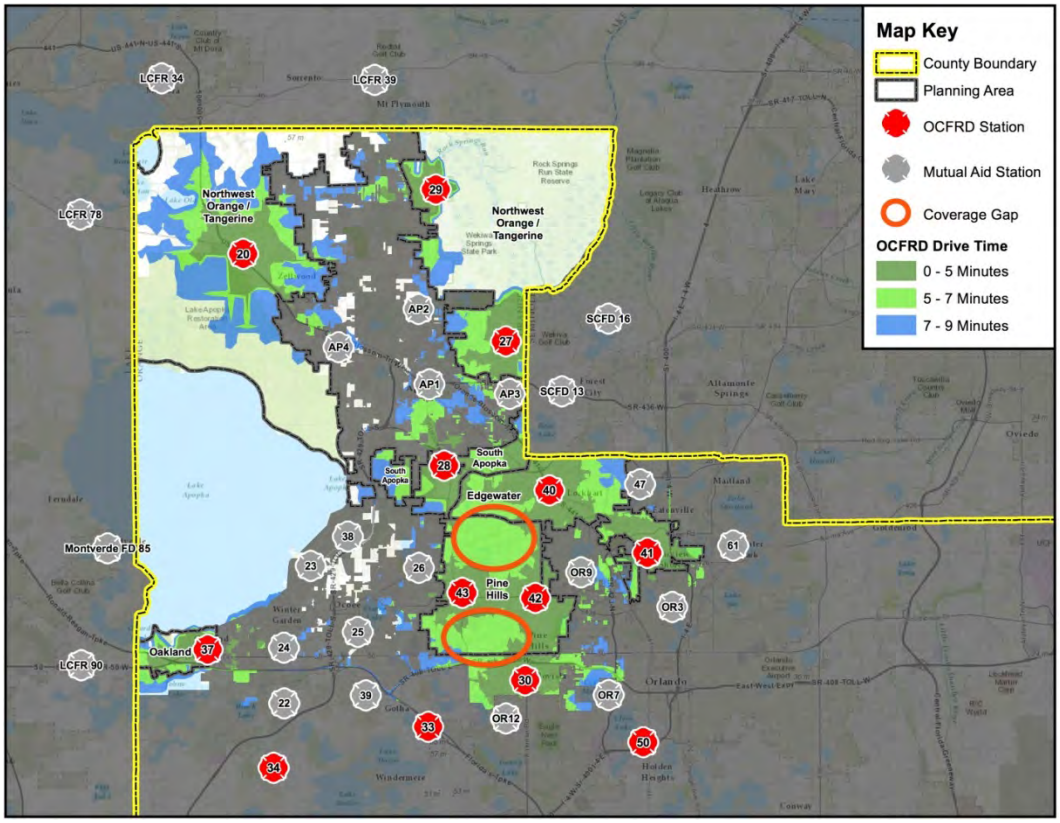
- Forest City Road south of Maitland Boulevard: This area is a coverage gap from OCFRD stations, but can be adequately covered from Maitland Station 47.
- Ferguson Drive north of West Colonial Drive: This area has a metropolitan population density, but can be covered by Orlando Station 7.
- Raleigh Street and South Ivey Lane: This area has a metropolitan population density, but can also be covered by Orlando Station 7.

The northwestern area has large areas of unincorporated Orange County enclaves that are essentially located within other jurisdictions, though the OCFRD remains legally obligated to provide service to them. In this part of the county, there are two particularly dense concentrations of unincorporated Orange County enclaves.

One of these concentrated areas is located in Ocoee and is not easily reachable from any of the Orange County stations. However, Ocoee stations 25, 26, and 38, along with Winter Garden Station 23, surround this area of high enclave density and provide very good coverage to the area. The OCFRD has a good working relationship with Ocoee departments. In fact, the OCFRD has submitted a proposal for consolidation to Ocoee (see Appendix G). The proposal has since been rejected but may be a future consideration.

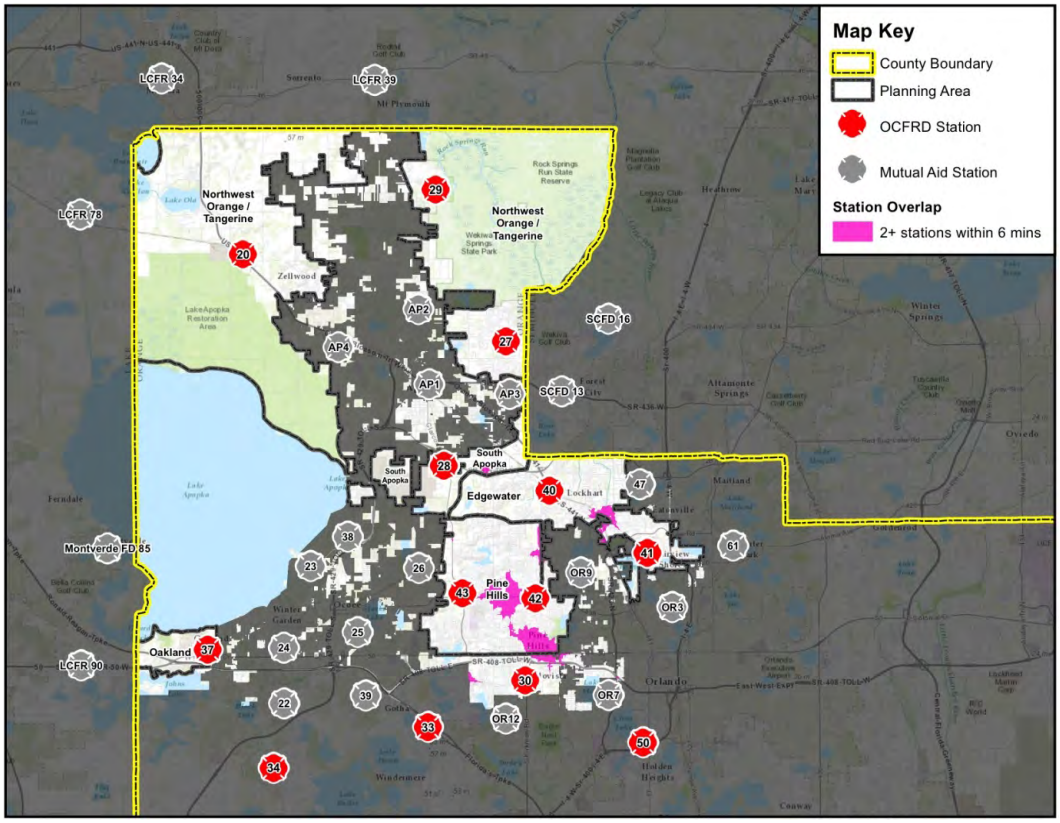
The Apopka area has the same situation, with large swaths of unincorporated Orange County enclaves. Unlike for Ocoee (and Winter Garden), relations with Apopka are not particularly good, and there is no automatic-aid agreement in place. From its four stations, Apopka can easily reach areas of northwestern Orange County long before a county unit would arrive. It makes little sense for Orange County to continue to staff stations that Apopka can easily cover. Considering the lack of automatic aid between Apopka and the OCFRD, the OCFRD does provide reasonably good coverage.

Figure 52. Fire Station Coverage, Northwest Orange County



The current OCFRD station layout in northwest Orange County generally has very little overlapping coverage, as depicted in Figure 53. There is some overlap in the Pine Hills planning area, but this overlap is necessary because this planning area has both metropolitan population density and a significant number of fire and EMS hotspots (as shown in the chapter on risk and demand). Although station redundancy coverage is taken into account when considering station-location recommendations, redundancy can also be achieved by simply having more units in some stations. For instance, later in this section we recommend combining Stations 42 and 43. Although redundancy is needed in Pine Hills because of the high risk and demand, the same redundancy achieved from two separate stations that are located close together can be achieved with double the units at a single station.

Figure 53. Fire Station Overlap, Northwest Orange County



Relocate Stations in Pine Hills and Gotho/ Orla Visto*:* This is a very high fire risk area and one of the areas of highest demand. There are significant fire and EMS hotspots in this area, and the units covering the area have some of the highest workloads (Engine 42 is the second busiest in the county). Our analysis found significant coverage gaps, including the northern portion of Pine Hills along Clarcona Ocoee Road between Apopka-Vineland Road and North Pine Hills Road. These areas are only reachable within seven minutes from Stations 42 and 43. Improvement is also needed in the area near Hiawassee Road and Balboa Drive.

Three stations providing service to Pine Hills are all located less than one mile from the boundary with another jurisdiction. Station 43 (7875 Silver Star Road) is .94 miles from Ocoee, Station 42 (5420 Silver Star Road) is .51 miles from Orlando, and Station 30 (20 S. Hastings Street) is .36 miles from Orlando. Though the distances are not expected to be reduced further because of annexation, their current locations reduce their coverage efficiency. Future plans for these stations should consider addressing the existing coverage gap while improving their locations relative to Orlando and Ocoee.

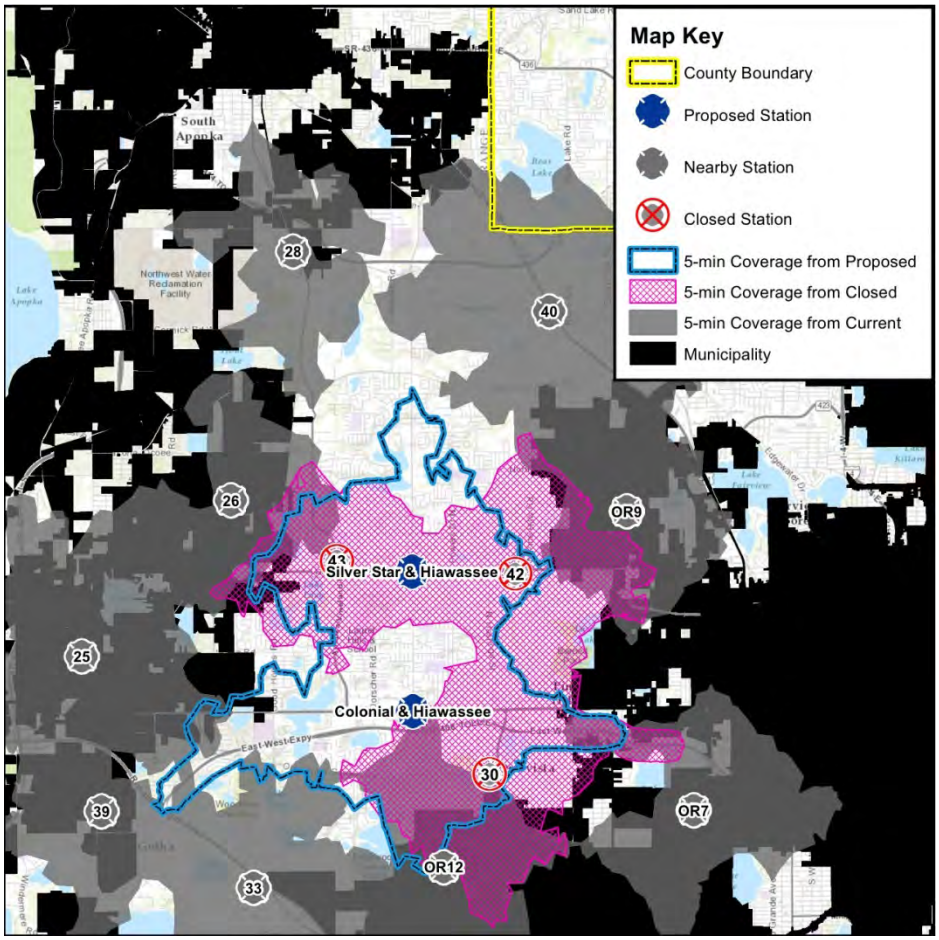
One solution to improve coverage while eliminating stations that are too close to other jurisdictions is to relocate Station 42 to the intersection of North Hiawassee Road and Silver Star Road in the near future. This new station should eventually be able to house units from both Stations 42 and 43. Station 42 and Station 43 are both extremely busy and while a consolidation

of stations is possible, a consolidation of units is not. The new station needs to have sufficient capacity to handle high demand from a single location. Building a super station at the intersection of Silver Star Road and North Hiawassee Road will increase northern coverage by allowing units to travel north along North Hiawassee Road. Because of the close proximity of the current Stations 42 and 43 to other municipalities, there would be no reduction in coverage to any areas with this consolidation.

Additionally, Station 30 should be relocated northwest to the intersection of West Colonial Drive and North Hiawassee Road sometime in the next 10-20years. This is an area with metropolitan population density where 5:20 travel times cannot be achieved. Moving Station 30 away from the Orlando boundary to the northwest will close the coverage gap without sacrificing any Orange County coverage.

Station 30 (constructed in 1991) and Station 43 (constructed in 2001) have many years of useful life remaining; thus we envision both the relocation of Station 30 and the closing of Station 43 (and moving of units to the relocated Station 42) as long-term considerations. If any annexations were to occur in this area, a decision could be made sooner.

Figure 54. Silver Star and Hiawassee Station and Colonial and Hiawassee Station



Recommendation 15: Relocate Station 30 to West Colonial Drive and North Hiawassee Road within the next 5 to 10 years, followed by consolidation of Stations 42 and 43 at North Hiawassee Road & Silver Star Road in 10+ years.

Work with Apopka for Northwest Orange/ Tangerine Coverage: Station 29 (225 Kelly Park Road), which covers a mostly rural area that includes Wekiwa Springs State Park, has the lowest demand of any station in the county. The engine and rescue unit, which are both staffed full time, have a combined volume of 1300 responses per year. Station 29 is clearly underutilized, and the area is easily reached by units from Apopka (Station 2).

OCFRD officials concur that an agreement with Apopka to provide service to the area served by Station 29 makes sense. As was mentioned earlier, however, relations between the OCFRD and Apopka have been less than ideal and an agreement has not been formally discussed. If such an agreement were reached Apopka would need to cover Station 29's area, plus provide automatic aid for emergencies such as structure fires and other multiple-unit incidents occurring in the areas covered by Station 20 (3200 Washington Avenue) and Station 27 (2248 Novella Eliza Lane). As it is, Station 29 now responds through Apopka and past two, and sometimes three, fire stations to assist on calls south of its location. The current arrangement makes little sense.

Recommendation 16: Move forward with negotiations to have Apopka provide service to the area presently served by Station 29. Consider a monetary incentive to Apopka as part of the package.

Summary

To summarize, we recommend the following new Stations and station relocations:

Short-Term (0-5 years)

- North Dean Road & Winder Trail (UCF)
- Avalon Park South Boulevard (East Orange/ Deseret Ranch)
- South Goldenrod Road & Lake Underhill Road (on border between Valencia College and Goldenrod)

Medium-Term (5-10 years)

- North Alafaya Trail & Research Parkway (UCF)
- Summerlake Boulevard & Ficquette Road (Horizon West)
- Daryl Carter Parkway near Palm Parkway (I-Drive/ Dr. Philips/ Williamsburg)
- Relocate Station 30 to West Colonial Drive & North Hiawassee Road (Station 30 is currently in Gotho/ Orla Visto; new location would be on the boundary between Gotho/ Orla Visto and Pine Hills)

Long-Term (10+ years)

- Relocate Station 71 to South Goldenrod Road & Pershing Avenue (Valencia College)

- Avalon Road & Horizon Boulevard (Horizon West)
- Avalon Road & Seidel Road (Horizon West)
- Relocate Station 32 to Avalon Road and Hartzog Road (Horizon West)
- Relocate Station 52 to Mandarin Drive Extension & Kirkman Road Extension (I-Drive/ Dr. Philips/ Williamsburg)
- Boggy Creek Station (Hunter's Creek/ Meadow Woods)
- Relocate Station 36 to Winter Garden-Vineland Road & Equestrian Drive (Horizon West)
- North Hiawassee Road & Silver Star Road (replaces Station 42 and Station 43 (Pine Hills) Note: Station 42 and Station 43 are both extremely busy and, while a consolidation of stations is possible, a consolidation of units is not. The new station needs have sufficient capacity to handle high demand from a single location.

Following are maps that show the coverage that would result from the entire set of new and relocated stations.

Figure 55. OCFRD Station Coverage 0-5 years

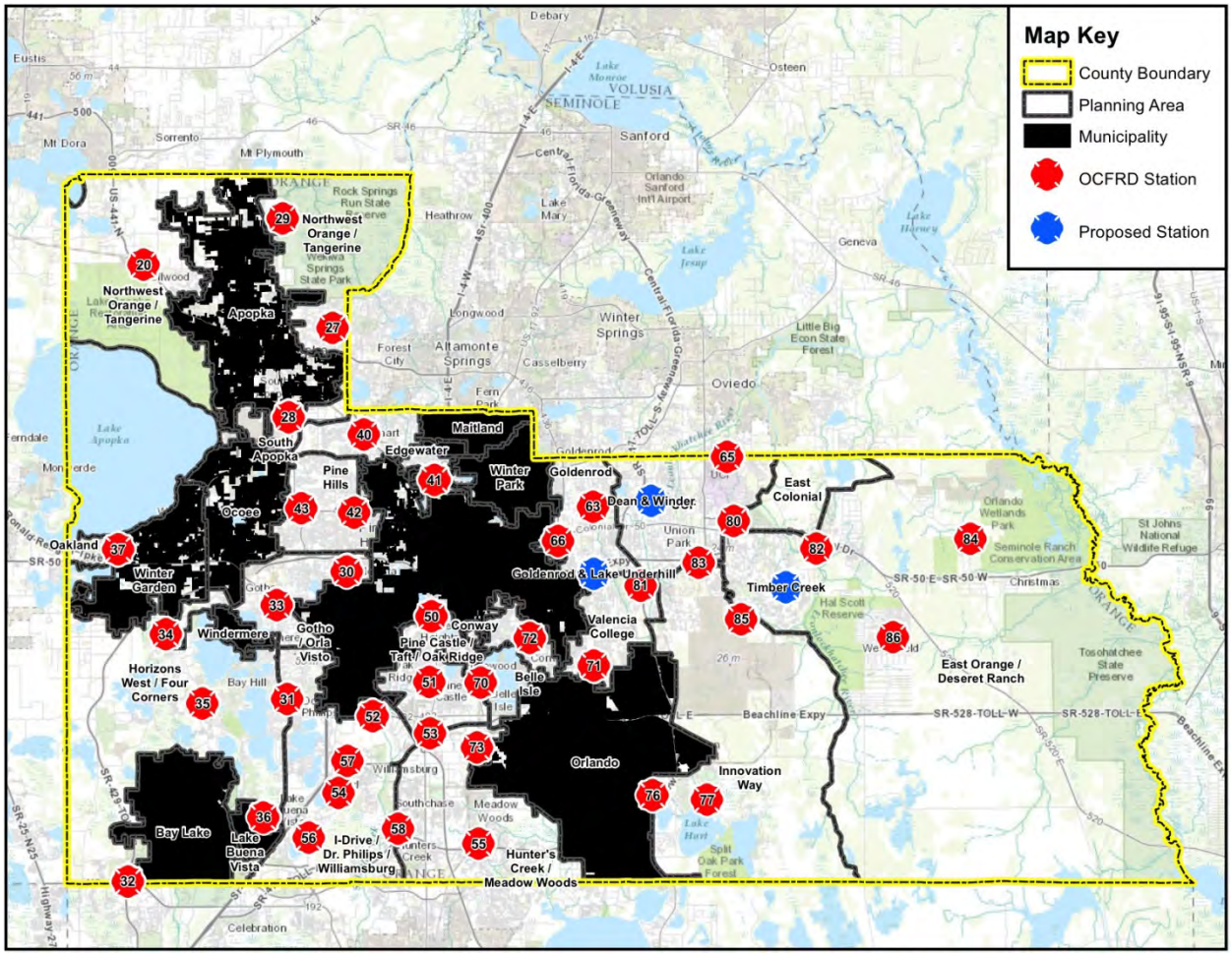


Figure 56. OCFRD Station Coverage 5-10 years

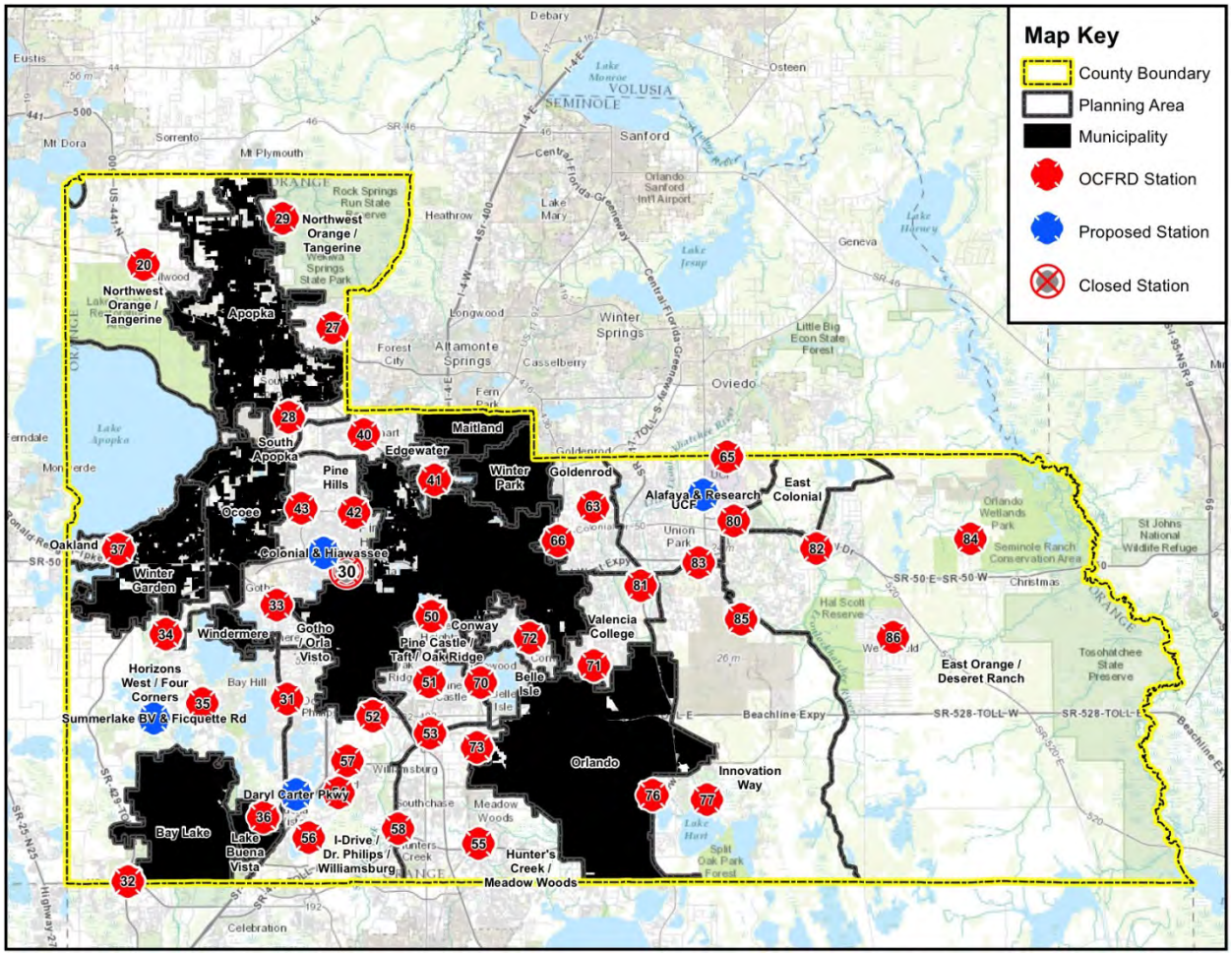
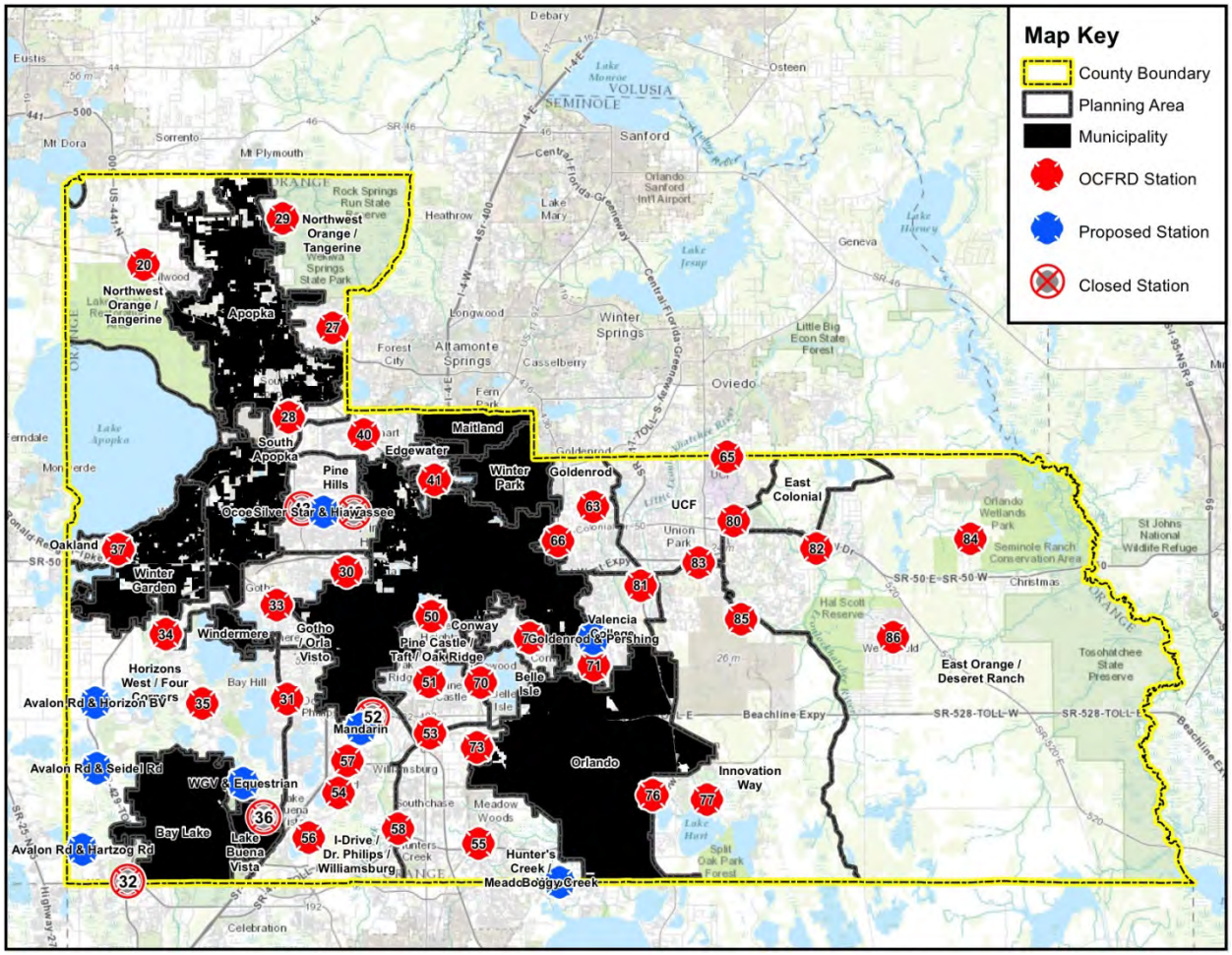


Figure 57. OCFRD Station Coverage 10+ years



CHAPTER VI. FIRE/EMS OPERATIONS AND FACILITY REVIEW

The key focus of this study was to analyze Orange County's expected growth, the demand increase associated with that growth, and the need for new fire stations (and locations) to meet the County's future needs, and the deployment of OCFRD units and personnel to the stations. This chapter focuses on the deployment.

Overview

OCFRD has 41 fire stations with an assortment of fire, EMS, and special units assigned to each. The following units are staffed:

- 38 engines (all of which have at least one paramedic 24/7)
- 2 quints (engines that also have hydraulic aerial ladders)
- 4 ladder trucks
- 3 heavy rescue squads
- 31 paramedic rescues
- 3 water tankers
- 1 command shift officer
- 6 battalion chiefs
- 6 shift captains (EMS supervisors that also fill in for battalion chiefs and provide training)

In addition to the above-listed units, which are staffed 24/7; OCFRD also has other specialized equipment such as brush units, boats, technical rescue vehicles, and a rehabilitation unit. The deployment of personnel and apparatus is good, generally. OCFRD has considered the demand for services and it has implemented such best practices as 'peak demand' medic units, which are staffed only during periods when demand is highest – typically weekdays.

Following are the units deployed by the OCFRD in each of the six battalions. Most fire departments are organized in a similar manner.

Table 32. OCFRD Units and Staffing by Battalion

Stations	Units & Daily Staffing	Total Personnel On-Duty	Stations	Units & Daily Staffing	Total Personnel On-Duty
Battalion 1			**Battalion 2**		
20	Engine - 3		30	Engine - 3	
	Rescue - 2	5		Rescue - 2	
				Truck - 3	
27	Engine - 3			Shift Commander - 1	9
	Rescue -2	5			
			31	Engine - 3	
28	Engine -3			Rescue -2	5
	Rescue -2				
	Tanker -1	6	32	Engine -4	4
29	Engine -3		33	Engine -4	
	Rescue -2	5		Battalion Chief - 1	5
40	Engine - 4		34	Engine - 3	
	Rescue - 2			Rescue - 2	
	Captain - 1	6		Tanker - 1	6
41	Quint - 3		35	Engine - 3	
	Rescue -2			Captain - 1	4
	Battalion Chief - 1	6			
			37		
42	Engine - 4				
	Rescue - 2		43	Engine - 4	4
	Squad - 4	10		Engine - 4	
				Rescue - 2	6

Stations	Units & Daily Staffing	Total Personnel On-Duty	Stations	Units & Daily Staffing	Total Personnel On-Duty
7 Stations	**6 Engines** **1 Quint** **1 Squad** **7 Rescues** **1 Tanker** **1 Captain** **1 Battalion Chief**	**43**	**8 Stations**	**8 Engines** **1 Truck** **4 Rescues** **1 Tanker** **1 Captain** **1 Battalion Chief** **1 Shift Commander**	**43**
Battalion 3			**Battalion 4**		
36	Engine - 3 Rescue - 2	5	50	Engine - 3 or 4 Rescue - 2 Captain - 1	6 or 7
54	Truck - 3 Rescue - 2 Squad - 4 Battalion Chief - 1	10	51	Engine - 4 Rescue - 2 Truck - 3 Battalion Chief - 1	10
56	Engine -4	4	52	Engine - 3 Rescue - 2	5
57	Engine -4 Captain - 1	5	53	Engine - 3 or 4 Rescue - 2	5 or 6
58	Engine - 3 or 4 Rescue - 2	5 or 6	55	Quint - 3 Rescue - 2	5
			70	Engine - 3 or 4 Rescue - 2	5 or 6
			73	Engine - 4	4

Stations	Units & Daily Staffing	Total Personnel On-Duty	Stations	Units & Daily Staffing	Total Personnel On-Duty
5 Stations	**4 Engines** **1 Truck** **1 Squad** **3 Rescues** **1 Captain** **1 Battalion Chief**	**29 - 30**	**7 Stations**	**6 Engines** **1 Quint** **1 Truck** **6 Rescues** **1 Captain** **1 Battalion Chief**	**40 - 43**
Battalion 5			**Battalion 6**		
63	Engine - 4 Rescue - 2	6	65	Engine - 4	4
66	Engine - 3 Rescue - 2	5	80	Engine - 3 or 4 Rescue - 2 Battalion Chief - 1	6 or 7
71	Engine - 4 Rescue - 2 Captain - 1	7	82	Engine - 3 Rescue - 2 Tanker - 1	6
72	Engine - 4 Rescue - 2 Battalion Chief - 1	7	83	Engine - 4 Rescue - 2 Truck - 3 Captain - 1	10
76	Engine - 3 Rescue - 2	5			
77	Engine - 4	4	84	Engine - 3 Rescue - 2	5
81	Engine - 4 Rescue - 2 Squad - 4	10	85	Engine - 3 Rescue - 2	5
			86	Engine - 4	4

Stations	Units & Daily Staffing	Total Personnel On-Duty	Stations	Units & Daily Staffing	Total Personnel On-Duty
7 Stations	7 Engines 1 Squad 6 Rescues 1 Captain 1 Battalion Chief	44	7 Stations	7 Engines 1 Truck 5 Rescues 1 Tanker 1 Captain 1 Battalion Chief	40-41

The daily staffing for OCFRD is usually 242 to 246 positions, depending on whether some engines are staffed with three or four personnel. With 41 stations the current organization by six battalions is reasonable. If however, OCFRD adds two or three more stations in the next few years, as this study recommends, the number of stations and units will exceed a reasonable span of control and another battalion district should be created.

Comparisons

It was requested that comparisons be made amongst the fire departments in the region. As can be seen in Table 33, OCFRD protects a significantly larger population than Osceola County, which is larger in land area.

Table 33. FD Comparisons

Community	Square Miles	Population	Fire Stations	Firefighters	Square Miles per Station	FFs/ 1,000 pop
Apopka	32.6	45,669	4	75	8.2	0.61
Lake County	1152.0	309,736	24	212	48.2	1.46
Maitland	6.4	16,411	2	39	3.2	0.42
Ocoee	15.7	39,676	4	52	3.9	0.76
Orlando	110.7	255,636	17	521	6.5	0.49
Osceola County	1506.0	295,533	15	321	100.4	0.92
Reedy Creek	38.6	0[7]	4	160	9.7	N/A
Seminole County	345.0	437,086	17	384	20.3	1.14
Winter Park	10.2	29,073	3	72	3.4	0.39
Average	**358.0**	**171,407**	**10**	**204**	**35.8**	**0.84**
Orange County	**1122.0**	**786,296**	**41**	**1173**	**27.4**	**0.67**

[7] Reedy Creek is a Special District and there are no permanent residents.

Unit Distribution and Effective Response Force

The distribution of response units throughout the County is generally good. The staffing of units based on their location and service needs are also reasonable. Some aspects of deployment could be improved: Of 41 stations in the County**, 9 stations (22 percent) do not have EMS rescues, which are the primary patient transport units** – Over 70% of the demand for OCFRD is medical calls. A long-term goal to have an EMS rescue in every County station should be pursued, for reducing transport times. OCFRD policy is that Advanced Life Support (ALS) can be provided by the paramedic on every County engine before an ALS unit arrives. Considering the demand for EMS, which is going to continue to increase, adding rescues to already existing and future stations is good public policy.

- **Four-person staffing should be provided on engines in the rural areas of the County** – Station 84 and 85 both operate with three-person engines. Though both stations also have two-person rescues, the likelihood exists that the rescue may be on a medical call when a structure fire occurs, given the high volume of EMS calls. Response times for additional arriving fire units to assist the engines in these areas is considerable, and engines staffed by three responders as the first unit to arrive will not be effective for structure fires. Station 29 is another three-person engine, though it is recommended this station be closed, with Apopka providing service under an automatic aid agreement.
- **The distribution of Battalion Chiefs could be improved** – As it stands, with the exception of Battalion 6 at Station 80, six battalion chief officers are all located within the metropolitan area of Orange County. Response times from Battalion Chiefs are important when it comes to developing effective incident strategies. The current rationale for Battalion Chiefs being in certain stations could be the available space. It is likely however, that a better distribution plan could be adopted to speed arrival of a battalion chief to a serious incident.

Effective Response Force – A positive for OCFRD is the excellent dispatch policy and event type codes used to determine the number of units to be dispatched on various call types. Especially good is the dispatch policy whereby suppression units, not specific unit types, are dispatched for structure fires. In larger departments concrete distinctions are made between engines (which are responsible for water supply and fire suppression) and ladder trucks (search, rescue, and ventilation). OCFRD does not use that formula; instead it considers suppression units the same and thus assigns priorities based on availability, not unit type. This good policy, which was adopted in the past few years, improves efficiency.

OCFRD classified events into 35 event types such as auto accidents, shed fires, automatic alarms, hazardous material incidents, and many more. The incident type of most concern as to unit deployment is the structure fire, as these require the heaviest response in terms of personnel and fire apparatus. Hazardous material incidents can also require many resources.

Structure fire responses in Orange County are generally one of two types: residential or commercial. The residential structure fire response for OCFRD calls for 3 suppression units, 2

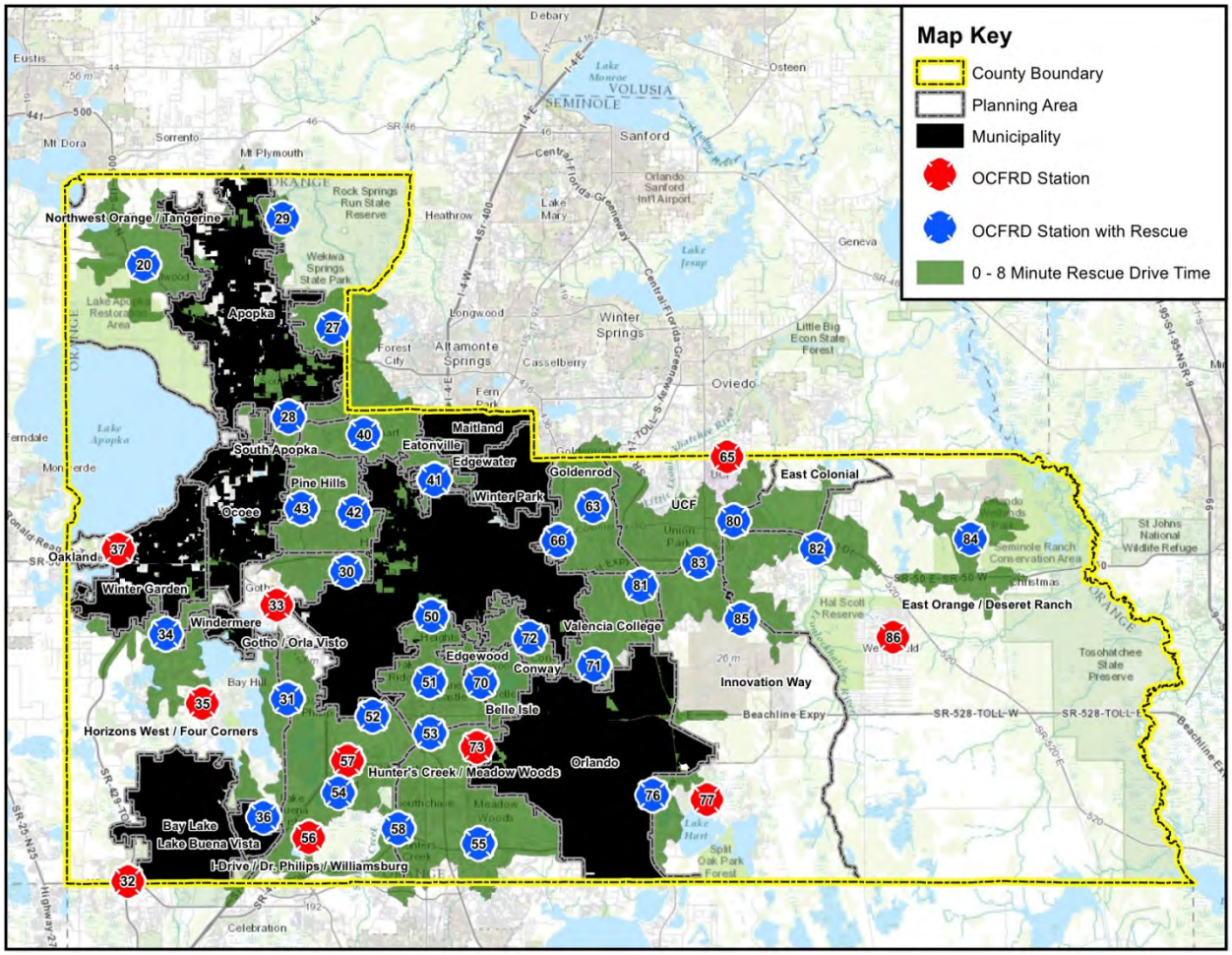
rescues, 1 captain and 1 battalion chief, for a total response of 15 – 18 personnel. When a fire is reported in a commercial structure, the response is 5 suppression units, 2 rescues, 1 squad, 1 captain, and 1 battalion chief, for a total of 19-23 personnel. The number of units and personnel mirror those suggested by the National Fire Protection Association (NFPA) standards and National Institute of Science and Technology (NIST), both of which have studied the issue of firefighter safety and health.

While the OCFD has developed good policies regarding dispatch it does not yet analyze the effectiveness of responses to various incident types. For example, how often are the units dispatched to certain call types actually used at the scene? In previous TriData studies it has often been determined that some event types may have too many units dispatched. Dispatching fewer units on some calls means that more units will be available to handle other calls. There is also a need to analyze in greater detail the effective response force of units and personnel as to the time it takes for them to actually arrive at the scene, especially to structure fires.

Rescues – While the engines are the first line of defense for fire suppression, it is the rescue units that have the highest workloads due to the demand for medical service. The County is fortunate to have a top-tier medical service with 31 of its 41 stations having a rescue unit. In addition to the rescues each of the fire units also has at least one paramedic.

A deployment plan for rescues should be such that a rescue with transport capabilities could be on-scene within eight minutes. The current deployment plan achieves this in most areas, as can be seen in the following map.

Figure 58. Rescue Coverage

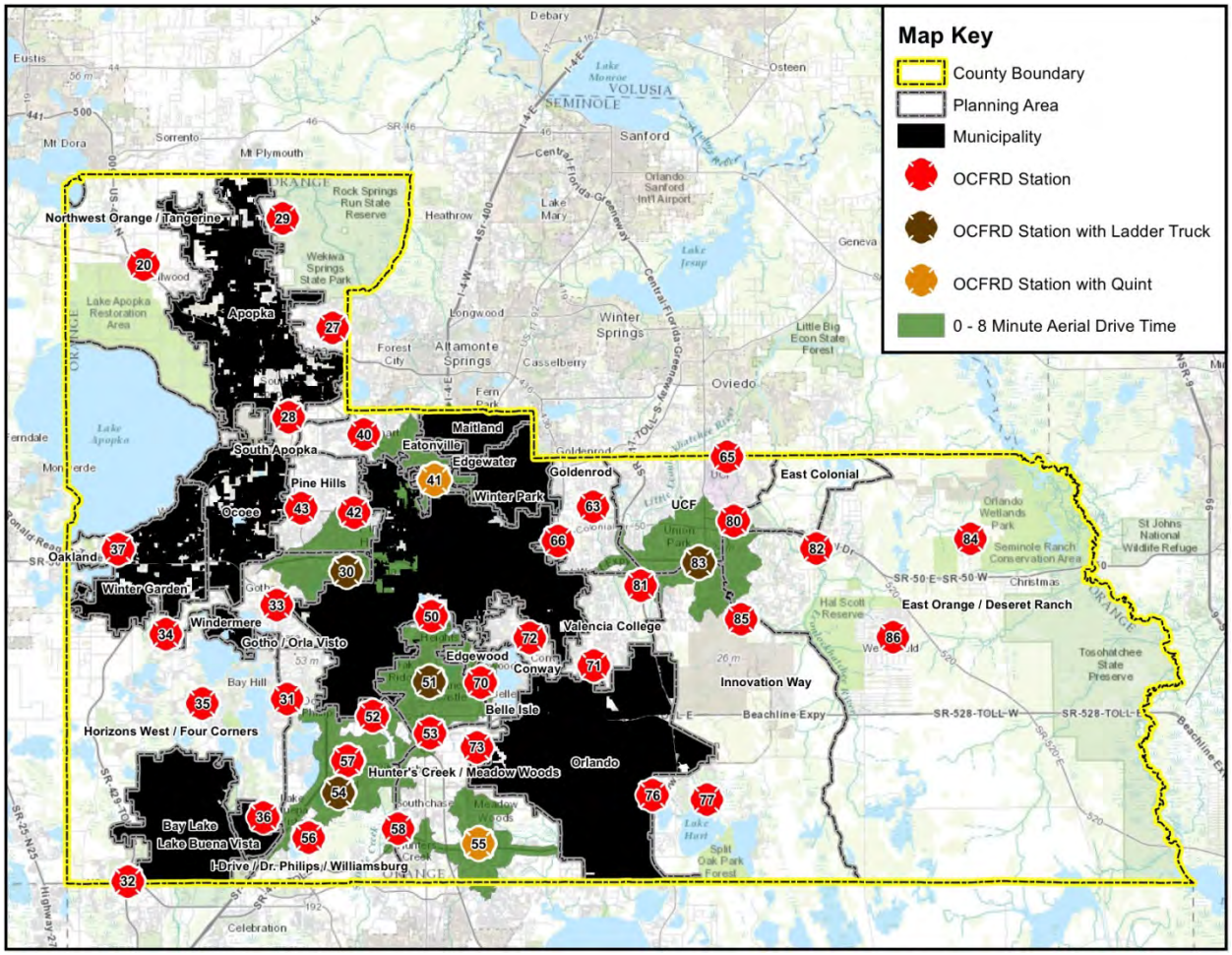


The one area where improvement could be made is if the rescue from Station 29, which we recommend could be covered by Apopka, were relocated. One possibility is to Station 33, which has a coverage gap.

Engines, Ladders, and Squads – The primary first response units for OCFRD are its engines, trucks (and quints), and squads. Each of the 41 stations has at least one engine (or quint) capable of fire suppression, so we did not focus too much on engines. Considered more important is the location of trucks (and quints) and squads, to determine whether there were concerns about the deployment of these units. There were not.

Trucks equipped a hydraulic aerial ladder or bucket is sometimes needed for incidents in multi-story buildings. For Orange County most of these structures are located in the metropolitan and urban area where there is sufficient ladder (and quint) coverage within the generally accepted response travel time of eight minutes.

Figure 59. Ladder Truck and Quint Coverage, 8 Minute Travel Time



The location of the four ladder trucks and two quints (six ladder trucks overall) is good. The one area where coverage can be improved in the future is the Goldenrod and University of Central Florida planning areas. This is not an immediate concern, however.

Medic Units – While the primary recommendations here are for new stations and possible consolidations, there are some areas where the issue is not a location of the station, rather it is the 'busyness' factor of units in them. When workloads get very high units are available less of the time and another unit from further away must handle the call. This is especially of concern for high priority EMS calls, which are frequent.

OCFRD recognizes that demand is so high in some areas, especially for EMS calls, that it has taken steps to improve response times by creating peak-load EMS transport units. Called medics, these are the same as rescues but staffed only during peak weekday periods when demand is highest. As could be seen earlier in this report, some of the medic units have very high demand. Medic units are current located at the following stations:

Medic 1 - Station 66	Medic 2 - Station 80	Medic 3 - Station 56
Medic 4 - Station 50	Medic 5 - Station 51	Medic 6 - Station 30

Medic 7 - Station 33 Medic 8 - Station 35

The workload for two of the medics is becoming so high as to consider whether an additional unit at the station, or nearby, is warranted. Medic 3, which operates out of Station 56 is already using 51% of its available time on calls. Medic 5, located at Station 51, is also very high (40% of time on calls). A general rule of thumb based on experience is that anything above 30% is the point at which to evaluate whether additional capacity is needed. Rescue 42 is the only rescue with a utilization rate of 35 percent. Responding to just over 3,000 calls per year, this unit should also be monitored. Private ambulance companies, which want to operate at peak efficiency, try to stay under 40% on calls, to avoid burnout of their personnel.

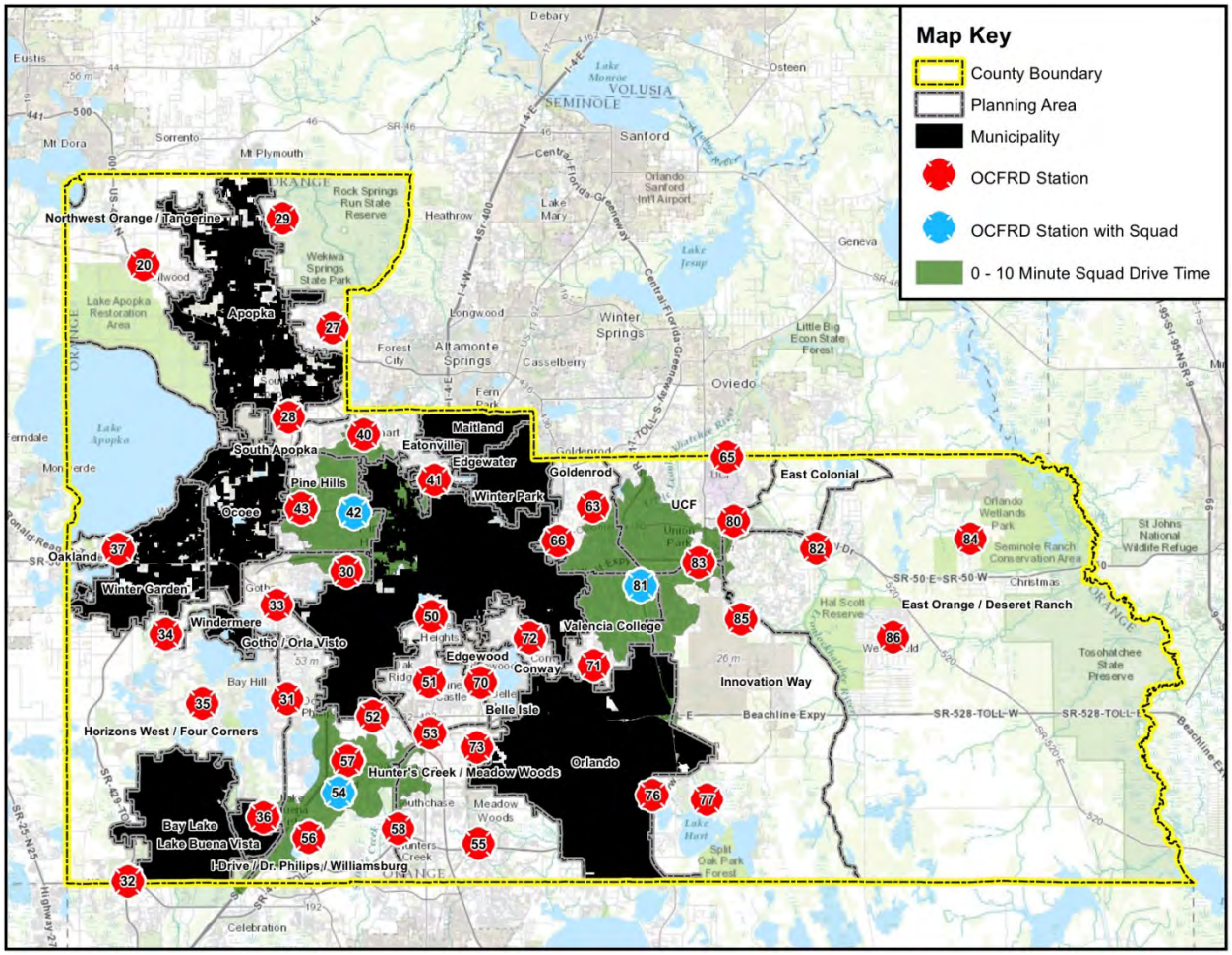
Recommendation 17: Add two additional medic units to reduce the workload of Medics 3 and 5.

Specialized Services: As an all-hazards department, OCFRD has some of the best equipment and training to deliver the specialized services often needed in a metropolitan area. It has clearly devoted considerable time and attention to making sure these services are available when they are needed. Though calls requiring specialized services are infrequent, it is important they be available when needed. Specialized services provided by OCFRD are:

- Hazardous materials response
- Structural collapse and confined space rescue
- Trench rescue
- Vehicle and machinery rescue
- High-angle rope rescue

Coverage of the three squads is also good, with their locations around the more urban core of the County. There are no travel-time standards for squads though a 10 minute drive time would be considered reasonable. The following map shows the location of OCFRD's three squads and the 10 minute travel times from their locations.

Figure 60. Location of Squads with 10-Minute Travel time



At the time of this study OCFRD was considering whether to add a dive-rescue team.

Special operations are primarily delivered from Station 54, located in the I-Drive corridor. Squad 1 is the primary special operations unit at Station 54, assisted by Truck 54, which is co-located with Squad 1. OCFRD's two other squads and three other ladder trucks support the primary special operations from Station 54.

While their capability is good, Station 54 may not be the best location for the special operations units because the station is in a high-demand area, and not particularly central to the rest of Orange County. The station also has limited space to house the special operations equipment, and some equipment is stored outside, as shown in Figure 61. This is not just a problem for Station 54 but other stations as well.

Figure 61. Specialized Equipment Stored Outside – Station 54



There are few options as to where the special operations component of OCFRD might be located. It is preferable that the location have one of the three squads, since the squad personnel are the most highly-trained in the various special services. The location should be close to a major roadway to allow better response times throughout the County.

Stations 42 and 81 are the other with squads. Station 42 is in a very high demand area and thus might not be the best choice to add a unit with high training requirements. Station 81 is less busy but not as well situated centrally, though it does have access to a major highway. Another site that was considered was Station 51, which does not have a squad but does have one of the four ladder trucks. Station 51 is also better situated centrally and has easy access to I-4 and other major roads. All things considered, Station 81 appears to be a good alternative to Station 54 for special operations units. It is shown in Figure 62.

Figure 62. OCFRD Station 81



Recommendation 18: Consider Station 81 as an alternative location for OCFRD's special operations.

OCFRD Facility Review

OCFRD has very good facilities generally. Crews take pride in their stations and there were no major facility issues reported. The average age of fire stations in Orange County is 21 years. Station 73, located in the Hunter's Creek/ Meadow Woods planning area, is the oldest station (60 years), followed by Stations 51 and 20, 51 and 53 years, respectively. Stations 84 (2 years) and 35 (6 years) are the newest fire stations. OCFRD does have several stations where

apparatus is parked outside and the crews are housed in a temporary facility. Temperate weather in central Florida does allow apparatus to be stored outside and the Department has secured the equipment fairly well.

In the following section we review the stations relative to their particular age, with the idea in mind that older stations, when they are considered for replacement or updating, should be considered for relocation at that time. We did not evaluate the actual condition of each station, as this would have required an in-depth review of each facility. The age and its relative classification for OCFRD stations are:

0 - 10 Years…	Excellent
10 - 20 Years…	Very Good
20 - 30 Years…	Good
30 - 40 Years…	Fair
40+ Years…	Poor

Stations that have been updated in recent years were upgraded one classification, though not to the excellent category.

The section is organized using the same east, northwest, and southwest regions of the County as were used in the previous chapter.

East

East Colonial – One station is located in the East Colonial planning area (82).

Station:	82
Constructed:	1991
Condition:	Good
Units:	Engine Rescue Tanker (staffed) Woods
Workload:	Moderate



East Orange/ Deseret Ranch – Stations 84 and 86 are in this area, which is the most rural area in Orange County.

Station:	84
Constructed:	2013
Condition:	Excellent
Units:	Engine Rescue Woods
Workload:	Low



Station:	86
Constructed:	1997
Condition:	Poor (Temporary)
Units:	Engine Woods
Workload:	Low



Goldenrod – Stations 63 and 66 are located in the Goldenrod planning area. This area has very high workloads and additional capacity is required. The fire risk for the Goldenrod area is also high.

Station:	63
Constructed:	2000
Condition:	Very Good
Units:	Engine Rescue
Workload:	Very High



Station:	66
Constructed:	1970
Condition:	Poor
Units:	Engine Rescue Medic
Workload:	High



Innovation Way – The area of Innovation way includes Stations 76, 77, and 85.

Station:	76
Constructed:	1983
Condition:	Fair
Units:	Engine Rescue
Workload:	Low



Station:	77
Constructed:	2007
Condition:	Excellent
Units:	Engine Tanker
Workload:	Low



Station:	85
Constructed:	2004
Condition:	Very Good
Units:	Engine Rescue
Workload:	Moderate



University of Central Florida – This planning area is served by three fire stations: 65, 80, and 83. Call demand and workloads are very high in this planning area and additional new development is occurring.

Station:	65
Constructed:	2000
Condition:	Very Good
Units:	Engine
Workload:	High



Station:	80
Constructed:	1973
Condition:	Poor
Units:	Engine Rescue Medic Battalion Chief Brush
Workload:	High



Station:	83
Constructed:	1989
Condition:	Good
Units:	Engine Rescue Ladder Captain
Workload:	High



Valencia College – This planning has two fire stations; 71 and 81. New development and longer than desired response times in this planning area are reasons for new stations.

Station:	71
Constructed:	1976
Condition:	Poor
Units:	Engine Rescue Captain Brush
Workload:	High



Station:	81
Constructed:	2007
Condition:	Excellent
Units:	Engine Squad Rescue
Workload:	Very High



Northwest

Edgewater – This planning area has two stations; 40 and 41.

Station:	40
Constructed:	1981
Condition:	Fair
Units:	Engine Rescue Captain
Workload:	Moderate



Station:	41
Constructed:	1990
Condition:	Good
Units:	Quint Rescue Battalion Chief
Workload:	High



Pine Hills – Located in the Pine Hills planning area are Stations 42 and 43. Station 42 is one of the busiest stations in the County.

Station:	42
Constructed:	1973
Condition:	Fair
Units:	Engine Rescue Squad
Workload:	Extremely High



Station:	43
Constructed:	2003
Condition:	Very Good
Units:	Engine Rescue Woods
Workload:	High



Northwest Orange/ Tangerine – Stations 20, 27, and 29 are located in the Northwest Orange/Tangerine planning area. Station 29's area can easily be covered by Apopka under an automatic-aid agreement with Station 29, which is in a temporary facility, being eliminated.

Station:	20
Constructed:	1962; Updated 2007
Condition:	Good
Units:	Engine Rescue Tanker Woods
Workload:	Moderate



Station:	27
Constructed:	2006
Condition:	Excellent
Units:	Engine Rescue
Workload:	Moderate



Station:	29
Constructed:	1989
Condition:	Poor (Temporary)
Units:	Engine Rescue
Workload:	Low



South Apopka – One station (28) is located in the South Apopka planning area.

Station:	28
Constructed:	1997
Condition:	Poor (Temporary)
Units:	Engine Rescue Tanker (Staffed)
Workload:	Moderate



Southwest

Belle Isle, Conway, Edgewood, Gotho/ Orla Visto, Horizon West/ Four Corners, Hunter's Creek/ Meadow Woods, I-Drive/ Dr. Philips/ Williamsburg, and Pine Castle/ Taft/ Oak Ridge are located in southwest Orange County. There are no fire stations located within the Belle Isle or Edgewood analysis area. These communities are protected under contract by OCFRD.

Conway – Station 72 is located in the Conway planning area.

Station:	72
Constructed:	1994
Condition:	Good
Units:	Engine Rescue Battalion Chief Rehab Unit
Workload:	High



Gotho/ Orla Visto – Stations 30 and 33 are located in the Gotho/ Orla Vista planning area.

Station:	30
Constructed:	1991
Condition:	Good
Units:	Engine Rescue Medic Ladder Ops Chief
Workload:	High



Station:	33
Constructed:	2001
Condition:	Very Good
Units:	Engine Medic Battalion Chief
Workload:	Moderate



Horizon West/ Four Corners – This planning area is the one most likely to be affected by future development. Located in this planning area are Stations 32, 34, 35, 36, and 37.

Station:	32
Constructed:	2005 (Temporary)
Condition:	Poor
Units:	Engine
Workload:	Low



Station:	34
Constructed:	1985
Condition:	Fair
Units:	Engine Rescue Tanker (Staffed)
Workload:	Moderate



Station:	35
Constructed:	2009
Condition:	Excellent
Units:	Engine Medic Captain Woods
Workload:	Low



Station:	36
Constructed:	1986
Condition:	Good
Units:	Engine Rescue Brush
Workload:	Moderate



Station:	37
Constructed:	2004
Condition:	Very Good
Units:	Engine Brush
Workload:	Low



Hunter's Creek/ Meadow Woods – Fire stations located in this planning area are 53, 55, 58, and 73.

Station:	53
Constructed:	1977
Condition:	Fair
Units:	Engine Rescue
Workload:	High



Station:	55
Constructed:	2007
Condition:	Excellent
Units:	Quint Rescue
Workload:	Moderate



Station:	73
Constructed:	1955
Condition:	Poor
Units:	Engine
Workload:	Moderate



I-Drive/ Dr. Philips/ Williamsburg – Fire stations 31, 52, 54, 56, and 57 are located in this planning area. This area is the most densely developed area in Orange County.

Station:	31
Constructed:	1978
Condition:	Fair
Units:	Engine Rescue
Workload:	Moderate



Station:	52
Constructed:	1980
Condition:	Fair
Units:	Engine Rescue
Workload:	High



Station:	54
Constructed:	1999
Condition:	Very Good
Units:	Rescue Ladder Squad Battalion Chief Special Operations
Workload:	High



Station:	56
Constructed:	2004
Condition:	Very Good
Units:	Engine Medic Air-Light
Workload:	Moderate



Station:	57
Constructed:	1992; Upgraded 2010
Condition:	Poor (Temporary)
Units:	Engine Captain
Workload:	High



Pine Castle/ Taft/ Oak Ridge – Fire stations 50, 51, and 70 are located within this planning area. This planning area has is one of the highest in terms of demand.

Station:	50
Constructed:	1981
Condition:	Fair
Units:	Engine Rescue Captain Medic
Workload:	Extremely High



Station:	51
Constructed:	1964; Upgraded 2011
Condition:	Good
Units:	Engine Rescue Medic Ladder Battalion Chief
Workload:	Very High



Station:	70
Constructed:	1999
Condition:	Good
Units:	Engine Rescue
Workload:	High



Following is the same information presented in tabular, summary format. Also provided is information depicting the general heath of fire stations, in particular those requiring additional review.

Table 34. Fire Station Demographics

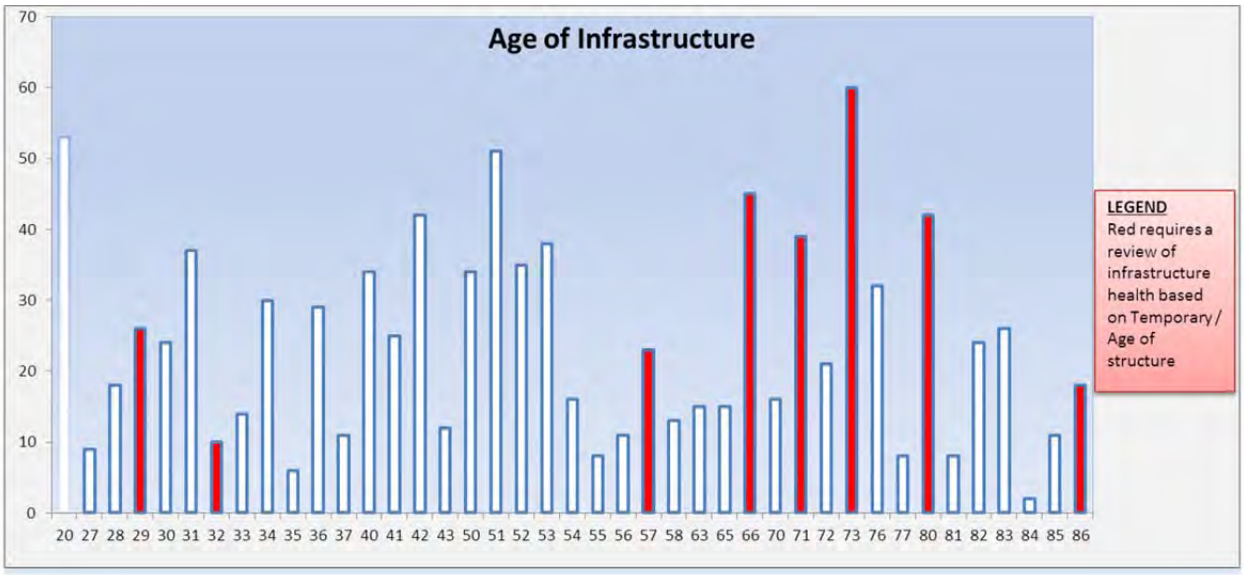
Station	Year Built	Age	Condition	Units in Station	Work Load	Rehab Date
20	1962	53	Good (Updated 2007)	Engine/Rescue/Tanker/Woods	Moderate	2007
27	2006	9	Excellent	Engine/Rescue	Moderate	
28	1997	18	Poor (Temp)	Engine/Rescue/Tanker (Staffed)	Moderate	
29	1989	26	Poor (Temp)	Rescue/Engine	Low	
30	1991	24	Good	Engine/Rescue/Medic/Ladder (Truck)/Ops Chief	High	
31	1978	37	Fair	Engine/Rescue	Moderate	
32	2005	10	Poor (Temp)	Engine	Low	
33	2001	14	Very Good	Engine/Medic/BC	Moderate	
34	1985	30	Fair	Engine/Rescue/Tanker (Staffed)	Moderate	
35	2009	6	Excellent	Engine/Medic/Captain/Woods	Low	
36	1986	29	Good	Engine/Rescue/Brush	Moderate	
37	2004	11	Very Good	Engine/Brush	Low	
40	1981	34	Fair	Engine/Rescue/Captain	Moderate	
41	1990	25	Good	Quint/Rescue/BC	High	
42	1973	42	Fair	Engine/Rescue/Squad	Extremely High	
43	2003	12	Very Good	Engine/Rescue/Woods	High	

Station	Year Built	Age	Condition	Units in Station	Work Load	Rehab Date
50	1981	34	Fair	Engine/Rescue/Captain/Medic	Extremely high	
51	1964	51	Good (Upgraded 2011)	Engine/Rescue/Medic/Ladder (Truck)/BC	Very High	2011
52	1980	35	Fair	Engine/Rescue	High	
53	1977	38	Fair	Engine/Rescue	High	
54	1999	16	Very Good	Rescue/Ladder (Truck)/Squad/BC/Special Ops	High	
55	2007	8	Excellent	Quint/Rescue	Moderate	
56	2004	11	Very Good	Engine/Medic/Air-Light	Moderate	
57	1992	23	Poor (Temp)	Engine/Captain	High	2010
58	2002	13	Good	Engine/Rescue/Woods	High	
63	2000	15	Very Good	Engine/Rescue	Very High	
65	2000	15	Very Good	Engine	High	
66	1970	45	Poor	Engine/rescue/Medic	High	
70	1999	16	Good	Engine/Rescue	High	
71	1976	39	Poor	Engine/Rescue/Captain/Brush	High	
72	1994	21	Good	Engine/Rescue/BC/Rehab	High	
73	1955	60	Poor	Engine	Moderate	
76	1983	32	Fair	Engine/Rescue	Low	
77	2007	8	Excellent	Engine/Tanker	Low	
80	1973	42	Poor	Engine/Rescue/Medic/BC/Brush	High	
81	2007	8	Excellent	Engine/Rescue/Squad	Very High	
82	1991	24	Good	Engine/Rescue/tanker/Woods	Moderate	
83	1989	26	Good	Engine/Rescue/Ladder(Truck)/ Captain	High	
84	2013	2	Excellent	Engine/Rescue/Woods	Low	
85	2004	11	Very Good	Engine/Rescue	Moderate	
86	1997	18	Poor (Temp)	Engine/Woods	Low	

Table of Criterions

0 - 10 Years…	Excellent
10 - 20 Years…	Very Good
20 - 30 Years…	Good
30 - 40 Years…	Fair
40+ Years…	Poor

Figure 63. Fire Station Age and Health



VII. SUMMARY OF RECOMMENDATIONS

Following is the entire set of recommendations (and page number) for each. The purpose and timing of each recommendation are also shown.

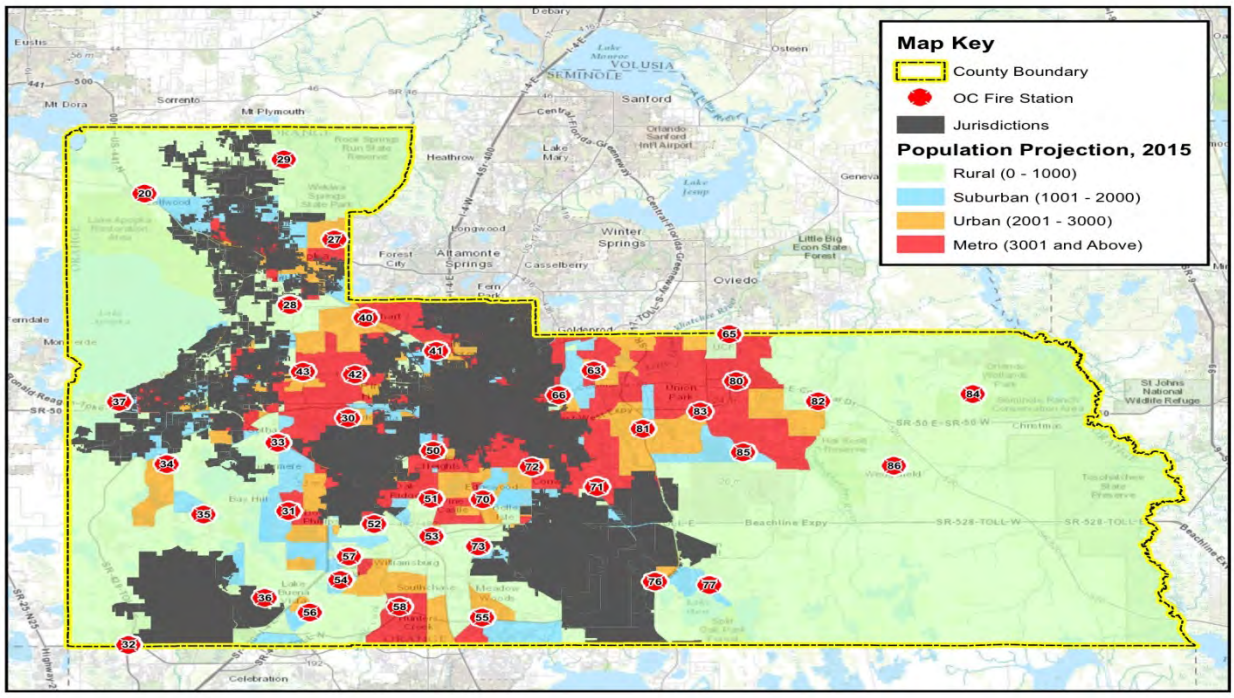
Recommendation	Page	Purpose	Timing
1. Consider adopting a framework of planning areas to be used by all County departments for study and analysis of service delivery.	41	To provide a common system for data, GIS, and planning information between County departments using the same GIS framework.	As soon as possible
2. OCFRD should continue to refine its performance goals and CPSE performance versus unit availability analysis and trigger points for determining the need for a new station or unit.	97	To continue and improve the reliability and response time analysis going into the future.	Immediate
3. Construct a new station at North Dean Road and Winder Trail, followed by a second station near the intersection of North Alafaya Trail and Research Parkway. Construction of the Dean and Winder station should begin as soon as possible. Construction of the Alafaya and Research station should coincide with the completion of the east-west road extension to Tanner Road North (2015-2020).	103	Improve service delivery and response times to the University of Central Florida planning area.	Dean and Winder station as soon as possible. Alafaya and Research station - 2015-2020.
4. Construct a new station near Avalon Park South Boulevard. A variety of locations were considered, and the best one appears to be near Avalon Park South Boulevard near the C3 church (just north of Timber Creek High School). Completion of the station should occur with the next five years (2015-2020).	104	Improve service delivery and response times to the Timber Creek community in East Orange/ Deseret Ranch)	2015-2020
5. Construct a new station near South Goldenrod Road and Lake Underhill Road within the next five years (2015-2020).	106	Improve response times and coverage to Goldenrod/ Valencia College planning area.	2015-2020
6. Relocate Station 71 near South Goldenrod Road and Pershing Avenue. The suggested timing for Station 71 to be relocated is long-term, 2025 and beyond.	106	To meet expected growth and improve response times and service delivery in the Goldenrod/ Valencia College planning area.	2025 and beyond

Recommendation	Page	Purpose	Timing
7. Construct a new station near Summerlake Boulevard and Ficquette Road. Suggested timing for the station is 5 to 10 years.	110	Improve response coverage to the Bridgewater community, which is expected to become almost entirely urban.	2020 to 2025
8. Construct a new station near Avalon Road and Horizon Boulevard to improve coverage to Town Center Village. Suggested timing for the new station is long term (10+ years).	110	Improve response time and coverage to Town Center Village.	2025 and beyond
9. Construct a new station near Avalon Road and Seidel Road to cover Village F and Village H. Suggested timing for the new station is long term (10+ years).	110	Provide adequate response coverage for the already approved Villages F and H in the Horizon West planning area.	2025 and beyond
10. Relocate temporary Station 32 to a permanent location near Avalon Road and Hartzog Road to improve coverage for Village I. Suggested timing for the new facility is long term (10+ years).	110	Provide a permanent site for Station 32 and improve coverage for Village I.	2025 and beyond
11. Construct a new station near the intersection of Palm Parkway and Daryl Carter Parkway within the next five years (2015-2020). Then move Station 36 to a location near Winter Garden-Vineland Road and Equestrian Drive (2025).	115	To address the significant development occurring in the I-Drive/ Dr. Philips/ Williamsburg (Palm Parkway area), expected to become urban by 2020 and metropolitan by 2025.	New station (2015-2020); Move Station 36 (2025 and beyond)
12. Relocate Station 52 to a site near the Mandarin Drive and Kirkman Road Extensions. The suggested timing is long term (10+ years).	117	To improve the very inefficient coverage of Sandlake Drive and the coverage area that borders Orlando. Moving the station southwest will improve overall coverage and at the same time maintain excellent travel times to Tangelo Park.	2025 and beyond
13: Consider a cooperative arrangement for a new Boggy Creek station, which could serve Osceola and Orange Counties and the city of Orlando equally well. The suggested timing for a station in Boggy Creek is long term, 10+ years.	118	To address the expected population and growth increase for Wyndham Lakes and Beacon Park, which are expected to transition from rural to urban and metropolitan.	2025 and beyond

Recommendation	Page	Purpose	Timing
14. Increase efforts for regional cooperation of service delivery such as by expanding automatic-aid agreements to improve coverage on the borders with Osceola County, Kissimmee, and Orlando.	119	To improve efficiency of the response system by increasing automatic aid.	Immediate
15. Relocate Station 30 to West Colonial Drive and North Hiawassee Road within the next 5 to 10 years, followed by consolidation of Stations 42 and 43 at North Hiawassee Road & Silver Star Road in 10+ years.	124	To reduce significant coverage gaps in Pine Hills, which has very high demand. Current stations are less than one mile from the boundaries of Ocoee and Orlando, thus the present arrangement is inefficient.	Station 30 (2020 to 2025) Stations 42 and 43 (2025 and beyond)
16. Move forward with negotiations to have Apopka provide service to the area presently served by Station 29. Consider a monetary incentive to Apopka as part of the package.	124	To improve efficiency of coverage by reducing the duplication of service in the Northwest Orange/ Tangerine planning area.	Immediate (A recent offer to Apopka was turned down but negotiations may continue at some point)
17. Add two additional medic units to reduce the workload of Medics 3 and 5.	137	To decrease workloads and thus improve reliability and response times for EMS response.	As soon as possible
19. Consider Station 81 as an alternative location for OCFRD's special operations.	139	Centralize the location to improve response times throughout the County.	When possible

APPENDIX A. POPULATION PROJECTION MAPS, 2015-2040

Figure A-1. Orange County Population Density Map, 2015



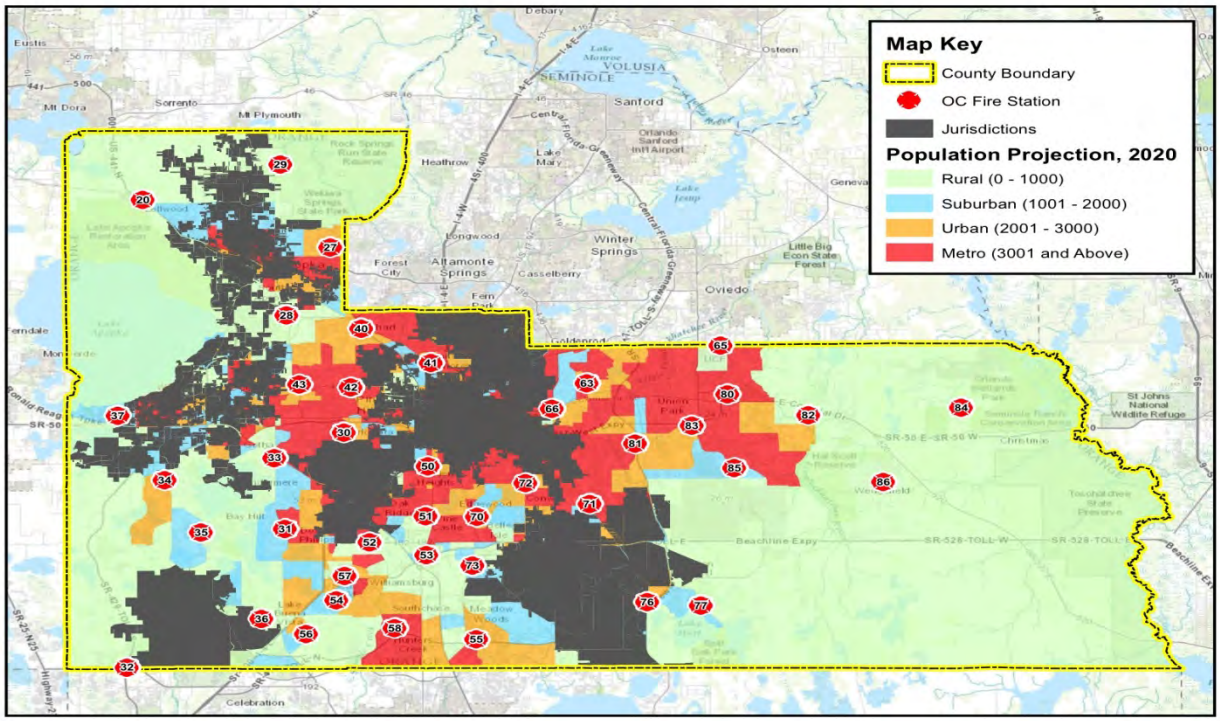
Square Miles:

	2015
Metro	148.84
Urban	88.09
Suburban	86.89
Rural	681.61

Percentage:

	2015
Metro	14.80%
Urban	8.76%
Suburban	8.64%
Rural	67.79%
Total	100.00%

Figure A-2. Orange County Population Density Map, 2020



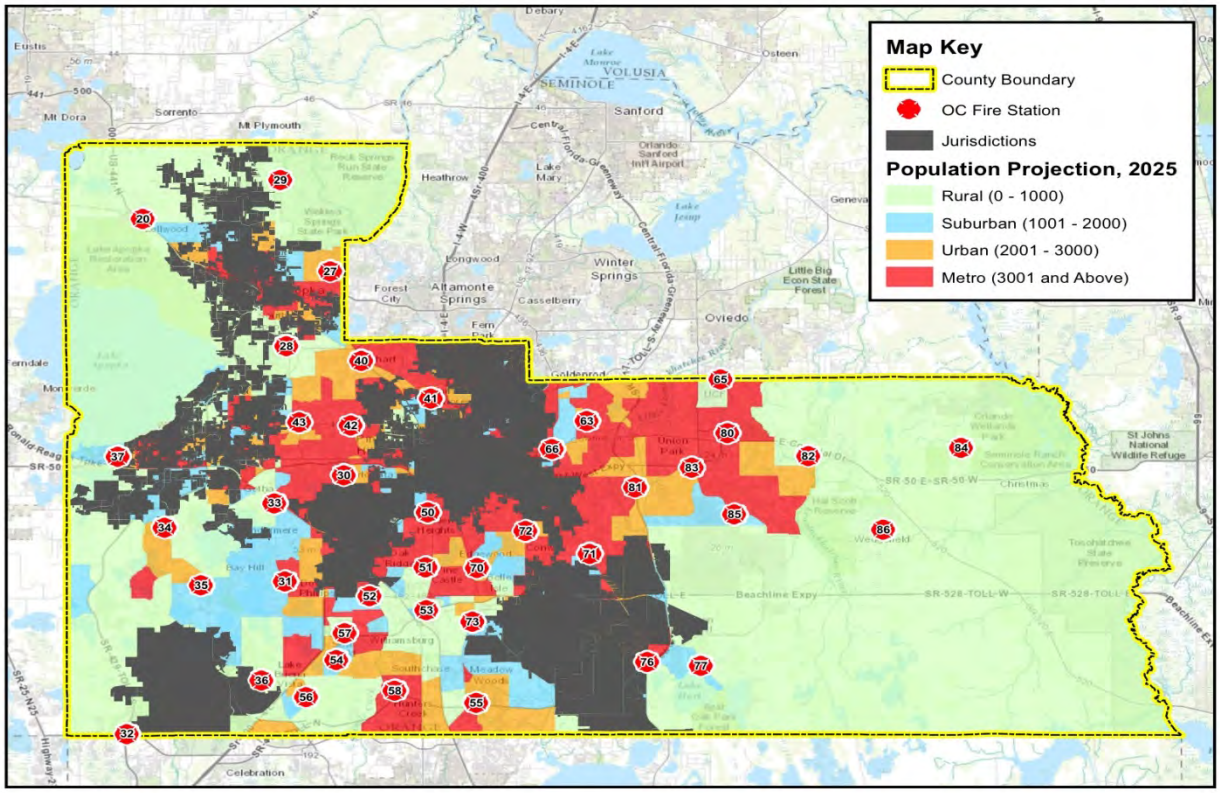
Square Miles:

	2015	2020
Metro	148.84	160.81
Urban	88.09	98.87
Suburban	86.89	91.96
Rural	681.61	653.78

Percentage:

	2015	2020
Metro	14.80%	15.99%
Urban	8.76%	9.83%
Suburban	8.64%	9.15%
Rural	67.79%	65.03%
Total	100.00%	100.00%

Figure A-3. Orange County Population Density Map, 2025



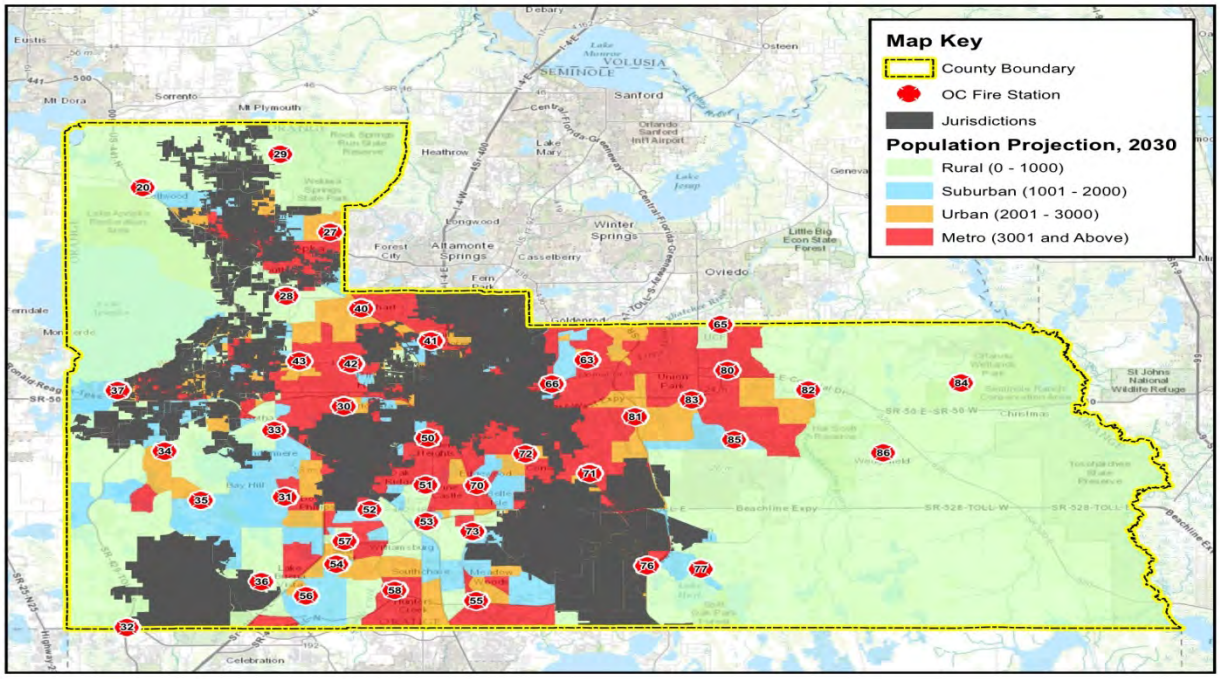
Square Miles:

	2015	2020	2025
Metro	148.84	160.81	180.55
Urban	88.09	98.87	96.14
Suburban	86.89	91.96	99.20
Rural	681.61	653.78	629.54

Percentage:

	2015	2020	2025
Metro	14.80%	15.99%	17.96%
Urban	8.76%	9.83%	9.56%
Suburban	8.64%	9.15%	9.87%
Rural	67.79%	65.03%	62.61%
Total	100.00%	100.00%	100.00%

Figure A-4. Orange County Population Density Map, 2030



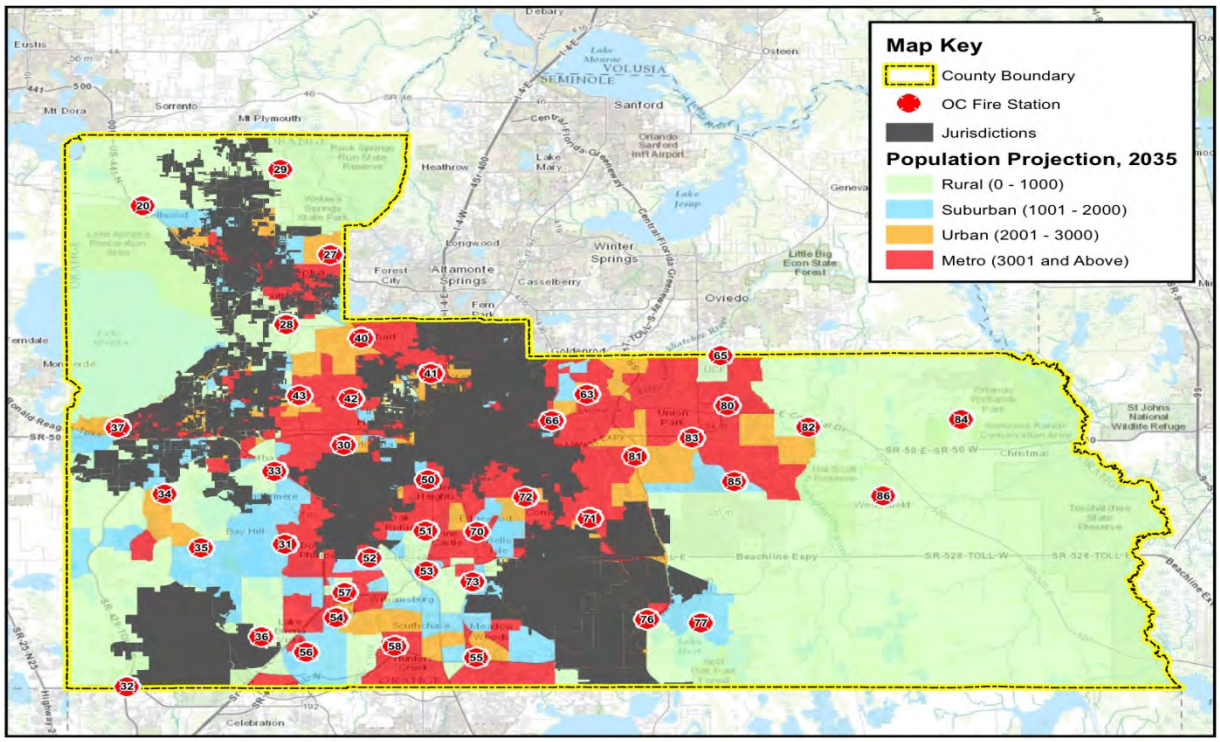
Square Miles:

	2015	2020	2025	2030
Metro	148.84	160.81	180.55	200.29
Urban	88.09	98.87	96.14	85.72
Suburban	86.89	91.96	99.20	105.84
Rural	681.61	653.78	629.54	613.59

Percentage:

	2015	2020	2025	2030
Metro	14.80%	15.99%	17.96%	19.92%
Urban	8.76%	9.83%	9.56%	8.53%
Suburban	8.64%	9.15%	9.87%	10.53%
Rural	67.79%	65.03%	62.61%	61.03%
Total	100.00%	100.00%	100.00%	100.00%

Figure A-5. Orange County Population Density Map, 2035



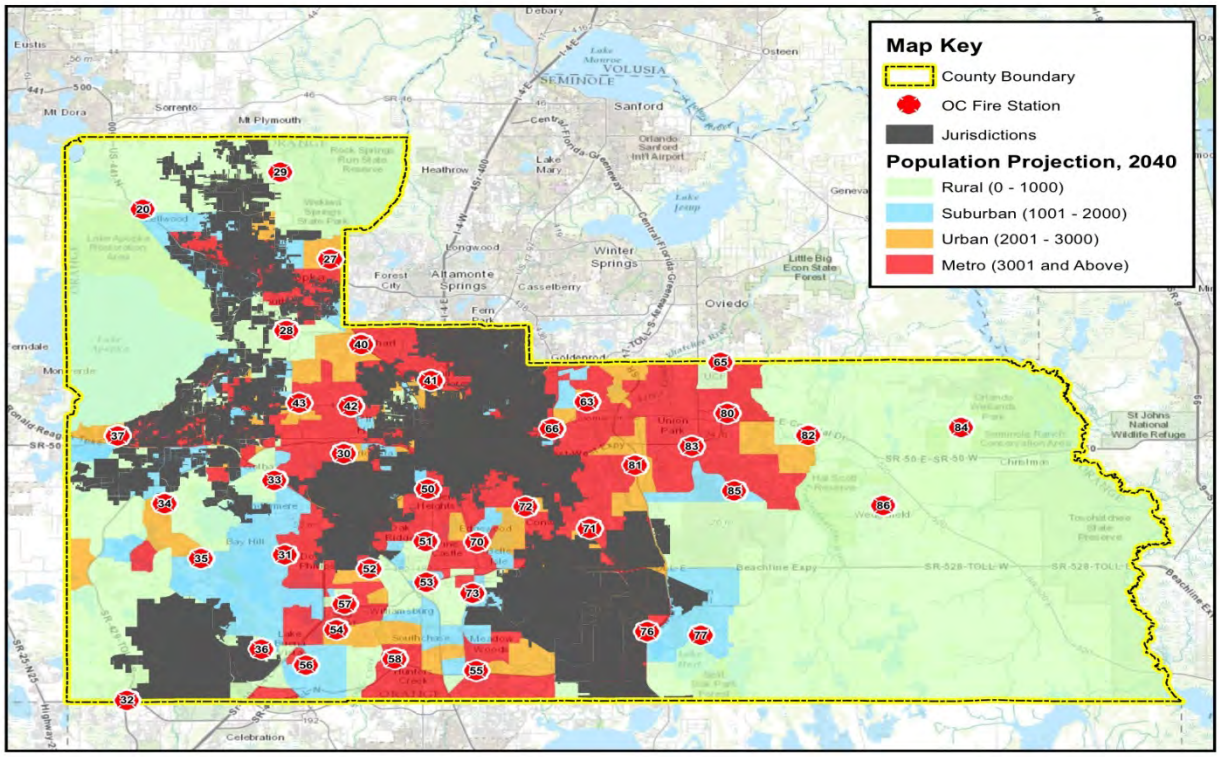
Square Miles:

	2015	2020	2025	2030	2035
Metro	148.84	160.81	180.55	200.29	214.99
Urban	88.09	98.87	96.14	85.72	79.21
Suburban	86.89	91.96	99.20	105.84	107.06
Rural	681.61	653.78	629.54	613.59	604.17

Percentage:

	2015	2020	2025	2030	2035
Metro	14.80%	15.99%	17.96%	19.92%	21.38%
Urban	8.76%	9.83%	9.56%	8.53%	7.88%
Suburban	8.64%	9.15%	9.87%	10.53%	10.65%
Rural	67.79%	65.03%	62.61%	61.03%	60.09%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Figure A-6. Orange County Population Density Map, 2040



Square Miles:

	2015	2020	2025	2030	2035	2040
Metro	148.84	160.81	180.55	200.29	214.99	228.19
Urban	88.09	98.87	96.14	85.72	79.21	78.73
Suburban	86.89	91.96	99.20	105.84	107.06	110.46
Rural	681.61	653.78	629.54	613.59	604.17	588.05

Percentage:

	2015	2020	2025	2030	2035	2040
Metro	14.80%	15.99%	17.96%	19.92%	21.38%	22.70%
Urban	8.76%	9.83%	9.56%	8.53%	7.88%	7.83%
Suburban	8.64%	9.15%	9.87%	10.53%	10.65%	10.99%
Rural	67.79%	65.03%	62.61%	61.03%	60.09%	58.49%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

APPENDIX B. REGRESSION ANALYSIS: ESTIMATED FUTURE DEMAND CALCULATIONS

Year	Projected	Lower Bound	Upper Bound
2015	109623	90402	128845
2016	114629	91624	137634
2017	119634	92635	146633
2018	124639	93517	155761
2019	129645	94315	164974
2020	134650	95055	174244
2021	139655	95755	183555
2022	144660	96425	192895
2023	149666	97073	202258
2024	154671	97704	211638
2025	159676	98321	221032
2026	164682	98927	230436
2027	169687	99524	239850
2028	174692	100114	249270
2029	179698	100698	258697
2030	184703	101277	268129
2031	189708	101852	277564
2032	194713	102423	287004
2033	199719	102990	296447
2034	204724	103555	305893
2035	209729	104118	315341
2036	214735	104679	324791
2037	219740	105237	334243
2038	224745	105794	343696
2039	229751	106350	353151
2040	234756	106904	362608

APPENDIX C. TOTAL INCIDENT FORECASTING METHOD

In statistics, linear regression is an approach to modeling the relationship between a dependent variable *y* and one or more independent variables denoted x_i. For our incident type trending, we are using year (x_1) and population (x_2) to predict incident type totals (y). We realize that time and population are not the only factors determining emergency services demand, so the model is not perfect for predicting the number of incidents. Linear regression is useful in that it shows trends, and trends are valuable for planning purposes.

For any model, it is necessary to say how statistically accurate it is, or what the confidence is in the estimates. For example, if we predict that there will be 1,000 emergency incidents ten years from now, we also have to state the confidence limits of that prediction. The confidence interval is a statistical plus/minus calculation. To continue with our example, we might say there will be 1,000 emergency incidents, plus or minus 100, with 95 percent likelihood it will be in that range. This gives the reader both a prediction and a range within which we are fairly certain (95 percent certain) that the eventual number of incidents will fall.

The confidence intervals are the result of a statistical calculation that analyzes how accurately our prediction model represents the actual data. A good model will have a small plus-minus confidence interval. This often happens when the historical trend stays fairly steady from year to year; as a result, a multi-linear regression is able to make fairly accurate predictions for total incidents for at least several years into the future. The further into the future, the wider the confidence limits become.

Large confidence intervals occur when there are large incidence fluctuations from year to year that are inconsistent and cannot be accurately modeled with any of the independent variables (time and population). For instance, if the annual number of incidents fluctuates up 30 percent one year and down 30 percent the next, and then up 40 percent and down 5, the model cannot accurately predict the exact number of incidents for a given year. In that case, there would be a large confidence interval that essentially says we predict *y*, but the number could be much higher or much lower.

APPENDIX D. PERFORMANCE MEASUREMENT

Many fire departments measure their deployment performance based entirely on the NFPA 1710 standard. The problem with using this standard "carte-blanche" is that it assumes all areas need equal fire protection. Even if it were possible to provide truly equal fire protection, the reality is that urban, downtown areas have different fire protection needs than a more rural area. A sparsely populated and sparely structured area of the city, for instance, does not need three ladder trucks within an 8-minute reach; some urban, downtown areas do.

The NFPA 1710 standard is oriented towards achieving a 6-minute total response time, a time at which fires are likely to expand rapidly (flashover), and defibrillated cardiac arrest patients have a markedly lower chance of survival. NFPA 1710 does not actually specify a total response time standard. Instead, it provides time and reliability standards for each of the time segments that comprise total response time (call-processing, turnout, and travel). For example, the standard specifies that for fires and special operations incidents, the first-arriving unit will have a travel time (time from the unit leaving the station to arrival at the emergency incident) of four-minutes 90 percent of the time. In this case, four minutes is the time standard, and 90 percent is the reliability standard. Although the NFPA 1710 standard is an excellent goal to work towards, few fire departments are able to completely meet the standard.

The standard is based on what is ideal and not necessarily what is realistic. For instance, to achieve a six-minute total response time, the original version of the standard specified a call-processing time of one minute, a turnout time of one minute, and a travel time of four minutes. It was subsequently realized that one-minute was not enough time for firefighters to get to their unit, don full turnout gear and leave the station. As a result, the 2010 version of the NFPA 1710 standard was revised to allow 80 seconds of turnout time for fire and special operations incidents.

Just as the standard itself was revised to reflect reality, it makes sense to consider whether the standard makes sense for all parts of the jurisdiction in its current form. Take for instance a rural, sparsely populated area. It may not be reasonable to expect a four-minute travel time for 90 percent of incidents. The jurisdiction might consider specifying a 5-minute travel time for 70 percent of incidents to account for the area's rural character.

Appropriate performance levels should be based on the characteristics of individual planning areas. Response time and reliability goals should match a particular area's risk characteristics, not just conform to a one-size-fits-all standard. For this to occur, fire departments need to consider that a data-driven approach can be a better approach for risk management than merely applying standards across the board, in our opinion. The UK after having been a model for standards of cover has completely dropped them nationally, in favor of locally made risk tradeoffs. Heavier investment in prevention might be considered vs. increasing suppression. We should try to develop the data on which to make such judgments.

Assessing Deployment Performance

Deployment decisions concerning fire station and apparatus locations should be an ongoing process based on periodic performance measurement. Because jurisdictional needs do change, the deployment change recommendations made in this study should be considered as a step in a continuing process. Going forward, the fire department needs to be regularly conducting neighborhood-level performance measurement for the process to be effective.

Police departments are decades ahead of most fire departments when it comes to analyzing data to drive operations. Most city and county police departments have several technical crime analysts who specialize in data analysis and mapping. Many fire departments should consider hiring a dedicated data analyst and begin to incorporate performance measurement into a regular (perhaps quarterly) review of deployment. The fire department culture, which is based on meeting standards, should reconsider its emphasis on static deployment (where unit locations and first-due areas rarely change) to one of dynamic deployment based on data-driven performance goals.

An excellent resource on how to measure performance and adapt deployment is the Center for Public Safety Excellence's (CPSE) Developing Standards of Cover Manual. One of the advanced, but effective techniques used by the manual is to measure the trade-off between unit availability (percentage of incidents where the correct (first due) unit handled the call) and response time performance (percentage of incidents below the response time goal).

Generally speaking, as the first-in correct unit for a particular area becomes less available (due to other calls, training, etc.), performance for that area decreases because units from other stations have to travel further to handle the call. How much of an impact reliability has on performance is largely dependent on how far away the nearest fire stations are. This type of analysis can be used to determine if a station needs an additional unit or might benefit from a first-due area adjustment. Fire departments should familiarize themselves with this performance measurement methodology and consider its use to gauge station and unit location performance.

Reporting Deployment Performance

After taking the time to establish deployment goals for each neighborhood or planning district and learning some of the more advanced CPSE analysis methodologies, the last step is to establish regular reporting mechanisms. We recommend that fire departments consider producing the following two types of reports:

- **Monthly Deployment Performance Report** – This report should be distributed department-wide each month. Such a report serves several important functions. First, it provides information and data feedback to those entering incident data; getting a detailed report that shows workload by units and response time performance can provide firefighters the ability to gauge and challenge themselves to better performance (e.g. one engine crew that has had the slowest turnout time in the past few months makes it their goal to be in the top three engine companies for turnout time in the next reporting period). Also, putting out a monthly report provides an excellent error checking mechanism, as firefighters will be the first to notice and announce any problematic performance statistics. Finally, having somebody try and pull together some statistics with Excel for an annual report is asking for problems because you cannot truly be familiar with data only looked at once a year. Putting together monthly reports helps to ensure that the fire department is on top of its data collection and performance measurement.
- **Quarterly Report** – While the monthly report can be fairly short and limited to some simple workload and response time results, we recommend a more in-depth quarterly report. The report should be set up so that department leaders can review deployment performance for the entire system and each individual planning district. The report should be set up to note performance changes/trends in specific planning areas so that fire department officials are in a good position to recommend near- and long-term deployment modifications. We strongly recommend that this annual performance measurement report reflect most of the analysis types found in the CPSE Standards of Cover Manual.

APPENDIX E. EVALUATING UNIT WORKLOADS

The location of fire stations is only one factor in determining whether response-time goals will be achieved. The 'busyness' factor or workload is also important since units that are extremely busy may not be available for the next call, thus necessitating the response from a station further away. EMS workload is typically described as Unit Hour Utilization (UHU), which is discussed later in this section.

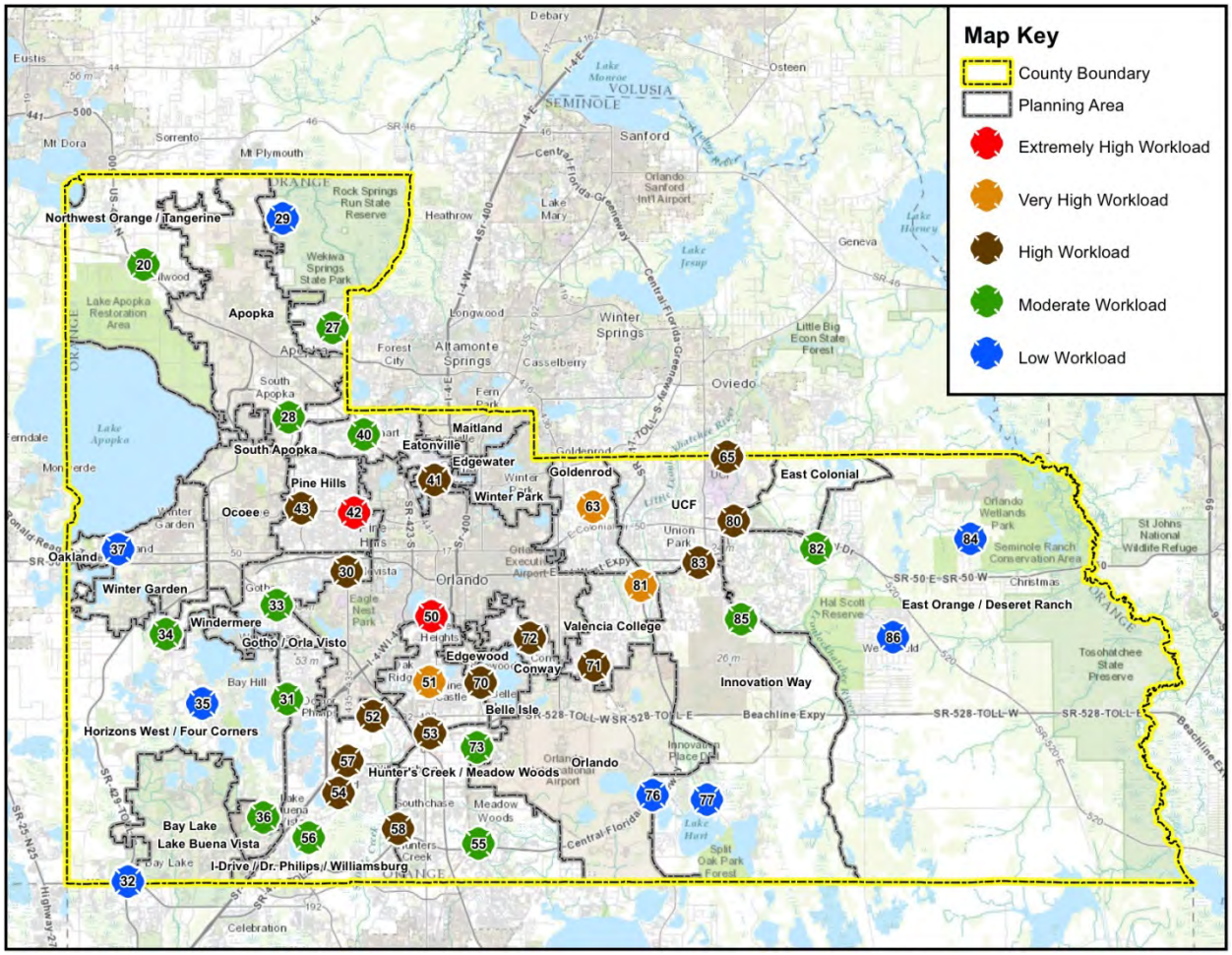
Through CAD systems, fire departments are able to keep detailed records about service times; these data are useful in determining the availability of a specific unit or station. Again, the concept of workload is not merely a count of how many calls to which a unit was dispatched. One unit can have fewer responses than another but remains on the scene longer on average (e.g. more working incidents, or a more distant hospital for EMS patients), 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 adopted by the county/department and is part of the CFAI self-assessment process. 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 units moved.

A fire/EMS system must incorporate the necessary redundancies based on whether adjacent stations or units are likely to be available for emergency response. Below are general guidelines developed by TriData to show the level of redundancy (overlap) necessary to achieve response-time goals. These were developed based on many fire department studies we have undertaken.

1. **Very Low Workload (<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 Workload (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 Workload (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 Workload (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 Workload (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/units must be located with the significant overlap to achieve stated travel time objectives established by the community. (Overlap can be achieved with additional stations or additional units in existing stations.)
6. **Extremely High Workload (>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 established by the community. 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. (Overlap can be achieved with additional stations or additional units in existing stations.)

Following is a map depicting the combined workload for the units in each of the fire stations.



The 3,000–3,900 response level (*very high workload)* is the point at which units are often considered "busy" and their availability should be evaluated. This is a rough rule of thumb, not a fixed standard. At this point, response times often begin getting longer because of simultaneous call occurring in the same area.[8] 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 better assessment of the impact of workloads on availability and response times. This is the second factor in workload, known as unit hour utilization (UHU).

Unit Hour Utilization

UHU is a calculation that estimates the amount of time a unit is occupied on emergency calls as a percentage of the total amount of hours a unit is staffed and available for response (a unit staffed full-time is available 8,760 hours per year). In other words, UHU measures the percentage of on-duty time consumed by emergency service field activities. A high UHU means lower availability for calls. Poor availability negatively impacts response times.

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

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

UHU measures the percent of a unit's time in service that is spent running calls. However, there is other productive time *not* accounted for, such as for training, maintenance public education, and other preparedness-related functions. When units are not engaged in emergency response, it does not mean they are not working.

UHU is used more in relation to EMS units than fire suppression units; although, evaluation of UHUs is useful to different extents for both functions.

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 more common with private ambulance providers.) If a UHU is greater than 45 percent, units often are not available and response times suffer. If a UHU is below 35 percent, units may not be well utilized, but response times may be high too often.

[8] A "first-due" 'area is a certain geographic area of the overall fire department response jurisdiction assigned to a particular fire station.

Many communities choose to aim for a UHU in the 15 to 25 percent range to balance productivity of a unity with good response times. 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.

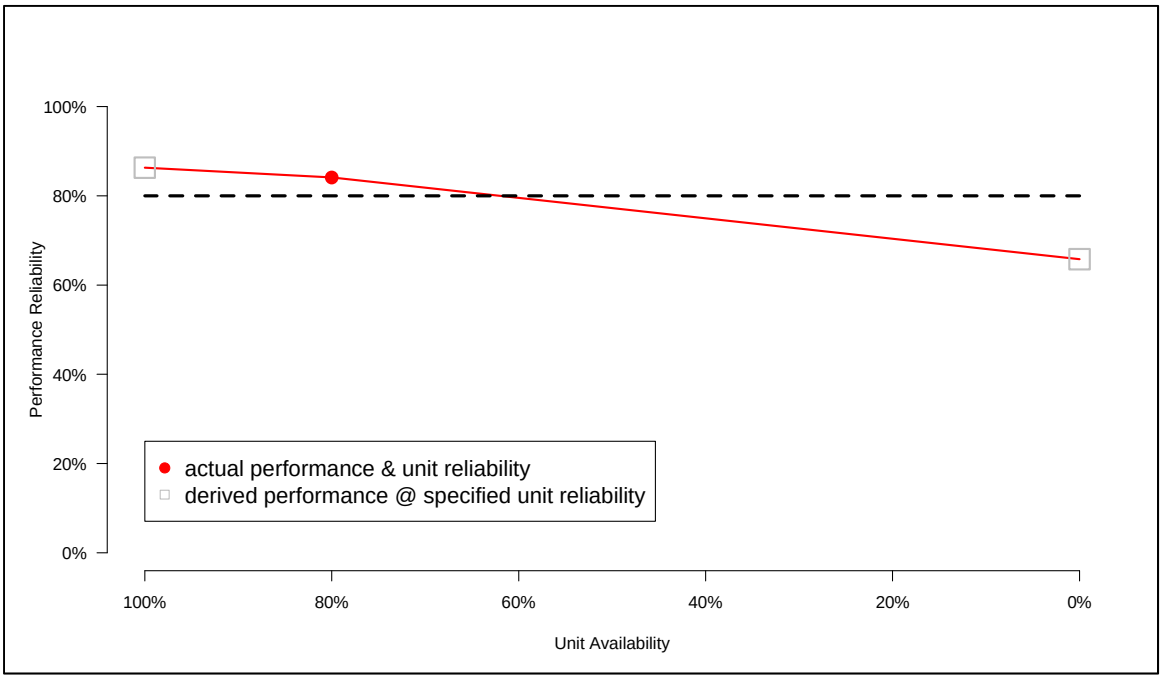
In order to develop an effective resource deployment plan, units must be available to respond to incidents most of the time. No amount of resource placement planning will improve system-wide response times if the responding units are not available.

APPENDIX F. UNIT AVAILABILTIY VS. RESPONSE TIME PERFORMANCE

The premise of the Center for Public Safety Excellence (CPSE) "unit availability vs. performance" assessment method is that for each station's area, there is a tradeoff between unit availability and performance. Unit availability is defined as the percentage of incidents where the closest unit was available to handle the call and did so. Performance is defined as the percentage of incidents where the travel time for the particular incident was responded to within the desired response time. Using this performance analysis method, we can look at the performance differences that occur when a correct units versus an incorrect units responds to a call.

Figure F-1 shows an example of unit availability vs. performance graph. The red dot plotted in the figure represents the actual performance and correct-unit availability percentage for all calls in a station's first-due area. In this case, it appears that a correct unit responded slightly less than 80 percent of the time and about 85 percent of the incidents had response times the fell below the performance goal. The station performance in this example is above the goal. Had the red dot fallen below the dotted black goal line, it would indicate that the station is currently not meeting its performance goal.

Figure F-1. Example of Response Time Performance



In addition to showing whether performance is being achieved, the performance graph can also show workload sensitivity or fire station location problems. In the example figure, the red line has a red dot and two black squares. The dot represents the actual unit availability and performance and the squares represent theoretical data points. The square at 100 percent unit availability is calculating by looking only at those incidents where a unit from the correct station responded. The square at zero percent unit availability is calculating by looking only at those

incidents where a unit from a fire station other than the first-due station responded (because the first-due unit was busy). The red line is then interpolated between these three data points to give the unit availability vs. performance line.

The slope of the line assesses workload sensitivity. A nearly horizontal line indicates that unit availability has little impact on performance, meaning that the area in question has low workload sensitivity. First-due areas with low workload sensitivity typically have either multiple first-due units or several nearby fire stations that can cover calls if the first-due units are unavailable. A line that slopes strongly downwards indicates that performance is heavily dependent on unit availability. These areas are very workload sensitive because second-due units are generally unable to achieve travel time goals when the first-due unit is unavailable.

The location of the line at 100 percent unit availability assesses fire station location problems. If this part of the line is under the 80 percent performance threshold, it means that, even when the correct unit responds, travel time goals are not being met 20 percent of the time. This means that the station is not well located to reach all parts of its first-due area. This problem can be fixed by relocating the current station, building a new station, or (perhaps the best solution) re-evaluating first-due boundaries to make sure that the most appropriate station is responding.

APPENDIX G. MEMO RE: FIRST-ARRIVAL AND EFFECTIVE-RESPONSE-FORCE GOAL TIMES

To: Rick Black, Compliance and Planning Administrator
Orange County Fire Rescue Department
From: Markus Weisner, TriData
Date: November 13, 2014
Re: First-Arrival and Effective-Response-Force Goal Times

In order to make determinations about what level of coverage is appropriate for different areas of the county. I need some kind of measuring stick. The reason for this memo is that there is a large discrepancy between the current travel times and the stated travel-time goals that the department would like to achieve. We are looking at both the department's current response-time performance and the expected growth and development of the county. It is important to make recommendations that move the department in a positive direction, but that are also feasible for the department to implement given its available resources. While it might be possible to develop recommendations that would help Orange County reach its current goal times, those recommendations might include an unrealistic number of additional stations and personnel. Such a proposal would be rejected by county administrators.

Locating stations and units is always about evaluating trade-offs. Very few municipalities can afford the perfect station layout, equipment, and manpower that would guarantee excellent coverage to every area of the city at all times. Nor can they create such a system in a short period of time. There is always a limit to the tax burden that citizens are willing to accept to improve the fire service. Under those conditions, the goal is to create the most effective system possible by balancing trade-offs: the best solution maximizes benefits while minimizing drawbacks and risks, but no system can ever eliminate all drawbacks.

Decisions about questions like where to place stations are necessarily impacted by local variables such as budgets, terrain, population distribution, residential versus commercial or industrial neighborhoods, and traffic density. Those conditions may either restrict or enhance a department's ability to meet national standards. The variability in local conditions makes it difficult to set uniform performance standards, even within the same municipality. For a community like Orange County that has a wide variety of areas that it protects—ranging from

extremely rural, such as the southeast corner of the county, to metropolitan areas like International Drive that are lined with high-rise hotels—it is extremely important to set different response-time performance goals for different areas of the jurisdiction.

Response-Time Goals by Specific Area

It is problematical to set one response-time goal for an entire municipality or county because the conditions that affect response time can vary significantly across the jurisdiction. A response time that is achievable and necessary in one area may be unrealistic or unnecessary for another area. Ideally, each part of Orange County would be evaluated separately to determine appropriate response-time thresholds for that area of the county. Currently the county is divided into more than 500 reporting districts for the purpose of analyzing response times in smaller, more specific areas. This number of areas is simply too high to evaluate individually and provide individual response-time thresholds. For this study we developed 16 planning areas for the county. Although these areas will help to organize our report and are also good for evaluating performance, they are too heterogeneous to set a single response-time goal for each planning area. In order for planning by individual areas to be useful, the boundaries of the areas need to be drawn to group together sections with similar characteristics and needs. If the sections of one area are too dissimilar—such as grouping rural and high-density urban sections in one area—no common goals can be set that will meet the needs of all sections. Thought needs to be given to how to delineate planning areas to group together sections with similar needs and conditions and to create a manageable number of areas.

In the future I recommend that the OCFRD work on finding something in between our 16 planning areas and the 522 reporting districts, where it would be possible to set specific goals based on the following factors, among others:

Fire Travel-Time Threshold Considerations

- Number of incidents
- Type of building construction
- Current travel time and its acceptability to the public
- Fire risk level (from Task 8, basic fire-risk analysis)
- Percent of sprinklered buildings

- Target hazards that require a specific response time
- Unique topography

EMS Travel-Time Threshold Considerations

- Number of incidents
- Demographic profile of the area
- Historical number of cardiac arrests
- Availability of local defibrillators
- Presence of medical personnel to begin initial care

Response-Time Goals by Population Density

In the short term, in the absence of an effective mapping of planning areas that would allow a systematic review and setting performance metrics for individual areas, the next easiest way of setting response-time goals is by population density. This is how the OCFRD currently structures its response-time goals, and also how several standards organizations set their response-time standard. Table 1 compares response-time goals set by each of these organizations for different population densities ("baseline" and "benchmark" are explained below).

Table 1. Comparison of Response-Time Standards

Population Density	NFPA Term	CPSE Term	NFPA 1710	NFPA 1720	CPSE Baseline	CPSE Benchmark
3000+	Urban	Metropolitan	6:20	10:00	7:32	6:20
2000-3000	Urban	Urban	6:20	10:00	7:32	6:20
1000-2000	Urban	Suburban	6:20	10:00	8:50	7:20
500-1000	Suburban	Rural	6:20	11:00	14:20	12:20
0-500	Rural	Rural	6:20	15:00	14:20	12:20

Because of slight differences in how the standards specify goal times, I had to make some conversions between travel-time standards and total-response-time standards. For making these conversions I assumed a one-minute call-processing time and 1:20 turnout time.

NFPA standard 1710 is typically applied to mostly career fire departments. Because most career fire departments do not cover the wide array of population densities found in Orange County, they do not provide any differentiation for population density. The assumption for this standard

is that the department is covering mostly metropolitan and urban areas. There is a disclaimer in the standard that reads, "There can be incidents or areas where the response criteria are affected by circumstances such as response personnel who are not on duty, unstaffed fire station facilities, natural barriers, traffic congestion, insufficient water supply, and density of population or property. The reduced level of service should be documented in the written organizational statement by the percentage of incidents and geographical areas for which the total response time criteria are achieved."

NFPA standard 1720 is also applied to mostly volunteer fire departments. Although the OCFRD is not volunteer, the response-time component of this standard is actually better set up to deal with the wide variety of population densities that the department protects.

The CPSE Standard of Cover document also contains performance metrics based on population density. The CPSE system is a little different from the NFPA standards in that it provides two performance metrics: a baseline and benchmark. The benchmark is a goal time and the baseline is the bottom end of minimally acceptable performance. The goal is to reach the benchmark, but performance should at least stay above the baseline.

ISO Response-Time Standard

The ISO uses a different method for prescribing response times. Rather than considering population density or whether a department is mostly career or volunteer, this standard uses a road-mile analysis method, which gives points to areas that have a fire station within 1.5 miles. We are examining whether other ISO response-time metrics might be effectively implemented by the OCFRD.

OCFRD Current, Baseline, and Benchmark Times

The OCFRD originally used both the baseline and benchmark time recommendations as found in the CFAI Standard of Cover manual. Consistent with the CFAI manual, separate benchmark and baseline times were set for areas of different population density (rural, suburban, urban, and metropolitan). However, because the department's actual times were far below the baseline,

adjustments were recently made to set a more reasonable baseline. The OCFRD is now setting new annual baseline goals, called "objectives," that are slightly faster each year. The OCFRD has had success with lowering its response times to meet these annual objectives, based mostly on improving call-processing and turnout times.

Although this year-to-year improvement is certainly positive, these slight annual improvements will not get the OCFRD to its stated benchmark (goal) times other than in the rural areas where they are already meeting those times. Table 2 shows the current baseline, benchmark, and 2013 performance times for first-arriving units. There is a large discrepancy between the current and benchmark times for metro, urban, and suburban areas.

Table 2. OCRFD First-Arrival Baseline, Benchmark, and 2013 Performance

Population Density	OCFRD Term	OCFRD Baseline	OCFRD Benchmark	2013 Performance
3000+	Metropolitan	11:28	6:20	8:19
2000-3000	Urban	12:02	6:20	8:35
1000-2000	Suburban	12:22	7:20	8:59
0-1000	Rural	13:33	12:20	9:49

Performance is also measured in terms of how long it takes a department to deliver adequate apparatus and personnel to the scene of an emergency, referred to as effective response force (ERF) or weight of response. Here too there is a large discrepancy between the current ERF times and the OCFRD benchmark times. None of the current population-density categories are close to meeting the OCFRD benchmark times.

Table 3. OCRFD ERF Baseline, Benchmark, and 2013 Performance

Population Density	OCFRD Term	OCFRD Baseline	OCFRD Benchmark	2013 Performance
3000+	Metropolitan	15:34	10:20	14:17
2000-3000	Urban	15:26	10:20	13:48
1000-2000	Suburban	17:16	10:20	16:13
0-1000	Rural	20:45	16:20	18:57

The OCFRD should be commended for taking a realistic look at its response times, setting achievable baseline goals, and working toward meeting those baseline goals. However, there is still a very large discrepancy between the current times—which are in line with the set baseline times—and the benchmark times that the department has set for itself. For the purposes of this study, we need to establish what level of performance we are trying to design the system around, especially when considering station coverage areas. Baseline times represent minimal performance and are too low to be used as a standard. On the other hand, the current benchmark times are not realistic given the current performance level. In the following section we recommend some reasonable goal times that are faster than the current baseline, but lower than the unrealistic benchmark times.

Recommended Goal Times

Below are the recommended goal times for both first-arriving units and the effective response force.

Recommended First-Arrival Goals

Population density	Travel time	Total time
Metro	5:00	7:20
Urban	6:00	8:20
Suburban	7:00	9:20
Rural (500-1000)	9:00	11:20
Rural (0-500)	13:00	15:20

Recommended ERF Goals

Population density	Travel time	Total time
Metro	5:00	7:20
Urban	6:00	8:20
Suburban	7:00	9:20
Rural	None	None

There is no stated ERF goal for rural areas due to the variability of conditions. Critical problems are dealt with on an individual basis.

Conclusion

We had a good discussion over the phone about setting realistic response-time goals. I welcome your input about as the above recommended reasonable first-arrival and ERF response-time goals. I am open to the concept that over time the department could work toward achieving realistic intermediary goals. I am also open to discussing the prioritization of certain areas that impact ISO scores. I look forward to receiving your feedback on this memo and our proposed goal times. This is a challenging but worthwhile exercise that will lead to better decision making.

APPENDIX H. OCOEE CONSIDERS FIRE MERGER WITH ORANGE COUNTY[9]

January 22, 2014|By Stephen Hudak, Orlando Sentinel

Ocoee may try to shed the hefty expense of a fire department by merging its fire services with Orange County's.

City Manager Rob Frank estimated Ocoee would save $1.7 million in annual costs by turning over fire services to the county.

"That's why we're talking about it," Frank said. "To not even consider it, we'd look silly."

City commissioners are planning a workshop Feb. 26 to consider a merger that also would affect the town of Windermere. The town pays Ocoee for fire services.

Ocoee's $5.7-million fire budget consumes about 16 percent of the city's general fund, the pot of public money used to pay city employees, improve parks and provide police and other services. City commissioners in September adopted a controversial fire fee to defray fire costs.

Ocoee, which has a population of 38,000 and ranks as Orange County's third-largest city, has employed and paid full-time firefighters since 1971.

Its department has 52 employees at its four fire stations – on South Bluford Avenue; North Clarke Road; South Maguire Road; and its newest location on West Road. Frank said no fire stations would close, no jobs would be lost, no salaries or ranks would be changed in the merger.

Mayor S. Scott Vandergrift opposes a merger, saying he's skeptical the city would get the same level of protection for less.

"I'm against it," said Vandergrift, whose older brother, George "Frog" Vandergrift, once served as chief of the city's volunteer firefighters.

The longtime mayor believes the city could save money other ways. Vandergrift said Frank doesn't want to deal with the city's fire union, whose current contract expires in September.

"That's what's underneath it," he said.

A consolidation study conducted by Orange County Fire Rescue concluded Ocoee would "obtain a greater level of [fire] emergency response" and "an increased level of pre-hospital emergency care." Ocoee firefighters currently "hand off" patients to Rural/Metro Ambulance, its transporting partner.

Under the proposed merger, Ocoee would retain fire inspection and prevention responsibilities.

Ocoee Fire Chief Pete McNeil retired Jan. 6 and could not be reached for comment. Interim Chief Tim Hoover declined comment.

But James Kelley, vice president of the local union representing Ocoee firefighters, spoke out against the proposed merger.

"We have no desire to be merged with Orange County," he said. "Not to bash Orange County, but we do an outstanding job for our citizens. We care about our citizens and we want to keep it that way."

[9] http://articles.orlandosentinel.com/2014-01-22/news/os-ocoee-fire-consolidation-20140122_1_orange-county-fire-rescue-fire-merger-fire-services