

Levy County, Florida



Radio System Needs Assessment and Alternatives Analysis Report

Final

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Executive Summary

Levy County, Florida (County) engaged Federal Engineering (*FE*) to assess the County's current radio communications system and review alternatives to upgrade or replace that system. County law enforcement agencies have been using the State of Florida (State) Statewide Law Enforcement Radio System (SLERS) system while County Fire/EMS departments and non-public safety users have been using a VHF digital radio system for the past seven years. Public safety users in the County have over 500 radios with over 240 additional non-public-safety subscriber radios. The County experiences coverage, operability and interoperability challenges communicating across multiple systems and with neighboring counties.

The current SLERS network is primarily comprised of proprietary, legacy technology that severely limits choices for user radio equipment as only one vendor can supply radios that will operate on the existing SLERS and APCO Project 25 (P25) public safety radio standards-based systems. The Levy County Sheriff's Office (LCSO) has many mobile and portable radios that the vendor no longer supports and has deferred replacing them awaiting deployment of a new SLERS system, which has been delayed several times. The State is now in the process of procuring the SLERS replacement, SLERS-2, based on the P25 standard and expects agency migrations to SLERS-2 to begin during the late summer or early fall of 2024 and to continue through 2026 or 2027. SLERS-2 service availability dates in this area are currently unknown.

Over the last few years, the County has made significant improvements to the existing VHF system's sites. These improvements will result in savings for new systems, including the implementation of three prefabricated communications shelters, sites that are closer to areas where the County needs improved coverage, and more favorable site use terms. *FE* estimates that this prior work may decrease the costs needed for deployment of new systems by over \$400k.

County radio system users identified primary needs for coverage focused on areas where the County responds most often, radio equipment that is available from multiple vendors, and better interoperability with neighboring Counties, State, SLERS/SLERS-2 and Federal agencies.

FE evaluated two alternatives to meet these needs:

- Alternative 1: County owned and operated 7/800 MHz six site P25 trunked system for all County and local public safety and public service users





- Alternative 2: Hybrid system comprised of SLERS-2, the SLERS replacement system, for County and local public safety users and a County owned and operated 7/800 MHz six site P25 conventional system for public service users

Coverage for Alternative 1 would be designed to meet County agency needs and the County would have direct control over all system features and functions. The County would also be directly responsible for all system costs and control the schedule for implementation.

Alternative 2 continues the current hybrid approach in the County, with County and local public safety entities using the new Florida statewide system, SLERS-2 and public service entities using a new County owned and operated 7/800 MHz six site P25 conventional system. This option also moves County and local fire agencies to SLERS-2 and moves all other users to the new County 7/800 MHz system, so that radios purchased for operation on SLERS-2 could also work on the County owned system, for interoperability. An upgrade to the County owned system could allow all County and local systems to operate on it, if SLERS-2 is delayed or does not meet County public safety users' needs. Coverage for SLERS-2 will be designed to meet State agency needs and may need to be supplemented to meet County needs. There may be opportunities to share costs with the State but since SLERS-2 is still in the initial system procurement phases, *FE* cannot quantify any potential savings at this time nor is the schedule for deployment in this area available. Features and functions available on SLERS-2 will be determined primarily by the State.

While there are minor differences in the predicted total Countywide system coverage for Alternative 1 and the projected SLERS-2 coverage, the SLERS-2 coverage may provide significantly less light inbuilding coverage to County public safety agencies.

To bring the projected SLERS-2 potential light in-building coverage up to the same levels as the Alternative 1, the County would likely need to add four sites to SLERS-2. Table ES1 provides a summary of the estimated 10-year total cost of ownership (TCO) for each alternative, assuming the County enhances SLERS-2 to meet the same in-building coverage levels as Alternative 1. The State and selected SLERS-2 vendor may also consider some of the County sites for use instead of existing SLERS sites, but *FE* cannot confirm this at this time.





Table ES1 - Alternatives 10-Year TCO Estimates

Category	Alternative 1 County Owned PS and Non-PS		Alternative 2 SLERS-2 (PS) County Owned (Non-PS)	
	Lower (est.)	Upper (est.)	Lower (est.)	Upper (est.)
Capital Costs (Infrastructure and Subscribers)	\$9.6M	\$11.6M	\$9.8M	\$12.1M
10 Year System Costs	\$4M	\$4M	\$6.7M	\$6.7M
Total	\$13.6M	\$15.6M	\$16.5M	\$18.8M

FE developed these high-level budgetary cost estimates using an in-house cost analysis that are based on:

- Data collected from previous projects
- Our experience and publicly available industry information
- Information collected specifically for this project
- *FE*'s experience designing comparable radio systems

Actual system costs are highly dependent upon final system design choices as well as conditions in the land mobile and microwave radio markets during the system procurement phase.

FE's budgetary estimates are intentionally conservative. Typically, vendor proposal pricing is unlikely to exceed *FE*'s estimate, based on a comparable design as outlined in our assumptions. Our cost estimates are based upon recent non-discounted pricing. Frequently, system vendors provide discounts for large system and subscriber unit purchases, however dynamics in the competitive systems market make it impractical to forecast the specific discounts vendors may offer at the time of proposal submission.

Both alternatives considered bring all County and local public safety and public service users onto the same frequency band and digital radio technology. This will increase the level of daily operability for all agencies and increase the level of interoperability with adjacent public safety systems in Alachua, Marion, and Citrus counties. Moving to public safety P25 standards-based systems also increases the potential to qualify for federal and state funding and grants.





Currently, Alternative 1, a standalone, County owned and operated, 700/800 MHz P25 Phase 1, six site trunked shared radio system provides the most certainty regarding costs, deployment schedule, and local system control and has the lowest estimated 10-year total cost of ownership.

To further refine these cost estimates, *FE* recommends the County consider assessing the viability of the current dispatch center for future operations, consistent with current industry standards and best practices. The current center may need to be significantly upgraded or replaced to meet the County's long-term needs and the County needs to address several existing facility deficiencies.

Once the County selects an alternative, *FE* recommends a competitive procurement process to replace the systems. The first step in this process would include the development of functional specifications, based on County requirements, that *FE* would combine with the County procurement requirements into a request for proposals (RFP) document. The RFP would allow for multiple vendors to provide proposals and pricing for the system expansion. The vendors would provide the detailed design of the system allowing for innovative approaches and placing system performance responsibilities on the vendors.





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1. Introduction

Levy County, Florida (County) public safety and public service agencies have used different radio systems for many years. County law enforcement agencies have been using the State of Florida (State) Statewide Law Enforcement Radio System (SLERS) system while County Fire/EMS departments and non-public safety users have been using a VHF digital radio system for the past seven years. Public safety users in the County have over 500 radios with over 240 additional non-public-safety subscriber radios. The County experiences coverage, operability and interoperability challenges communicating across multiple systems and with neighboring counties.

To address these issues, the County contracted with Federal Engineering, Inc. (*FE*) to conduct a needs assessment of the County radio and transport systems including systems reviews, coverage studies, and cost analyses. *FE* assessed the needs of both public safety and non-public safety users and evaluated two radio system alternatives. *FE* presents results of these analyses and findings in this report, the *Levy County Needs Assessment and Alternatives Analysis Report*.

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2. Methodology

The following sections describe the processes and analysis *FE* utilized to develop an understanding of the County radio systems and user needs as well as development of viable alternatives for the County pursue.

2.1 Request for Information (RFI)

During the week of January 4-8, *FE* sent a Request for Information (RFI) to the County to initiate the process of gathering pertinent technical information about their existing systems. The RFI categorized the requested information into the following areas:

- Previous communications system studies
- Radio system sites and tower information
- Backhaul / transport system information
- PSAP / dispatch system information
- Subscriber equipment inventory information
- Additional system information

Upon receiving the requested information, *FE* cataloged and reviewed several documents including previous studies, subscriber inventories, and other relevant documents. We used this initial information to facilitate in-person discussions and to determine other information needed for the analysis.

2.2 Project Initiation Meeting

On January 13, 2021, *FE* conducted a Project Initiation meeting with the County project team, and other officials from participating agencies. The purpose of the meeting was to establish a common understanding of the project goals, objectives, and vision; items best understood through a close working relationship between the respective management teams and staffs. At the meeting, *FE* introduced the team and discussed in detail the scope of work, project schedule, interview schedule, and next steps.

2.3 Stakeholder Interviews

Both during and after the Project Initiation meeting, *FE* conducted stakeholder interviews to gather additional information from users about the operational and technical needs for public safety communications. Data gathered through these discussions helped to identify





the ability of the current systems to meet users' needs, to identify any unmet needs, and to gather ideas for meeting those unmet needs.

These discussions included a mix of public safety/public service disciplines, including field users, dispatchers, and technical support. This mixture of different agencies and roles provides a cross section of radio system users, technical staff, and interoperability partners. Participants included the following County representatives:

- Robert McCallum, Jr., Levy County Sheriff
- Colonel Mike Sheffield, Levy County Sheriff's Office (LCSO)
- Mark Morgan, LCSO Information Technology
- Donna Capps, LCSO 911/Dispatch
- Mike West, LCSO E911/Addressing
- Franco Almeida, LCSO Training
- Mitch Harrell, Chief, Levy County Department of Public Safety (DPS)
- Clayton Drew, Levy County DPS

2.4 Site Visits

On January 13 and 14, 2021, **FE** conducted site surveys at nine radio frequency (RF) sites to confirm the site coordinates, elevation, tower heights, and to collect information on:

- Access road condition
- Tower and shelter condition
- Physical site security
- Grounding/lightning protection
- Tower and shelter space
- Power systems
- Needed site improvements





- Equipment inventory
- Heating, ventilating and air conditioning (HVAC)

FE assessed the feasibility of re-using these sites in a new system and found that many of the existing radio towers appear capable of supporting new antennas, but that some of the equipment shelters and buildings housing the equipment require upgrades or replacement. Several sites have limited shelter and/or tower space and many will likely require upgrades to the electrical grounding systems, HVAC, and emergency backup power systems. The RF sites assessments did not include tower structural analyses or tower climbs. *FE* also assessed several sites that the County is in the process of developing to replace some of their existing sites.

2.5 Requirements Analysis

FE compiled the onsite user feedback to prepare a list of system needs and requirements. *FE* grouped these requirements by the following subject areas, highlighting stakeholder-specific comments and concerns:

- System Requirements
 - Coverage
 - Spectrum
 - Capacity
 - Expansion
 - Reliability
 - Sustainability
 - Features
 - Management
- Backhaul
- Interoperability
- Dispatch
- Subscribers





- Civil / Site Improvements
- Training

The Needs Assessment section of this document provides a detailed list of the system requirements as specified by key County stakeholders.

2.6 Coverage Analysis

FE conducted a computer-based radio coverage analysis to identify the specific sites and equipment required to meet the County's coverage requirements, as follows:

- Worked with County stakeholders to define their radio coverage requirements and to identify existing radio coverage problem areas
- Identified potential RF sites to meet the County's coverage requirements
- Produced radio coverage maps and developed a preliminary list of sites for the system upgrade alternatives
- Conducted a radio coverage workshop, on February 11, 2021, with the County to present the initial results and obtain feedback on *FE's* initial choice of radio sites, and to identify other radio sites to cover specific areas
- Based on input received from the County at the coverage workshop, *FE* completed the coverage analysis and developed a final list of radio sites for the system upgrade alternatives

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3. Systems Overview

As noted in the introduction, most law enforcement agencies in the County, including LCSO, Chiefland PD, and Cedar Key PD, utilize the 800 MHz SLERS while County Fire/EMS departments and non-public safety users use a VHF analog/digital radio system for communications. The following sections describe the status of each of these systems.

3.1 SLERS

SLERS provides mission-critical communications services for 22 state agencies and 41 other SLERS partner jurisdictions and agencies. The current SLERS network is primarily comprised of proprietary, legacy technology from L3Harris. Numerous system components are at, near, or beyond the manufacturers' published dates for planned availability of repair parts.

The proprietary nature of the SLERS primary system technology severely limits choices for user radio equipment as only L3Harris can supply radios that will operate on existing SLERS and the current predominate public safety standard for public safety radio systems, Project 25 (P25).

The State is currently in the process of procuring the SLERS replacement, SLERS-2, which will be based on the P25 standard. The State issued an Invitation to Negotiate (ITN) for prospective system suppliers to respond to on February 16, 2021. The State expects agency migrations to SLERS-2 to begin during the late summer or early fall of 2024 and continue through 2026 or 2027. SLERS-2 will be a subscription service, like the current SLERS model. SLERS-2 service availability dates for Levy County are not available at this time, though the expectation is that SLERS-2 services will be deployed in the southern portions of Florida first and progress northward as those areas are completed.

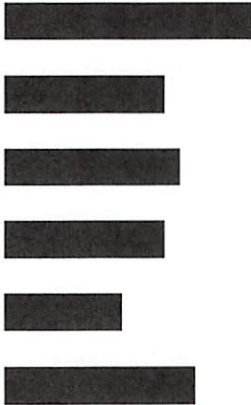
3.2 County VHF System

The County VHF system utilizes six transmit and voted receive RF sites linked via a Microwave Networks Inc (MNI) 4.9 GHz wireless transport network. The wireless transport network also connects the VHF system to the County's dispatch center's AVTEC Scout™ consoles. The VHF system is based on the Icom Digital Advanced System (IDAS™) which utilizes the Next Generation Digital Narrowband (NXDN™) common air interface (CAI) developed by JVCKenwood. The VHF system operates in a mixed (analog/digital) conventional mode and contains four analog/digital channels and one analog only paging channel. The system also utilizes Icom's LINQVOTE+® technology.





The VHF system six RF sites are currently located in the following areas:



Per ICOM technical literature, with use of "... Multisite Conventional and Votescan technologies... subscribers are able to roam from site to site without operator interaction. Subscriber transmissions received at each site are voted at a central location and the best digital audio is re-distributed to be repeated over the entire system. Subscribers then scan each site to determine which tower signal to receive...Two-way voice traffic is available at the dispatch console for all IDAS LINQVOTE+ subsystems...".

These types of voted scanning systems are typically less expensive to deploy than multicast or simulcast topologies, but the user experience may be less consistent than the latter types of systems.

3.2.1 VHF Paging

The VHF paging system shares the voted mixed mode system's antenna network, site networking equipment and wireless transport network. Each of the six RF sites contain a paging transmitter, controlled from the dispatch console system. These six paging transmitters operate on six discrete VHF frequencies. Icom subscriber radios including the "Votescan" feature allow radios to scan between the six different paging frequencies without user intervention. However, non-Icom paging devices such as the Motorola Minitor pagers also used in the County, must be programmed to a RF site's specific paging frequency. Given the size of the County a single paging RF site does not cover the entire County.

A simulcast paging system would allow for a single paging frequency Countywide.

3.2.2 Microwave Backhaul System

The microwave backhaul system utilizes MNI Proteus UMX radios to provide connectivity between RF sites and dispatch. The Proteus UMX microwave radios utilize 4.9 GHz





outdoor units. The tower mounted units contain the radio and modem electronics connected to the equipment inside the shelter via a networking cable. Power over Ethernet (POE) provides power to the tower mounted unit. While outdoor microwave units may be cheaper to implement, repairs become a bit more difficult and costly as they require tower climbs to replace a faulty unit.

The County microwave backhaul network as currently configured, in a spoke and hub or star configuration, does not provide redundant paths and a failure of individual microwave radios will remove a site from operation. Additionally, a catastrophic failure of the hub site, which in this case is the Gulf Hammock site, would cause the entire system to fail. Figure 1 details the current configuration of the County microwave backhaul network. Note that the dispatch consoles connectivity is via the Bronson site, and a failure at the Bronson site or the dispatch center would disconnect the consoles from the radio system.

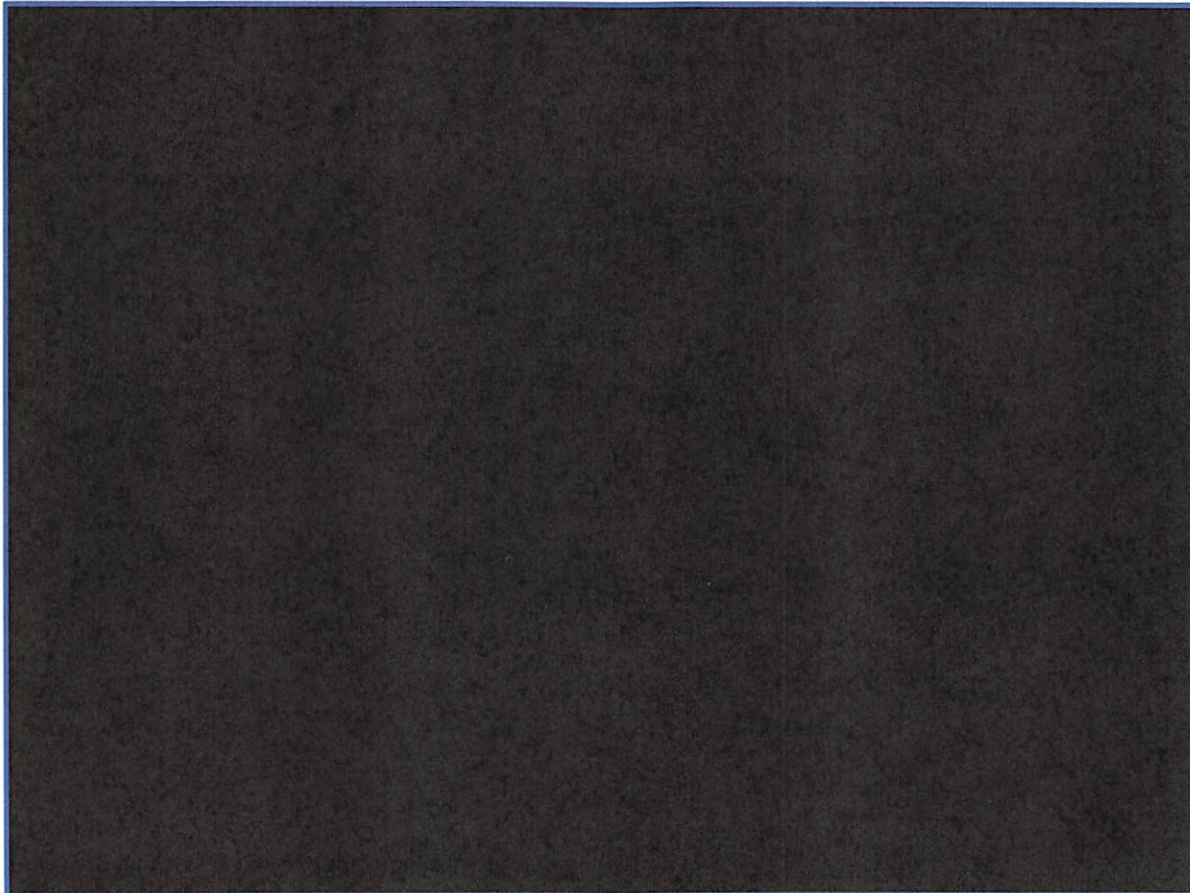


Figure 1 – Current RF Sites, Dispatch and Microwave Connectivity

The microwave backhaul system provides point to point ethernet capabilities between sites, licensed to the County under FCC callsign [REDACTED]. The 4.9 GHz public safety band was originally allocated to support public safety but has recently been considered





for use by other non-public safety entities not limited to point-to-point microwave. These other uses may add interference within the 4.9 GHz spectrum not previously accounted for.

FE recommends replacement of the current microwave backhaul network with a more robust and resilient microwave backhaul network designed in a ring configuration that utilizes licensed microwave spectrum dedicated to public safety.

3.3 Radio Site Assessment

At the time of the site visits, the County was pursuing replacement of three existing sites with three new tower sites, built and operated by tower development company NexTower. These locations provide new towers with better lease rates than the existing locations. Table 1 contains a list of radio sites visited, the site coordinates, tower heights and FCC Antenna Structure Registration (ASR) number.

Table 1 - County Radio Sites Surveyed

Site Name	Latitude	Longitude	Tower Height (feet)	ASR#
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

Figure 2 depicts the location of the sites within Levy County, FL. Green pins on the map denote the new NexTower locations while yellow pins mark existing tower sites.

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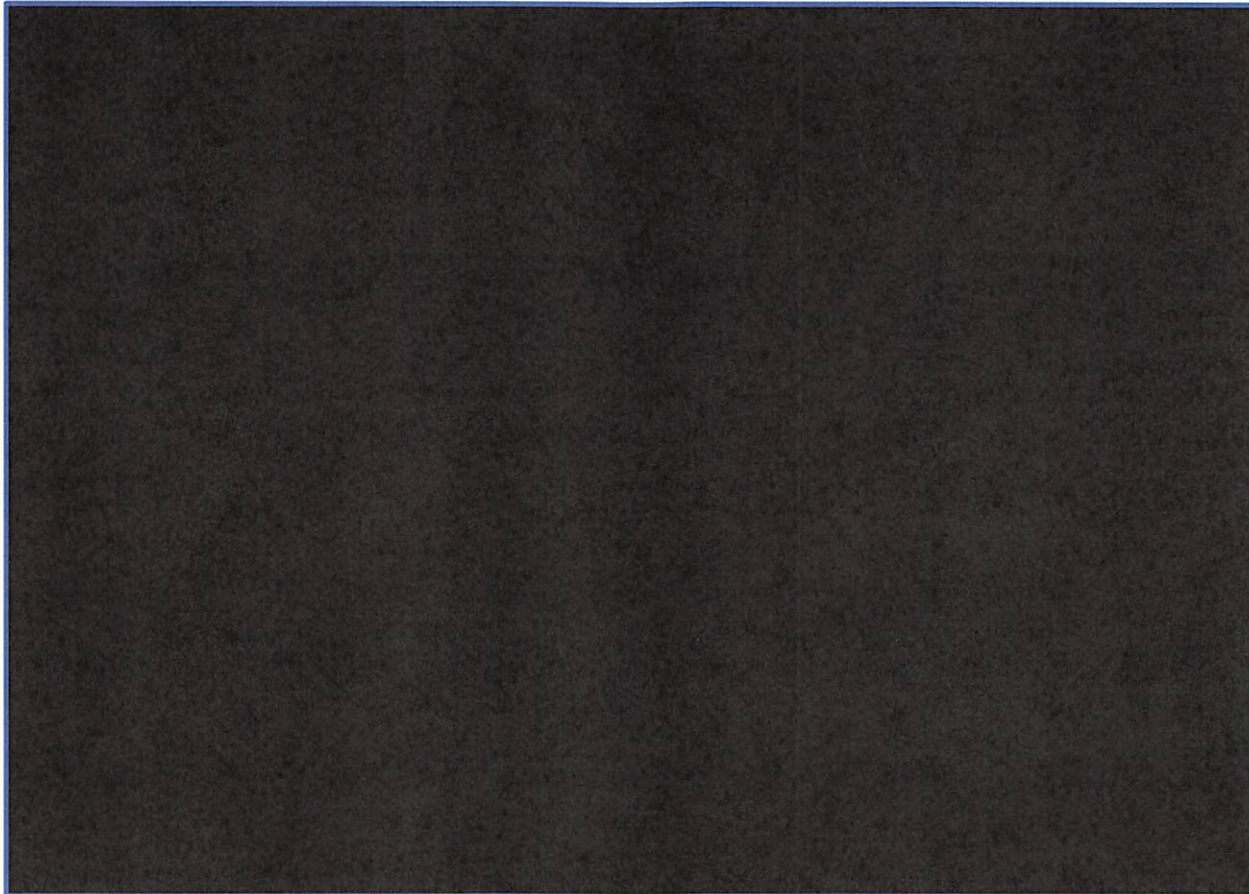


Figure 2 - County Site Locations

3.3.1 Bronson

The County owns the Bronson tower site [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

The tower is a 220-foot guyed wire, Rohn 65G tower constructed in the 2013-14 timeframe and appears to be in overall good condition. [REDACTED]
[REDACTED]

[REDACTED] The original tower design drawings included a few more antennas than are currently on the tower, but if the Bronson tower is utilized in a replacement system, *FE* recommends a complete structural analysis to ensure the tower is structurally sound to support any proposed antennas which may include LMR antennas and microwave dishes.





The communications shelter located [REDACTED]
[REDACTED]
[REDACTED] he building appears to be in overall good condition and has recently had a new roof installed. The interior height of the building was approximately eight feet. While the building is in overall good condition, there were a few improvements that *FE* would recommend if the County used the building for the replacement system. A [REDACTED].

Dual commercial Heating, ventilation, and air conditioning (HVAC) units would provide an environment more typical for the longevity of communications equipment. Housing equipment in environments containing high humidity and high temperatures can shorten the life expectancy of communications equipment and provide for an unreliable communications system.

The building also lacks a cable management system typically found in communications shelters. The building contained standoffs typically found on telephone communications boards to support coaxial cables and ground wires. A new cable management system installed within the shelter would provide better support for coaxial, power and grounding cables.

Overall, site grounding was mostly consistent with industry best practices with the following items noted as needing improvement or remediation, to include:

- Tower ground wires are not CAD welded to tower
- No ground halo installed within equipment room
- Unused coaxial cables with no lightning protection devices
- No electrical surge protection device installed
- Unused telco cables not properly grounded

Table 2 provides an assessment summary of the Bronson site.

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Table 2 - Bronson Site Assessment Summary

Item	Comment
Access Road Condition	Good, no special vehicles required
Tower/Shelter Condition	Good condition
Tower/Shelter Space	Space available for expansion
Physical Site Security	No fence however, site located directly adjacent to Sheriff's Office
Equipment Inventory	Icom IDAS system and interoperability station
Heating, Ventilation and Air Conditioning (HVAC)	Small window unit
Power Systems	AC, DC with battery backup and generator
Grounding/Lightning Protection	Basic RF protection installed, could use improvements
Needed Site Improvements	HVAC, grounding, and cable management improvements
Reuse Potential	Recommend for reuse if required for coverage

3.3.2 Chiefland

The Chiefland tower site contains a [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

The shelter is a 12-foot by 40-foot prefabricated communications shelter and contains equipment from various tenants including the County's Icom system equipment. The shelter is in overall good condition though the entry port did appear to have some coaxial cables installed without typical entry port weather sealing boots, as shown in Figure 3.

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Figure 3 – Cable Entry Port

The shelter has room for expansion and grounding appears to be in accordance with industry best practices. Items requiring attention were relative to other tenant's equipment however, *FE* assumes the County would have no control over the other tenants and their equipment grounding. If reusing the shelter and site in a replacement system, the County would need to ensure the installation of new equipment meets industry best practices for grounding. Figure 4 details the base of the tower, the shelter currently utilized for County equipment (on the left) and a cellular carrier's shelter (on the right). The compound also appears to have room for expansion.

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Figure 4 – Equipment Shelters

The tower appears in overall good condition and the documentation provided by the County indicated that the tower did receive a passing structural analysis in 2013. *FE* recommends a complete tower structural analysis prior to adding any new equipment, given changes in tower structural analysis standards. The tower appears to have several open heights available for use with additional antennas. Table 3 provides an assessment summary of the Chiefland site.

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Table 3 - Chiefland Site Assessment Summary

Item	Comment
Access Road Condition	Good, no special vehicles required
Tower/Shelter Condition	Good, entry panel missing proper boots
Tower/Shelter Space	Space available for expansion
Physical Site Security	Fence with multiple vendor's locks
Equipment Inventory	County Icom IDAS system and other tenants' equipment
Heating, Ventilation and Air Conditioning (HVAC)	Dual HVAC
Power Systems	AC, DC with battery backup
Grounding/Lightning Protection	Observed as following industry standards, requires audit
Needed Site Improvements	Proper entry boots installed, grounding audit, minimal updates
Reuse Potential	Recommend for reuse if required for coverage

3.3.3 Gulf Hammock

The Gulf Hammock site is located at coordinates [REDACTED]
[REDACTED]
[REDACTED]

[REDACTED] The ground lease includes a 10 foot by 20-foot area to house the shelter, generator and the ground space required for the liquid propane tank and associated 10-foot radius spark buffer. The tower space lease includes the two Icom system LMR antennas and five microwave dishes. Figure 5 provides a view of the site compound.

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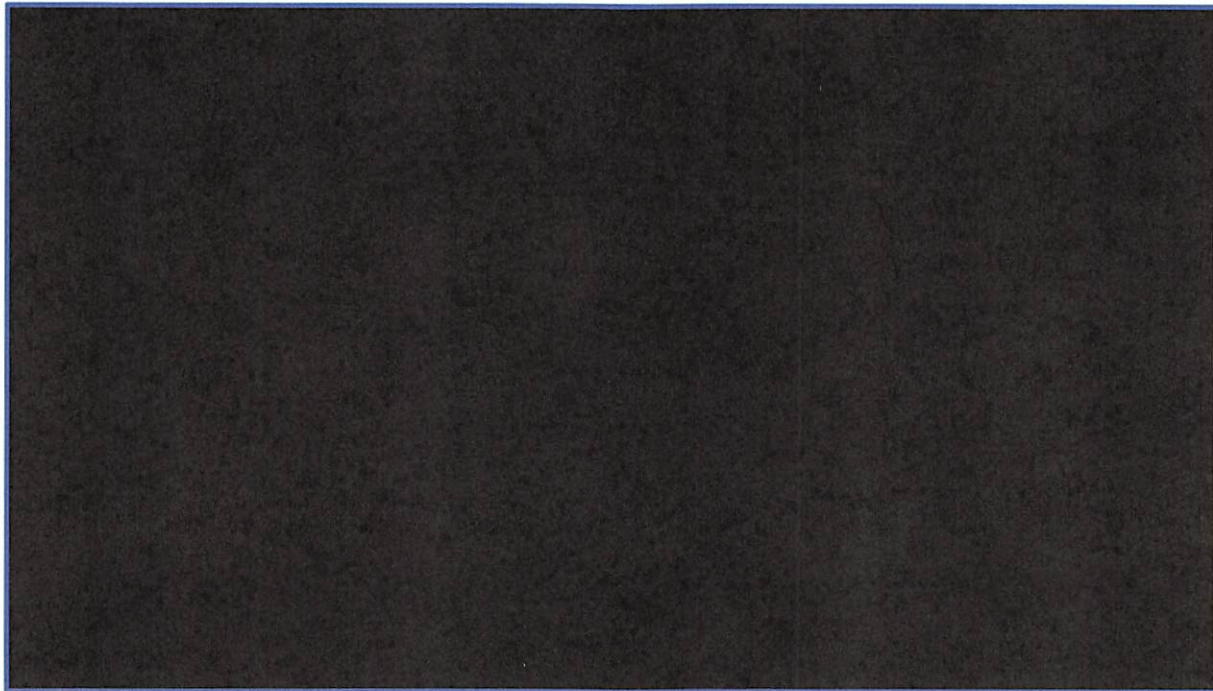


Figure 5 – Gulf Hammock Site Compound

The tower is a [REDACTED] and appears to be in overall good condition. The documents provided by the County included a structural analysis performed in 2014, presumably as part of the original Icom VHF system installation. This analysis detailed that addition of the proposed County equipment and existing site equipment passed the structural analysis at 105% loading. It is not known if any other equipment has been added or removed from this tower or if any modifications may have been done to the tower to increase its loading capacity since then. Assuming the tower loading, and structural capacity has not changed, adding any new antennas would most likely result in a failed structural analysis. Structural enhancements and removal of any unused antennas and the costs associated with this would typically be the County's responsibility.

The County's [REDACTED]
[REDACTED]
[REDACTED] see Figure 6. The shelter is in overall fair condition but there is minimal room for expansion within the shelter. Due to the CONEX box width, only a single row of equipment can be installed within them. With the five racks of equipment and the required setback area from the electrical panels, there is no additional room for any other equipment racks. Shelter cooling and heating is via a small split system reported by the County as having multiple issues in the past. A small, residential style 16 kW liquid propane generator provides backup power to the shelter.



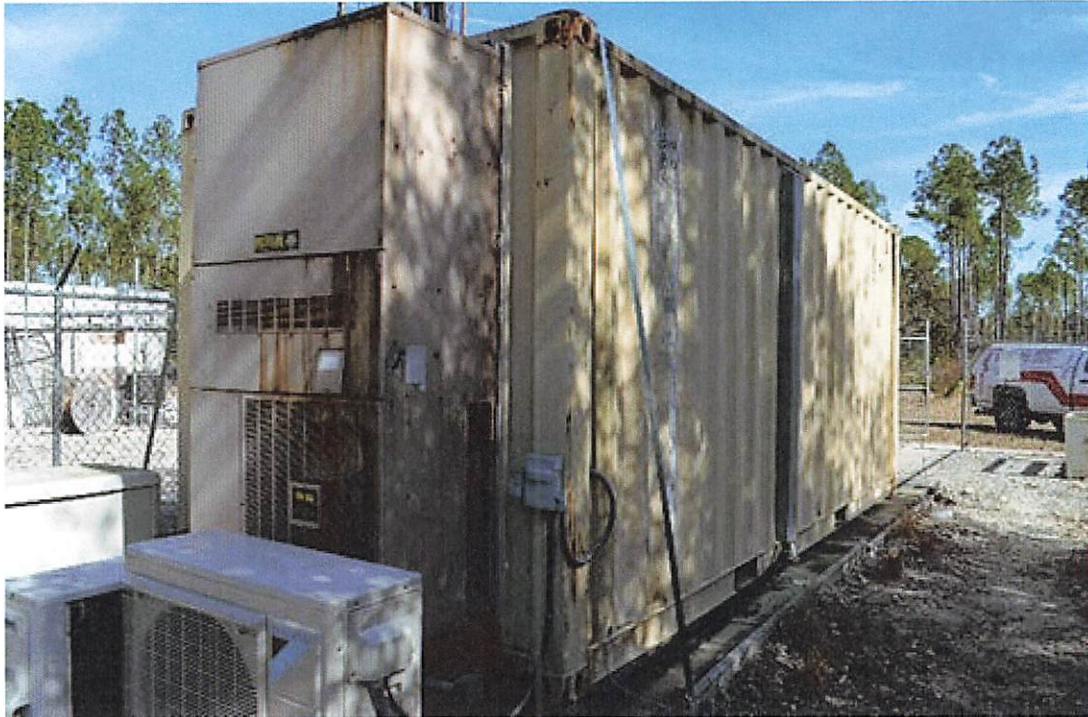


Figure 6 – CONEX Equipment Shelter

Reuse of this site would require replacement of the existing shelter with a prefabricated communications shelter including dual HVAC units and a larger generator. Table 4 provides an assessment summary of the Gulf Hammock site.

Table 4 - Gulf Hammock Site Assessment Summary

Item	Comment
Access Road Condition	Good at time of visit. 4x4 suggested due to potential for flooding during rain.
Tower/Shelter Condition	Good
Tower/Shelter Space	Minimal to no room for expansion
Physical Site Security	Fence with multiple vendor's locks
Equipment Inventory	County Icom IDAS system, Road and Transit equipment, amateur radio equipment
Heating, Ventilation and Air Conditioning (HVAC)	Split unit type
Power Systems	AC, DC with battery backup. 16 kW LP generator
Grounding/Lightning Protection	Observed as following industry standards, need audit
Needed Site Improvements	New shelter w/dual HVAC and generator
Reuse Potential	Recommend for reuse if required for coverage





3.3.4 Williston (Existing)

The Williston tower site currently utilized by the County [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]. Accordingly, therefore *FE* did not evaluate this this location for reuse.

3.3.5 Williston (NexTower)

The new Williston NexTower tower site is located at 29 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]. The County has procured used prefabricated communications shelters (12' x 20') to install at this location along with a new generator. The communications shelter will have ample room for expansion and reuse of this site for a replacement system is appropriate. The shelter and backup power generator foundations are complete and new antennas installed on the tower. Figure 7 shows the County building and generator foundations to the right.

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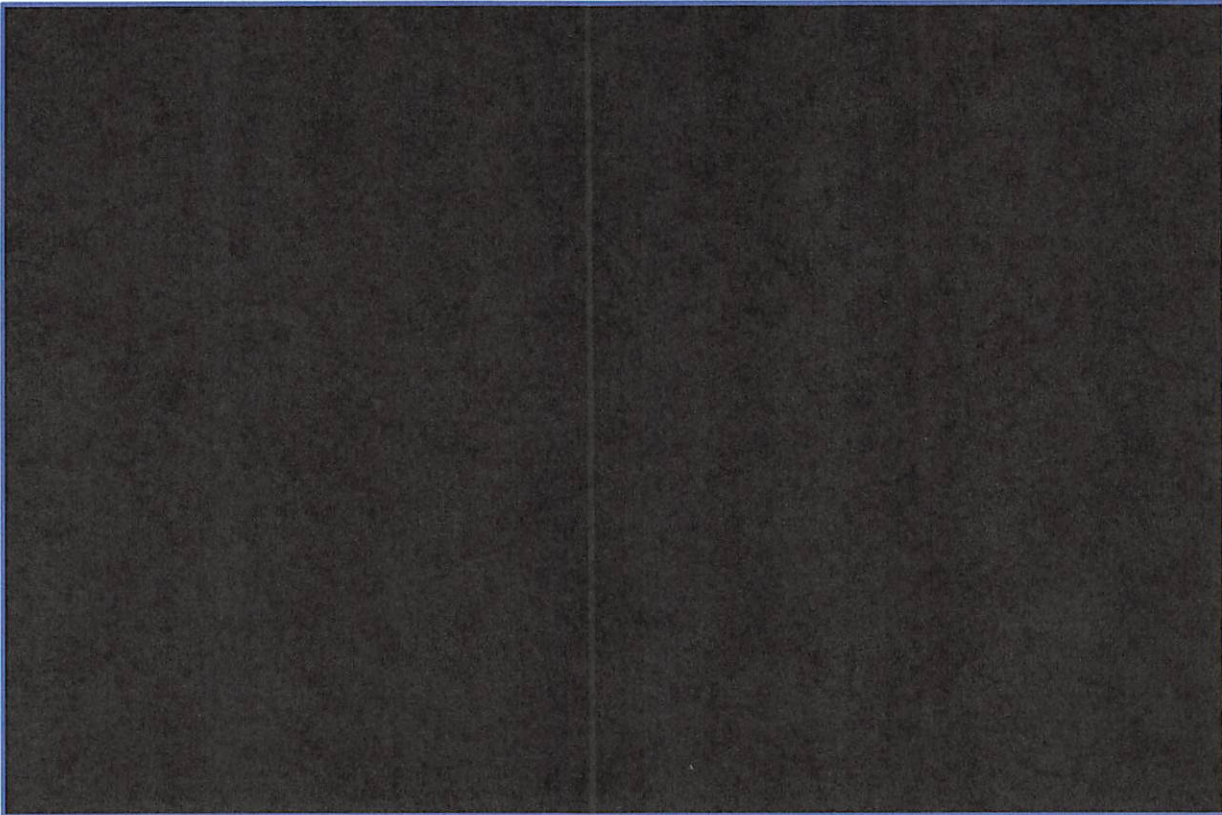


Figure 7 – Williston NexTower Site Compound

The County expects to have the existing system’s equipment relocated to this site within the next three months. Table 5 provides an assessment overview of the Williston (NexTower) site.

Table 5 - Williston (NexTower) Site Assessment Summary

Item	Comment
Access Road Condition	Good, no special vehicles required for access
Tower/Shelter Condition	Not installed during visit
Tower/Shelter Space	Room for expansion
Physical Site Security	Fence with multiple vendor’s locks
Equipment Inventory	None installed during visit
Heating, Ventilation and Air Conditioning (HVAC)	None installed during visit
Power Systems	None installed during visit
Grounding/Lightning Protection	Tower installed to industry standards. Shelter not installed during visit
Needed Site Improvements	N/A
Reuse Potential	Recommend for reuse if required for coverage





3.3.6 Inglis (Existing)

The Inglis tower site currently utilized by the County contains [REDACTED]
[REDACTED]
[REDACTED]

[REDACTED] The property is reportedly being sold and the tower users have been advised to vacate this location. The County has obtained a lease agreement with NexTower and is currently in the process of relocating the equipment from this location to the new Inglis NexTower location.

3.3.7 Inglis (NexTower)

The new Inglis tower site [REDACTED]
[REDACTED]
[REDACTED]

[REDACTED] Constructed in 2020, the tower currently has no occupants. The County will be installing a 12-foot by 20-foot prefabricated shelter and 40 kW backup power generator at this location. This shelter and generator will support the County's current Icom system once relocated from the existing Inglis site. Figure 8 shows the empty compound and guyed tower.

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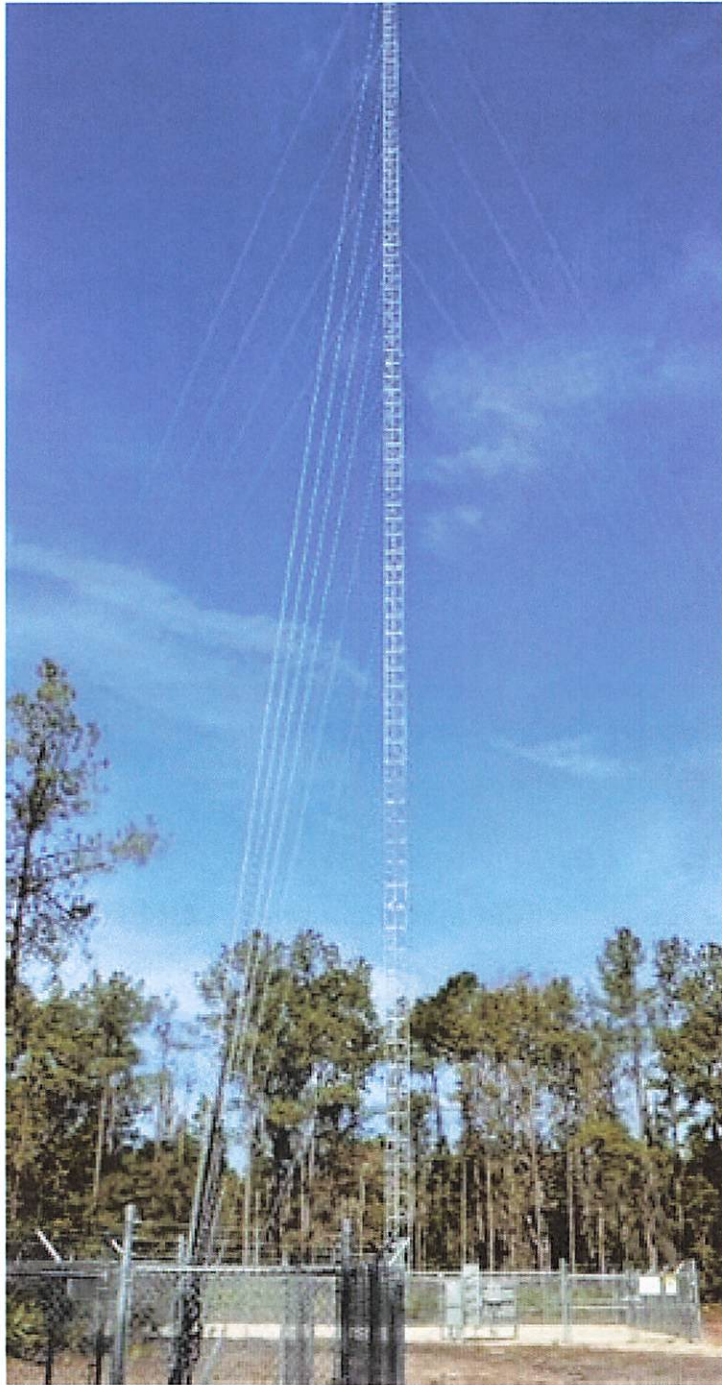


Figure 8 – Inglis NexTower Site Compound

██████████ Reuse of this tower site is appropriate. Table 6 provides an assessment summary of the Inglis (NexTower) site.





Table 6 - Inglis (NexTower) Site Assessment Summary

Item	Comment
Access Road Condition	Good, no special vehicles required for access
Tower/Shelter Condition	Not installed during visit
Tower/Shelter Space	Room for expansion
Physical Site Security	Fence with multiple vendor's locks
Equipment Inventory	None installed during visit
Heating, Ventilation and Air Conditioning (HVAC)	None installed during visit
Power Systems	None installed during visit
Grounding/Lightning Protection	Tower installed to industry standards. Shelter not installed during visit
Needed Site Improvements	N/A
Reuse Potential	Recommend for reuse if required for coverage

3.3.8 Cedar Key (Existing)

The Cedar Key tower site currently utilized by the County [REDACTED]
[REDACTED]
[REDACTED]

[REDACTED] The County has currently acquired a lease from NexTower and plans on relocating the equipment from this location to the new Cedar Key NexTower tower site.

3.3.9 Cedar Key (NexTower)

The new Cedar Key site is located [REDACTED]
[REDACTED]
[REDACTED]

[REDACTED] The site compound is roughly 60 foot by 60 foot and currently does not have any occupants. The site is in a flood zone and the electrical meters, communications shelter and generator must be mounted on platforms twelve feet above ground level. Figure 9 above shows the base of the tower and the elevated electrical meters. During site visits, access did not require specialized vehicles however, given the flood zone, the use of four-wheel drive vehicles is advisable during period of excess rain.

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Figure 9 – Cedar Key NexTower Site Compound

As with the other NexTower sites, the County has procured a used prefabricated shelter for use at this site. The shelter measures 10-foot by 20-foot and will have ample room for expansion. The site will also include a new 40 kW backup power generator. Reuse of this tower site is appropriate. Table 7 provides an assessment summary of the Cedar Key (NexTower) site.

Table 7 - Cedar Key (NexTower) Site Assessment Summary

Item	Comment
Access Road Condition	Good, no special vehicles required for access
Tower/Shelter Condition	Not installed during visit
Tower/Shelter Space	Room for expansion
Physical Site Security	Fence with multiple vendor's locks
Equipment Inventory	None installed during visit
Heating, Ventilation and Air Conditioning (HVAC)	None installed during visit
Power Systems	None installed during visit
Grounding/Lightning Protection	Tower installed to industry standards. Shelter not installed during visit
Needed Site Improvements	N/A
Reuse Potential	Recommend for reuse if required for coverage





3.3.10 Dispatch Center

The Levy County Dispatch Center [REDACTED]
[REDACTED]. [REDACTED]
[REDACTED]

[REDACTED] Figure 10 shows the front of the complex and the dispatch center is in the lighter colored building to the left.

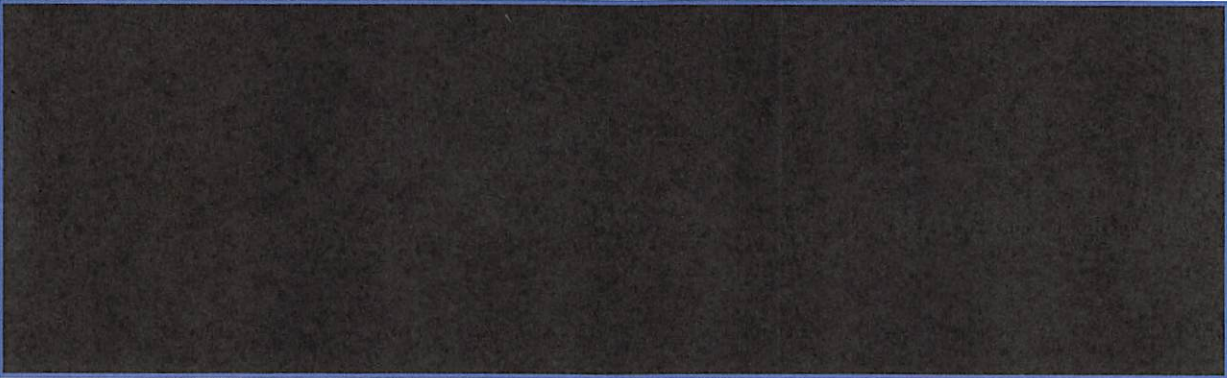


Figure 10 - Levy County Sheriff's Office Complex

Connectivity to the radio system is via a point to point 4.9 GHz microwave link between the dispatch center and the Bronson tower. The dispatch center also contains several control stations for SLERS connectivity and interoperability. There is a small tower, shown in Figure 11, attached to the dispatch building that supports the 4.9 GHz equipment and the control station antennas. The tower lacks any type of fencing for security. The tower serves its current purpose but is unlikely able to support additional equipment. For this reason, the County could either build a larger, or the dispatch center may continue to connect to the Bronson tower via a point-to-point link using smaller antennas like the ones in use today. Given the distance to the Bronson tower these smaller units may provide reliable connectivity. The base of the tower needs minor grounding improvements as some of the connections appeared corroded or rusted. The tower and building's ground buss bars utilized compression fittings on the tower and ground bars. These compression fittings have corroded and should be replaced with Cadwelds. Another option the County could consider is installing a short run of fiber between the Bronson tower and the dispatch center.

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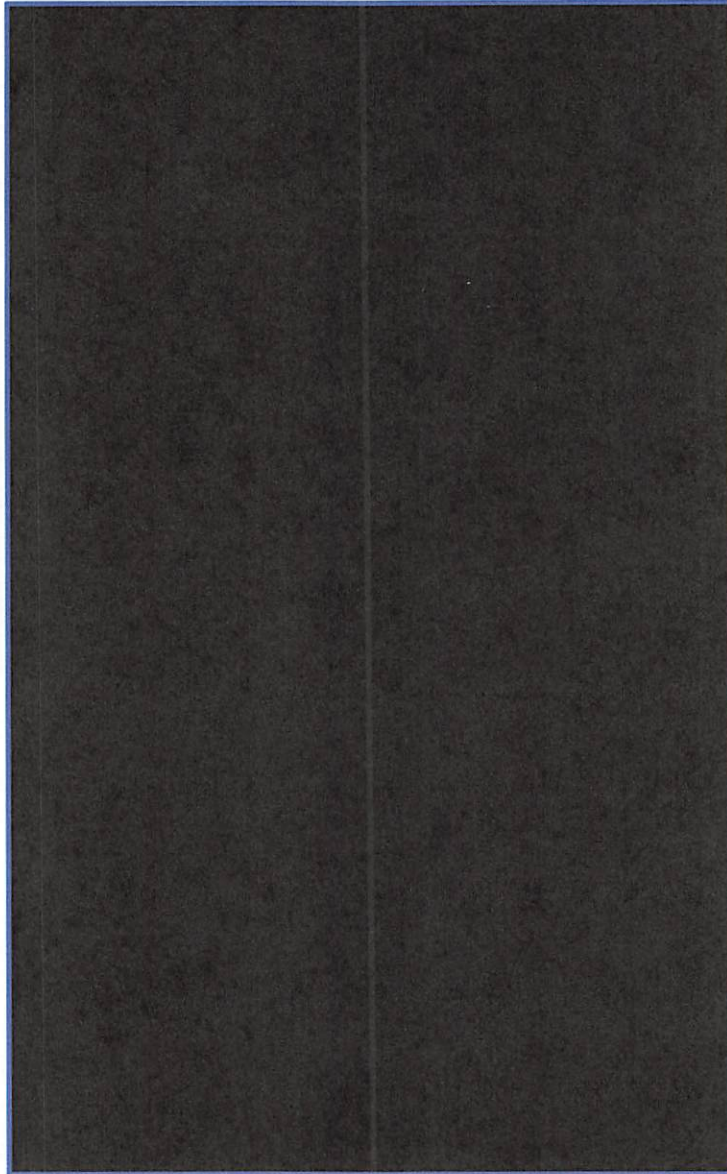


Figure 11 – Dispatch Center Tower

The equipment room is located adjacent to the tower location. The equipment room is relatively small and contains typical dispatch/911 equipment such as servers, radios, switches, and UPS equipment. The equipment room also contains a sink, and it appears that the room is used for activities other than housing public safety communications equipment. *FE* recommends a dedicated equipment room to house the dispatch/911 equipment to ensure the proper security and longevity of the equipment. Figure 12 below shows the equipment housed within the equipment room at the dispatch center.



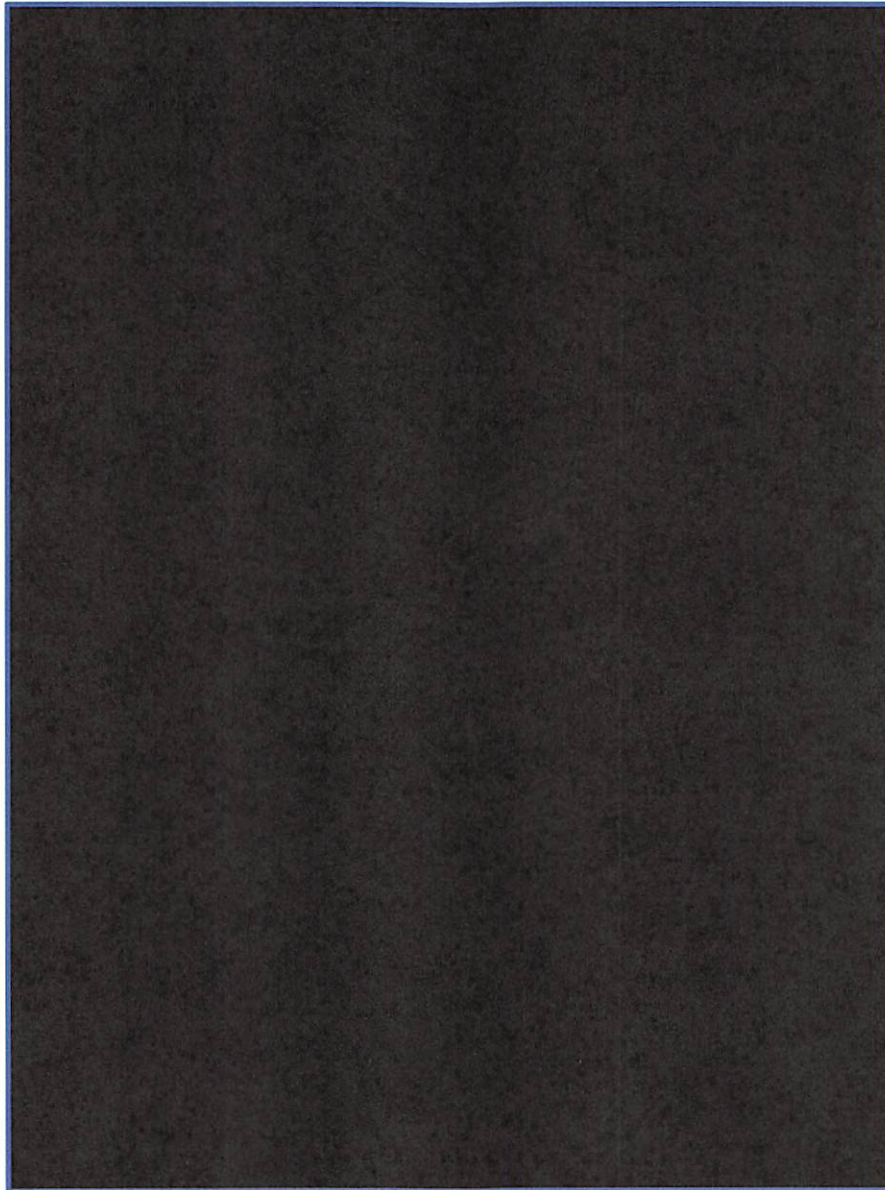


Figure 12 - Dispatch Center Equipment Racks

Figure 13 shows the sink located behind and to the right of the equipment rack housing which contains the bidirectional amplifier coverage enhancement equipment for the building and the console to radio system interface equipment.

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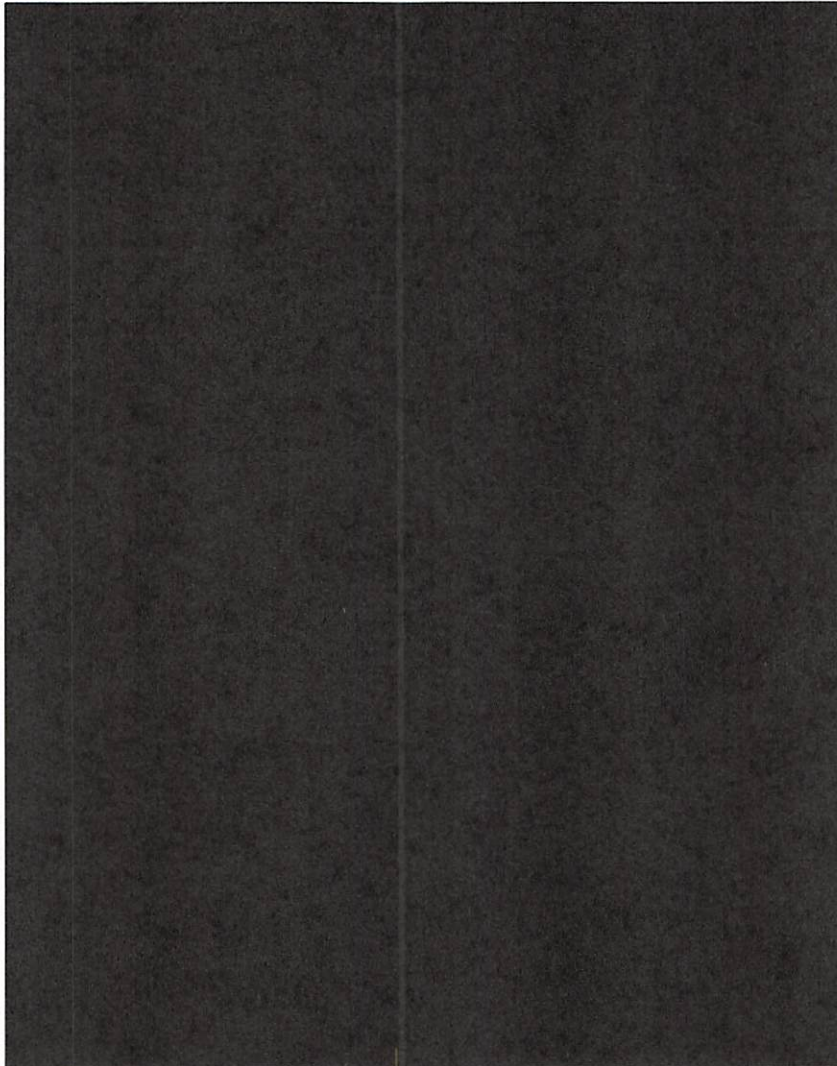


Figure 13 - Equipment Room Sink

The room housing the dispatch equipment is located within the same building. There are a total of six dispatch positions with five equipped with radio dispatch consoles. The room itself has limited space with little room for expansion. The room also does not include typical public safety communication center features as it was not purpose built to provide these functions. Public safety communication centers operate 24 hours a day, seven days a week, with rotating shifts during normal conditions. Extreme weather or events, such as terrorist activity, biohazards, pandemics, threats to the safety of the center personnel or structure, can all result in a need for facility lockdowns. Dispatch employees must be able to safely shelter in place during these types of events. *FE* recommends the County consider an assessment of the viability of the current center for future operations, consistent with current industry standards and best practices, such as those developed by the Association of Public-Safety Communications Officials (APCO), the National





Emergency Number Association (NENA) and the Commission on Accreditation for Law Enforcement Agencies, Inc. (CALEA®).

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4. Needs Assessment

FE interviewed stakeholders from the County departments and other agencies in the County using the radio system to obtain feedback related to the ability of the existing radio system to meet their operational requirements, and to identify needed improvements. FE compiled this information into a requirements matrix and reviewed the requirements with the County Project manager and key stakeholders. Following is a summary of the information FE obtained or developed in response to the stakeholder interviews and requirements.

4.1 Stakeholder Requirements

Table 8 provides a summary of the stakeholder identified requirements, listed by topic and technical or functional requirement.

Table 8 - Stakeholder & System Requirements

TOPIC	TECHNICAL OR FUNCTIONAL REQUIREMENT
System	Implement standards-based system that supports multiple vendor's devices
System Alternative 1	Utilize SLERS-2 as Countywide solution
System Alternative 2	Implement County owned and operated, standards based (Project 25) system
Spectrum	System implemented utilizing spectrum in most efficient manner
Capacity	System shall provide a Grade of Service of 1% or less
Reliability	Radio system shall be fault tolerant with no single point of failure
Sustainability	System implemented utilizing currently supported technology
Sustainability	System vendor shall provide lifecycle support plan to ensure system is supported for next 10 years (min)
Expansion	Radio system shall allow for future growth by being capable of expansion by adding sites or channels.
System Features	Radio system equipped with AES encryption and multikey
System Features	Radio system shall provide dispatch center with location information of any subscriber initiating an emergency
Interoperability	System shall provide for interoperability with neighboring Counties, State, SLERS/SLERS-2 and Federal departments
Interoperability	System shall provide solution for VHF, UHF, and 7/800 MHz interoperability solution (example - NIFOG interop channels, forestry red/white/blue, etc.)
Management	A network management system allowing for a single point to monitor and configure the entire radio system.





TOPIC	TECHNICAL OR FUNCTIONAL REQUIREMENT
Management	The network management system shall monitor all system components and provide fault, configuration, accounting, performance, and security management functions
Management	The network management system shall monitor site environmental alarms. (door open, temperature, AC fail, etc.)
Management	Report to include language related to need for and requirements of a "System Manager" position
Training	Training provided to users for the operation of subscriber devices, dispatch consoles and management applications
Coverage	System shall provide Countywide coverage to a portable worn at hip level
Coverage	System shall provide increased coverage within schools
Coverage	System shall provide increased coverage within Williston area and big box stores in Chiefland
Coverage	System to provide coverage within County Jail
Coverage	FE to conduct coverage workshop as method to obtain County consensus on system coverage expectations
Backhaul	System shall be implemented with ring protected microwave network providing five-9's reliability
Backhaul	Backhaul network design shall evaluate use of all indoor microwave radios vs. split-mount system deploying outdoor units. (all indoor preferred)
Backhaul	Backhaul network design to utilize licensed microwave
Dispatch	Dispatch center provided with six new dispatch console positions
Dispatch	Dispatch console subsystem shall have "direct" connection to system resources and not rely upon RF control stations for primary communications
Dispatch	Dispatch console subsystem provided with backup solution allowing for continued dispatching during the unlikely failure of the dispatch console subsystem
Dispatch	Dispatch console subsystem shall not lose any existing capabilities of the Avtec consoles
Dispatch	The new logging recorder system provided with XX playback licenses
Dispatch	The dispatch console positions equipped with: Radio system talkgroups, Paging, Fire Station Alerting, AES encryption, Emergency Alarms, Patching, Multiselect, and location of subscriber units upon Emergency Alarm activation or, upon manual polling of subscriber location, alias information, headsets, instant recall recorder and emergency traffic marker (10-33 tone) ability
Dispatch	The system shall allow for "deployable" consoles for use in command type vehicle or as "ad hoc" dispatch locations
Dispatch	Current dispatch center evaluated





TOPIC	TECHNICAL OR FUNCTIONAL REQUIREMENT
Subscribers	Subscriber devices shall provide interoperability with neighboring Counties, State and Federal departments
Subscribers	Subscribers may be a mix of single band and dual-band and/or multi-band radios, depending on selected frequency band and interoperability requirements.
Subscribers	Subscribers to be available in multiple tiers to account for public safety and public service users
Subscribers	Mobiles to be available in Remote mount, dual control head and dash mount configurations to account for multiple vehicle types
Subscribers	Subscribers configured with GPS, AES Encryption and multikey
Subscribers	Subscribers provided with a Wi-Fi feature allowing for communicating and configuring via Wi-Fi
Subscribers	Subscribers capable of operating in multiple frequency bands shall be available
Subscribers	Control stations/consolettes shall be available in single band and multi-band configurations capable of supporting AES encryption and multikey as well as any other implemented system feature
Subscribers	Required subscriber features are: Emergency button, PTT ID, out of range indicator and push to talk grant tone
Subscribers	A Smartphone application allowing for use of broadband devices (Wi-Fi and LTE) to communicate on system talkgroups supported
Subscribers	A Subscriber option allowing for subscriber devices to communicate on system talkgroups via Wi-Fi and LTE
FSA	Fire stations alerted via the dispatch center
Civil	System shall make use of existing sites where possible
Civil	The existing sites, if reused, shall receive grounding and power system upgrades to meet current industry standards
Civil	If required, greenfield sites shall ensure designs and installations meet grounding industry standards
Civil	If required, greenfield sites shall include new towers, shelters, power systems, UPS and diesel generator in a secure fenced compound.
Civil	New towers designed with an expansion factor allowing for additional equipment to be added later - all system equipment shall not surpass 75% of total tower loading.
Inglis	Reuse existing tower, shelter, and generator (NexTower)
Bronson	Reuse existing tower, shelter, and generator (County)
Williston	Reuse existing tower, shelter, and generator (NexTower)
Chiefland	Reuse existing tower and shelter (Crown Castle) propose new 40 kW diesel generator (generator in budget for this year, remove requirement once generator is purchased)
Cedar Key	Reuse existing tower, shelter, and generator (NexTower)
Gulf Hammock	Reuse existing tower (ATC) replace shelter and generator (40kW diesel)
Maintenance	System maintained by the vendor via service contracts





TOPIC	TECHNICAL OR FUNCTIONAL REQUIREMENT
Legacy System	Evaluate use of legacy system for non-public safety users vs. complete migration of all departments to replacement system

4.2 Subscriber Counts

Table 9 provides a breakdown of the expected subscriber counts, listed by agency, radio types and quantities, replaced, or updated for each County radio system alternative.

Table 9 - Subscriber Counts

Agency	Mobiles	Portables	Base/Control Stations	Pagers	Total
Levy County Sheriff's Office	84	129	6		219
Levy County School Board	100	100			200
Levy County DPS	48	88	0	10	146
Levy County Detention Facility		60			60
Levy County Road Department	25				25
Levy County Transit	20		1		21
Levy County Emergency Mgmt.	6	6	2		14
Levy County Animal Control		10			10
Bronson Fire	9	25			34
Cedar Key Police	7	7			14
Cedar Key Fire	8	16		5	29
Chiefland Police	11	17	1		29
Chiefland Fire	6	18		8	32
Fanning Springs Fire	5	8			13
Inglis Fire	6	9			15
Williston PD	16	19	1		36
Williston Fire	11	30			41
Totals	362	482	11	23	938

4.3 Fire Stations

Table 10 provides a list of County and City fire stations, station location, and radio equipment replaced or updated for each County radio system alternative.





Table 10 - Fire Stations

Station	Street Address	Equipment to be Replaced
Rescue Station #3 and Inglis Fire	141 Highway 40 West, Inglis, FL 34449	Motorola Minitor pager with charger/amplifier base
Fire Station #4	9990 SW 63rd Lane, lane, Cedar Key, FL 32625	Motorola Minitor pager with charger/amplifier base
Rescue Station #5	9991 SW County Road 347, Cedar Key, FL 32625	Motorola Minitor pager with charger/amplifier base
Fire Station #6	4591 NW County Road 347, Chiefland, FL 32626	Motorola Minitor pager with charger/amplifier base
Rescue Station #7	101 SW 2nd Street, Chiefland, FL 32626	Motorola Minitor pager with charger/amplifier base
Rescue Station #8	17651 NW 90th Court, Fanning Springs, FL 32693	Motorola Minitor pager with charger/amplifier base
Rescue Station #9	7851 NE90th Street, Bronson, FL 32621	Motorola Minitor pager with charger/amplifier base
Rescue Station #10	800 South Main Street, Williston, FL 32668	Motorola Minitor pager with charger/amplifier base
Fire Rescue Station #11	2830 SE County Road 121, Moriston, FL 32668	Motorola Minitor pager with charger/amplifier base
FD ST 77 (Fanning Fire)	17651 NW 90th Court, Fanning Springs, FL 32693	Kenwood NX-5000
FD ST 71 (Chiefland Fire Station #12)	2851 SE County Road 326, Gulf Hammock, FL 3263916 NE 1st Chiefland, FL	Motorola Minitor pager with charger/amplifier base
FD ST 70 (Bronson Fire)	660 E Hathaway Ave Bronson, FL	Motorola Minitor pager with charger/amplifier base
FD ST 72 (Williston Fire)	5 SW 1st Ave., Williston, FL	Icom IC-f5061
FD ST 75 (Cedar Key Fire)	489 1st ST Cedar Key, FL	Motorola Minitor pager with charger/amplifier base

4.4 Critical Buildings

Table 11 contains a list of critical buildings that the County desires coverage in, including the building name, address, and type of structure.

Table 11 - Critical Buildings

Name of Building	Street Address	Type of Structure
Bronson Elementary	400 Ishie Avenue, Bronson, FL 32621	School
Chiefland Elementary	1205 N.W. 4th Avenue, Chiefland, FL 32626	School
Joyce Bullock Elementary	130 S.W. 3rd Street, Williston, FL 32696	School
Williston Elementary	801 South Main Street, Williston, FL 32696	School





Name of Building	Street Address	Type of Structure
Cedar Key Combination (K-12)	950 Whiddon Ave. Cedar Key, FL 32625	School
Yankeetown Combination (K-8)	4500 Highway 40 West, Yankeetown, FL 34498	School
Bronson Middle & High School	351 Ishie Avenue, Bronson, FL 32621	School
Chiefland Middle & High School	808 North Main Street, Chiefland, FL 32626	School
Williston Middle & High School	350 S.W. 12th Avenue, Williston, FL 32696	School
Winn Dixie Chiefland	2202 N Young Blvd, Chiefland, FL 32626	Grocery Store
Walmart Super Center	2201 N Young Blvd, Chiefland, FL 32626	"Big Box" Store
Fanning Spring City Hall	17651 NW 90th CT, Fanning Springs FL 32693	Local Government/Municipal Bldg.
Chiefland City Hall	214 East Park Ave, Chiefland, FL 32621	Local Government/Municipal Bldg.
Chiefland Police	14 East Park Ave, Chiefland, FL 32626	Police Station/Municipal Bldg.
Bronson City Hall	550 Oak Street Bronson FL 32621	Local Government/Municipal Bldg.
Levy County Court House	355 South Court ST Bronson, FL	Local Government/County Bldg.
Levy BOCC	310 School ST Bronson, FL	Local Government/County Bldg.
LCSO and Jail	9150 NE 80th Ave Bronson	Law Enforcement/Detention County Bldg.
Levy EOC	7911 NE 90th Ave Bronson	Emergency Operations Center/County Bldg.
Levy County School Board	480 Marshburn Dr Bronson	School Department/County Bldg.
Winn Dixie Williston	727 West Noble Ave Williston	Grocery Store
Williston City Hall	50 NW Main ST Williston	Local Government/Municipal Bldg.
Williston Police	5 SW 1st Ave Williston	Police Station/Municipal Bldg.
Williston Airport FBO	1800 SW 19th Ave Williston	Airport Office
Monterey Boats	1579 SW 18th St Williston	Large Warehouse/Manufacturing Bldg.
Food Ranch	40 HWY 19 N Inglis	Grocery Store
Inglis City Hall	135 HWY 40 W Inglis	Local Government/Municipal Bldg.
Yankeetown City Hall	6241 Harmony Lane Yankeetown	Local Government/Municipal Bldg.
Cedar Key Police and City Hall	490 2 ST Cedar Key	Police Station/Municipal Bldg.
Levy DPS Complex	1251 NE CR 343 Bronson	Local Government/County Bldg.
Levy County Road Dept	620 North Hathaway Ave	Local Government/County Bldg.





4.5 Alternatives Review

Based on the results of the coverage workshop and user needs analysis, the County selected the following alternatives for further review.

- Alternative 1: County owned and operated 7/800 MHz six site P25 trunked system for all County and local public safety and public service users
- Alternative 2: Hybrid system comprised of SLERS-2, the SLERS replacement system, for County and local public safety users and a County owned and operated 7/800 MHz six site P25 conventional system for public service users

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5. Alternative 1 – County Owned P25 system

Alternative 1 consists of a standalone, County owned and operated, 700/800 MHz P25 Phase 1, six site trunked radio system. This alternative assumes all public safety agencies in the County migrate to a shared system that also includes County public service agencies and Levy County Schools.

5.1 Coverage Analysis

5.1.1 Methodology

FE produced the radio coverage maps in this section using *FEPerformancePro*[™] and high-resolution elevation and land use/cover data from the United States Geological Survey (USGS). *FE* used site information provided by the County and the technical parameters in Table 12 to model the coverage for the existing County LMR system. For the purposes of this analysis, *FE* performed this analysis for P25 Phase 2 operation, should the County decide to migrate to Phase 2 later.

Table 12 - Coverage Study Parameters

Parameter	Description
System Type	P25 Phase 2
Frequency Band	700/800 MHz
Channel Bandwidth	12.5 kHz
Reliability	95%
Audio Quality	Delivered Audio Quality (DAQ) – 3.4
Talk Paths	Mobile radio talk-out ¹ Mobile radio talk-in ² Portable radio talk-out, on-street Portable radio talk-in, on-street Portable radio talk-out, in light/residential buildings Portable radio talk-in, in light/residential buildings

Reliability is a measure of confidence in the signals in areas shown as covered on the maps and is based on recommendations from the Telecommunications Industry Association (TIA) TSB-88³ suite of documents. In the case of public safety radio systems, TSB-88 recommends 95% reliability, which means that users should be able to receive

¹ Repeater to mobile and portable radio.

² Mobile and portable radio to repeater and receivers.

³ TIA TSB-88 Wireless Communications Systems - *Performance in Noise and Interference-Limited Situations*





audio at Delivered Audio Quality (DAQ) 3.4 or better in any area deemed “covered” at least 95% of the time.

The coverage displayed on each map indicates the areas predicted to have audio quality greater than or equal to DAQ 3.4. DAQ is a measure of audio quality over a transmission medium, with different levels as shown in Table 13. DAQ 3.4 is the level most often used for public safety radio systems.

Table 13 - Delivered Audio Quality Definitions

DAQ Level	Definition
1.0	Unusable. Speech present but not understandable
2.0	Speech understandable with considerable effort. Requires frequent repetition due to noise or distortion
3.0	Speech understandable with slight effort. Requires occasional repetition due to noise or distortion
3.4	Speech understandable without repetition. Some noise or distortion present. DAQ 3.4 is the minimum Channel Performance Criterion (CPC) used for public safety agencies.
4.0	Speech easily understandable. Little noise or distortion
5.0	Perfect. No distortion or noise discernible

FE used the mobile and portable radio parameters in Table 14 to model radio coverage.

Table 14 - Mobile and Portable Radio Parameters

Parameter	Mobile	Portable
Transmit Power (watts)	30	3
Receive Sensitivity (dBm)	-119	-119
Antenna Location	Roof	Hip
Antenna Gain (dB)	0	0
Body Loss (dB)	N/A	14.3

Following the analysis of existing system coverage, *FE* conducted a radio coverage workshop with County stakeholders to:

- Review the existing system coverage maps
- Identify areas with insufficient coverage
- Evaluate potential new sites to supplement coverage
- Identify a final set of sites that would best meet the County’s coverage needs





5.1.2 Results

Based on *FE's* radio coverage analysis, a 7/800 MHz simulcast system would best meet the County's coverage requirements. Table 15 provide the list of repeater sites utilized by the new system.

Table 15 - Alternative 1 Site List

Site Name	Latitude	Longitude	Tower Height (feet)	ASR#
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

The coverage maps below show predicted mobile, on-street portable and in-building portable radio coverage. Mobile radio coverage footprints tend to be larger than portable radio coverage footprints, as mobile power output is usually much higher than portable radios (typically 30-35 Watts for mobiles vs. 2.5-3 Watts for portables in 700/800 MHz systems). In addition, mobile radios in 700/800 MHz systems typically include higher gain antennas (e.g., 3 dB gain antennas), and portable radios are subject to signal loss by being next to a user's body. On-street portable radio coverage exceeds in-building portable coverage due to the additional signal loss incurred when inside buildings. The coverage maps use the following colors to model predicted coverage:

- Green - areas where users should be able to communicate using their portable radios when inside light-density and/or residential buildings. For these coverage prediction studies, *FE* used 10 dB to represent signal loss inside these types of buildings
- Yellow - areas where users should be able to communicate using their portable radios on the street (on-street portable coverage should also exist in all green areas)
- Purple - areas where users should be able to communicate using their mobile radios (mobile coverage should also exist in all green and yellow areas)

Note: The radio coverage portrayed by the maps in this section may vary from actual system coverage. Computer modeling cannot account for all variables, such as individual radio performance, electrical noise, and radio interference. General





loss factors used for trees and buildings, but actual signal loss varies based on the type, height and density of the trees and buildings.

Figure 14 shows the composite “round-trip” coverage for the potential six-site simulcast cell. Round-trip coverage is a preferred method for evaluating overall system performance, as coverage is only displayed in the areas where both talk-out (site to radio) and talk-in (radio to site) coverage should meet the required signal thresholds.

The coverage maps account for the possibility of time delay interference (TDI) within the simulcast cell and the specified radio sites should provide the displayed coverage, provided the awarded vendor practices sound engineering to mitigate the possibility of TDI.

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Levy County, FL - Potential 700/800 MHz Coverage - Six-site System
P25 Phase 2 Coverage >= DAQ 3.4; Round-Trip Coverage (talk-out and talk-in); 95% Reliability

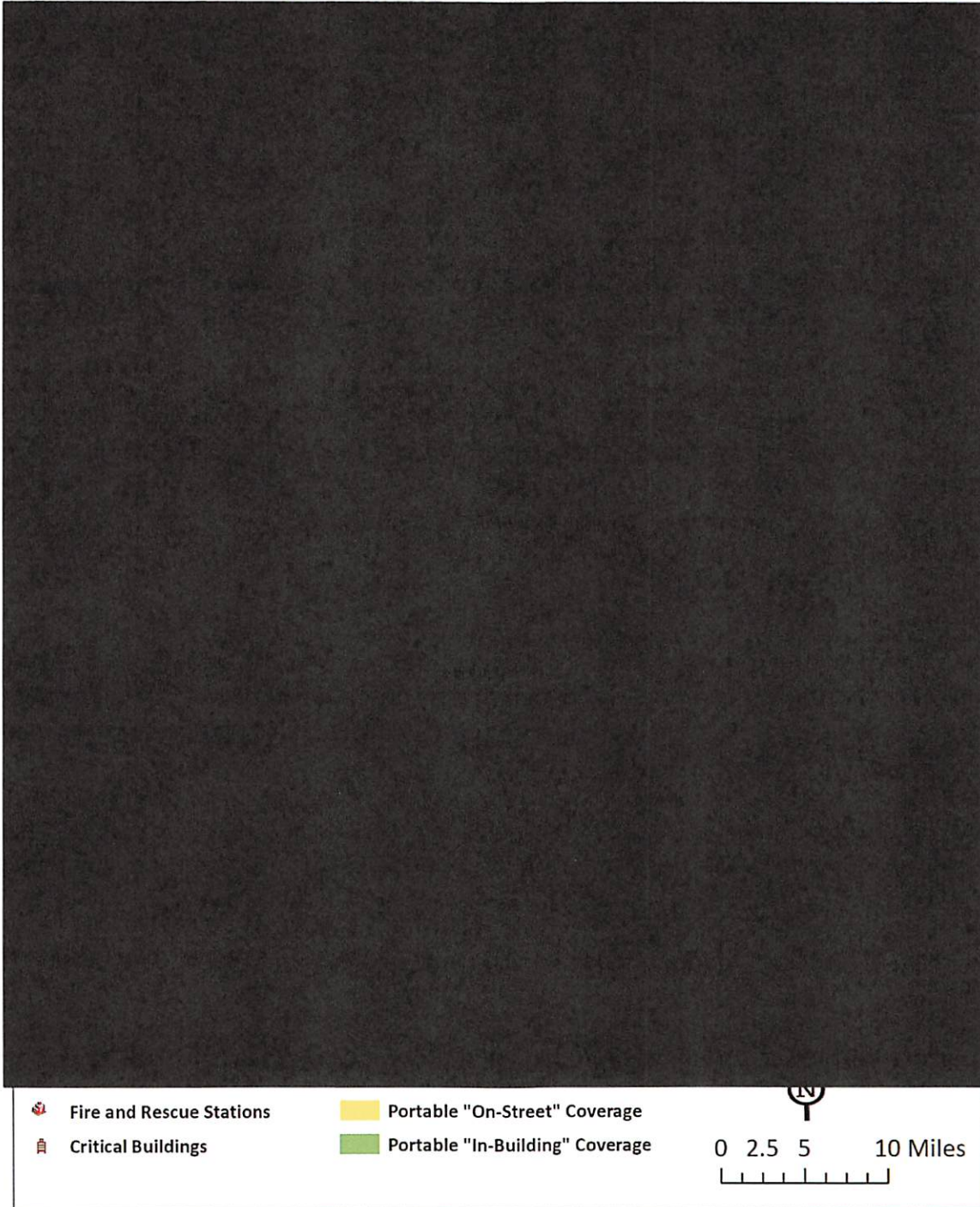


Figure 14 - Alternative 1 Predicted Round-Trip Coverage





The anticipated round-trip coverage percentages of the geographical boundaries of Levy County for the Alternative 1 design are as follows:

- Mobile > 99%
- Portable On-Street – 96%
- Portable In-Building – 65%

5.1.2.1 In-Building Coverage

FE also evaluated potential light in-building portable radio coverage in the population centers for locations identified previously in *Table 10 - Fire Stations* and *Table 11 - Critical Buildings*.

The results of this analysis indicates that 12 of the 13 Fire and Rescue stations and all 31 critical buildings are within the light in-building coverage areas in this conceptual design. Building construction and densities may require additional coverage enhancements for these facilities if the actual building losses are more than 10 dB.

5.2 Channel Capacity Analysis

FE used existing and projected County subscriber unit quantities to perform an Erlang-C trunked system loading analysis, which determines the required number of channels at each site to meet the County system capacity needs. *FE* used the following design targets for the capacity analysis:

- The system would have a public-safety Grade of Service (GoS) less than or equal to 1%, meaning that less than 1% of all attempted calls would be queued or blocked
- The system would support a subscriber unit growth factor of 2% per year for 10 years

FE made the following assumptions regarding the capacity analysis for the P25 trunked radio system:

- P25 Phase 1 would provide one voice paths per radio licensed frequency pair using frequency division multiple access (FDMA) technology





- Due to a lack of existing traffic data, *FE* assumed projected push-to-talk (PTT) duration and PTTs per hour based on our extensive experience analyzing public safety radio system traffic data
- The number of talk paths would support projected traffic in the Average Non-Busy Hour, as well as Busy Hour traffic scenarios

FE derived an Average Non-Busy Hour user traffic profile for the County by examining public safety traffic data obtained from other similar public safety radio projects. Based on evaluations by the Public Safety Wireless Advisory Committee (PSWAC)⁴, Busy Hour traffic is assumed to be 4 times the Average Non-Busy Hour traffic. *FE* used the Busy Hour traffic scenario as the minimum requirement for the channel capacity throughout the P25 system.

Based on the results of the Erlang-C analysis, a five-channel P25 Phase 1 system would meet the GoS requirement during Busy Hour traffic scenarios. A 6-channel P25 Phase 1 system would provide 5 talk paths (e.g., 5 distinct simultaneous conversations can occur amongst P25 Phase 1 talkgroups) and one trunking control channel. Providing this amount of capacity at all sites should meet the County's current capacity needs as well as provide room for growth.

To accommodate additional future County growth, the system will be capable of being software upgraded to support P25 Phase 2. This upgrade could provide an increase in talk paths from 5 to 10 supporting 10 simultaneous conversations.

5.3 Radio System Design Criteria

FE used the following criteria for the 700/800 MHZ P25 trunked system conceptual design:

- Implement a new standalone P25 Phase 1 trunked simulcast system that includes the following new equipment:
 - P25 Phase 1 trunked system control equipment
 - Simulcast control and voting equipment
 - Site equipment (P25 Phase 1 repeaters and/or receivers)

⁴ Final Report of the Public Safety Wireless Advisory Committee to the Federal Communications Commission. September 11, 1996. <https://www.apcointl.org/doc/spectrum-management/173-public-safety-wireless-pdf/file.html>





- 700/800 MHZ antenna systems (e.g., antennas, transmission lines, transmitter combiners and receiver multicouplers)
- DC power systems
- Grounding and lightning protection systems
- Leverage existing sites to greatest extent possible; only adding new sites, including towers and shelters, as needed to provide the required radio coverage
- Utilize existing and available 700/800 MHZ channels from approved regional plans

5.3.1 System Architecture

Figure 15 shows high-level block diagram for the standalone P25 Phase 1 trunked system, including system control sites, simulcast control, repeater sites, and dispatch equipment.

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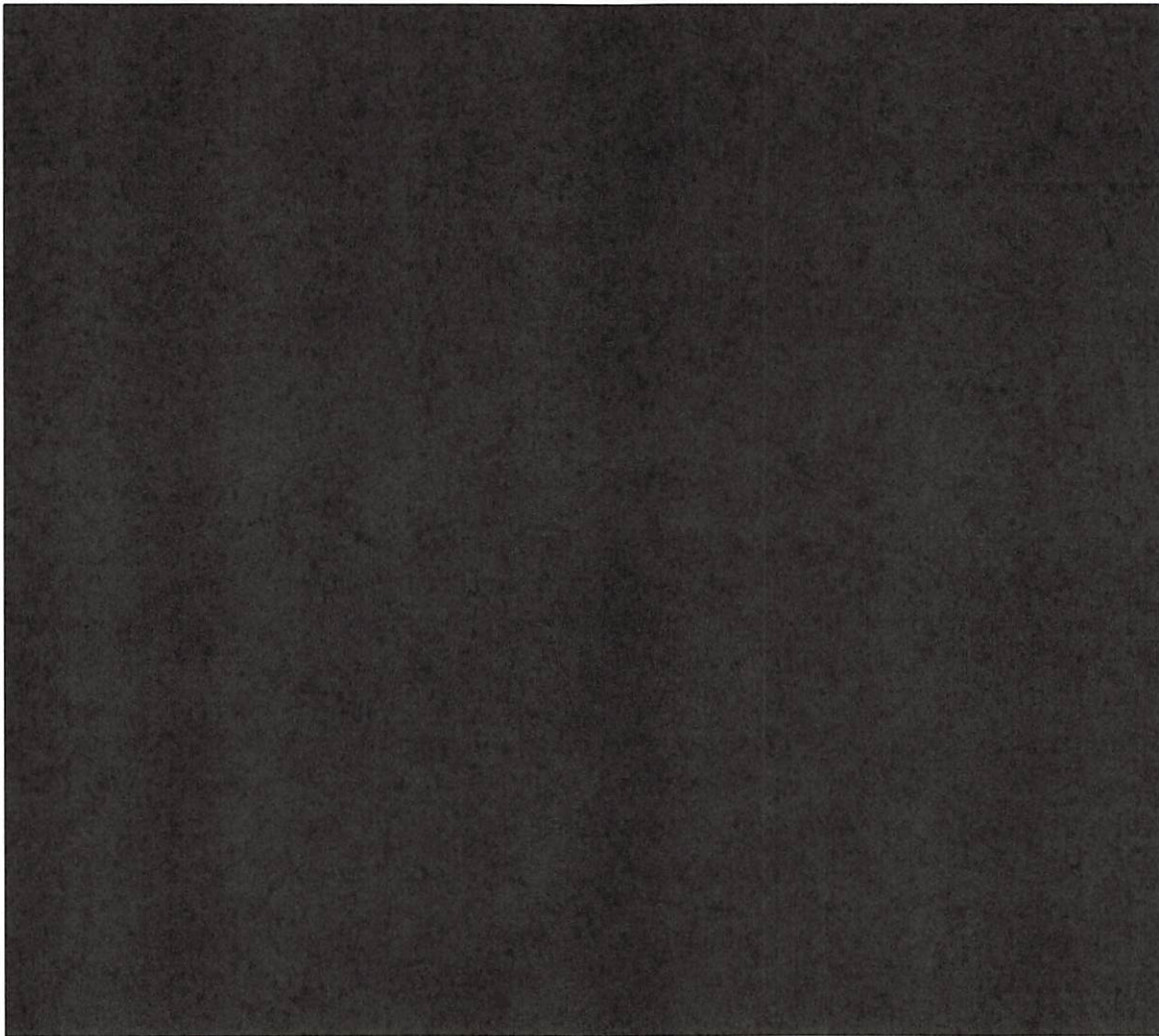


Figure 15 - Alternative 1 Architecture

5.3.2 LMR System Equipment

5.3.2.1 System Control Equipment

P25 system control equipment includes management, administration and networking components utilized for control of the 700/800 MHZ trunked system. The control equipment provides voice call processing, mobility management and system management. Voice call processing manages all aspects of call setup, queuing, and tear down. Mobility management refers to the system's ability to track users as they move from site to site. System management includes management of aliases and unit permissions as well as system fault monitoring.





The P25 trunked control system could be either centralized or distributed. *FE* functional specifications allow both approaches, but for the conceptual design, *FE* assumed a centralized architecture. The primary control site can be located at any of the proposed 700/800 MHz repeater sites, provided there is adequate space and supporting infrastructure. In a distributed architecture, each 700/800 MHz repeater site would have the capability to take on central control functions for the entire system. For this conceptual design, *FE* selected the Bronson site as the system control site, primarily due to the proximity to the dispatch center and the security of having the system control equipment on Sheriff's Office property. The system control equipment also includes with a redundant set of control equipment.

5.3.2.2 Simulcast Control and Voting Equipment

The simulcast controller maintains the frequency, phase, and amplitude stability of the 700/800 MHz repeaters to minimize audio distortion for mobile and portable radios in areas where the transmit signals from multiple repeaters overlap. The voting equipment selects the highest quality audio from multiple sites and routes the selected audio to the simulcast controller and dispatch consoles. The simulcast controller then routes the audio to all repeater sites for retransmission. The backhaul system transports audio between repeater sites, simulcast controller/voting equipment and the dispatch consoles. Simulcast controller/voting equipment sites would also include Global Positioning System (GPS) receivers with a high-stability oscillator.

The simulcast control and voting equipment are key components of the system. A failure of the simulcast controller would disable the entire system. A failure of the voting equipment would disable an entire channel, multiple channels, or all channels. For this reason, the conceptual design includes a geographically separate redundant set of simulcast control and voting equipment. This geographically redundant equipment would keep the system operational in the event of a failure to any or all the simulcast control and voting equipment. For this conceptual design, the primary set of simulcast control and voting equipment will be located at the Bronson site with the geographically redundant set located at the Gulf Hammock site.

5.3.2.3 Base Station/Repeater Site Equipment

All repeater sites include new equipment, as follows:

- 700/800 MHz P25 base stations/repeaters licensed and configured to operate in P25 Phase 1 FDMA mode. The base station/repeaters would also support an upgrade to P25 Phase 2 TDMA mode, allowing for system expansion in the future.





- 700/800 MHZ antenna system including transmit and receive antennas, transmit combiners, receiver multicoupler, radio frequency (RF) cable and lightning protection devices (i.e., lightning arrestors and feedline ground kits). All channels at a site would share common transmit and receive antennas.
- GPS receiver for frequency stability and timing reference
- Associated networking equipment for local communication between devices and to interface site equipment with microwave backhaul network.
- Alarm interfacing equipment to provide site status, operation and alarm conditions to network management system.
- Interoperability gateway at each repeater site and associated multiband control station to allow interoperability with outside agencies

5.3.3 Interoperability

The County owned system including all County and local public safety as well as public service agencies provides the highest level of interoperability between these agencies. The system would include interoperability talk groups available to all users. These common talkgroups will allow for direct communications between everyone on the system. Outside agencies that operate on 7/800 MHz P25 systems, such as those from Alachua, Marion, and Citrus Counties, could configure their radios directly operate on the new Levy County P25 system. Alternatively, Levy County users could configure their radios to operate on these neighboring county radio systems.

Interoperability with Gilchrist and Dixie Counties will be provided through the implementation of control stations and gateway devices at each of the tower sites. The gateway device allows for the interface of these control stations with the new P25 system's control equipment, permitting console patching of these control stations to the talkgroups utilized by users of the new P25 radio system. Once patched, users of the new P25 system would be capable of directly communicating to the outside agencies. Patching outside agencies to the new P25 radio system will only be effective when the users are within the coverage areas of their respective radio systems Mutual aid into Gilchrist and Dixie counties would require the Levy County agencies to have radios capable of operating on the separate County's radio systems. This could be achieved by supplying some key Levy County users with multiband radios capable of operating in the 7/800 MHz band as well as the VHF band for interoperability with Gilchrist and Dixie counties.





5.3.4 System Features

The new 700/800 MHz P25 trunked system would offer the following features and capabilities.

Improved Coverage and Less Noise

Many legacy radio systems use frequency modulation (FM) technology. While FM is relatively resistant to noise in areas with a moderately strong signal, in areas of low signal strength radio users would hear the desired signal and the noise. As the noise level increases, radio users must consciously separate the audio from the noise. A digital P25 radio system would provide relatively noise-free communications by leveraging voice coders (vocoders) and forward error correction (FEC).

P25 vocoders encode sounds related to understandable speech while providing some protection from transmission of noise when the analog voice signal is converted to a digital signal. After the signal is digitized (turned into a string of digital bits), FEC is applied to help the receiving radio correct errors that occur during transmission, due to weak signal levels or external interference. The result of these two processes is that the received signal quality is relatively consistent over much of the coverage area, which allows radio users to listen without the extra effort needed to separate audio from noise.

Encryption and Improved Encrypted Voice Quality

While many legacy radio systems have had encryption options, prior to P25 there was no standardized encryption system for LMR systems. P25 has a set of encryption standards that includes the encryption protocol and encryption key distribution and management. Over the Air Rekeying (OTAR), which is described below, can be implemented on P25 systems facilitates key system/subscriber management without the need to manually reprogram subscriber units.

Open Data Interfaces

P25 provides an open-standard data interface at both the network and subscriber unit levels which simplifies development of third-party data applications and prevents the sunk cost of application development from becoming a barrier to the use of new subscriber products. The applications to which this applies vary widely from simple messaging to location and over the air programming.

Competitive Procurement

P25 standards have created a marketplace where radio system manufacturers produce radio systems that are compatible with subscriber radios from different manufacturers.





Most major radio system manufacturers supply P25 radio systems and subscriber units, but others may only supply one or the other. In addition, several specialty manufacturers supply standards-based equipment for specialized uses such as aircraft, surveillance, data, and receive-only applications. This range of suppliers fosters a truly competitive procurement process and makes it easy to acquire comparable pricing sources from the multiple public contracts available.

Other System Features

The 700/800 MHZ P25 trunked system would retain all features of the existing system and would provide other features and capabilities that may be beneficial to County departments/radio users, such as:

- **Emergency Calls** – allows a radio user or dispatcher to declare an emergency for their group with a single button press. This feature informs all users on that talkgroup of the emergency, and that talkgroup receives highest priority on the system so critical communications is not blocked
- **User Authentication** – ensures that only properly authorized subscriber radios may communicate on the system, preventing unauthorized (and potentially disruptive or fraudulent) access to the system
- **Radio Inhibit/Uninhibit** – the system manager may temporarily or permanently disable a lost, stolen or misused radio
- **Global Positioning System (GPS)** – GPS and Automatic Vehicle Location (AVL) systems typically use the standardized GPS protocol within the P25 standard
- **Call Alert** – allows a dispatcher or subscriber unit to send a page-like call to another subscriber unit
- **Announcement Group Call** – much like a talkgroup call, but is usually used to make announcements to larger groups made up of two or more talkgroups
- **Status Query** – allows a user to set a status on his/her radio that can be displayed to a dispatcher or used by a Computer Aided Dispatch (CAD) system in directing calls
- **Private Calls** – allows a radio user to talk directly to a dispatcher or to another radio user, in relative privacy. While not encrypted, it does assure that other users on the system are not included in the conversation





- **Short Messaging Service (SMS)** – allows transmission of short text messages between radio units or between a dispatch position and a radio unit
- **Dynamic Regrouping** – allows units to be regrouped, or for multiple groups to be brought together for short-term activities

While a new P25 trunked radio system may support all the above features, it is important to note that specific hardware options and/or software licenses may be required on the system and/or subscriber units for features to function properly.

5.4 Microwave Backhaul System

A ring protected licensed microwave backhaul network connects the six RF sites. The ring configuration will retain connection in the event of a microwave radio failure on a single path. A catastrophic failure of any site, completely removing that site from operation would allow the remaining sites to remain connected. The link between the dispatch center and the Bronson site includes monitored hot standby microwave radios. These monitored hot standby (MHSB) radios will protect the link from a failure of a single microwave radio. MHSB radios provide two links whereas failure of one of the links will not remove the link from operation. *FE* selected the MHSB option for the dispatch link mainly due to the size of the tower currently located at the dispatch center. To add the dispatch center into the microwave ring requires a more substantial tower structure. The MHSB option and backup control stations within the dispatch center increase the reliability of the system. In the event of a total failure of the link to Bronson, the backup control stations provide for communications with users in the field. Figure 16 depicts the conceptual microwave backhaul system.

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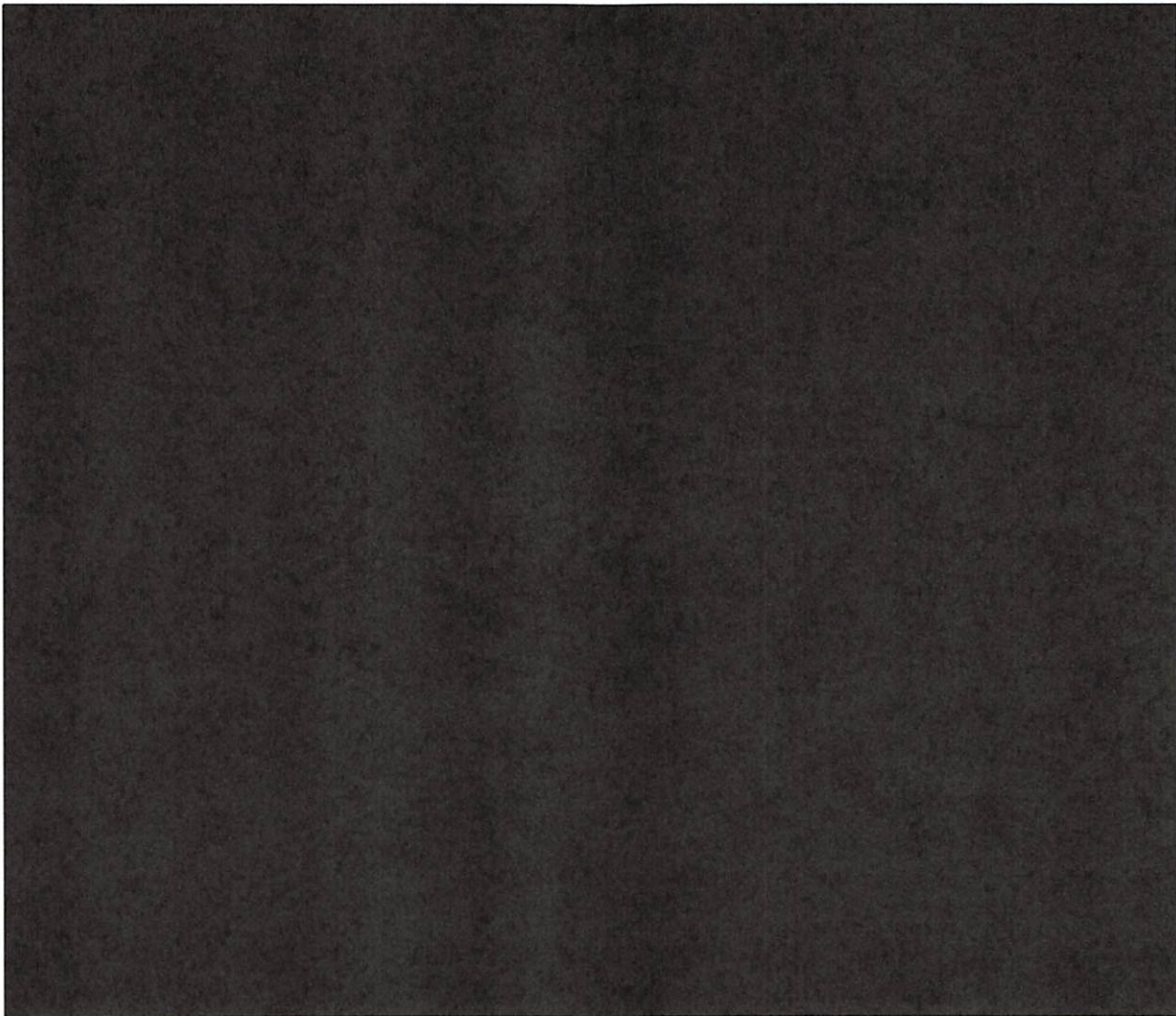


Figure 16 - Microwave Backhaul System

5.5 Dispatch Equipment

5.5.1 Design Criteria

FE used the following criteria for the dispatch center design for Alternative 1:

- Replace the existing consoles with six new mission-critical, IP-based dispatch consoles capable of direct connection with new P25 system
- Install one new backup control station for each dispatch console position, along with a new antenna system
- Retain use of the existing logging recorder, upgrading its capability to P25 operation





- Install new networking equipment (routers, switches, and gateways).

5.5.2 System Architecture

The conceptual design includes the replacement of the existing dispatch consoles, redundant networking equipment and backup RF control stations. The new console system would replace the existing backroom equipment with compact servers, routers, switches, and computers. Each console position retains all functionality of the existing consoles and provides new features including:

- Radio system channel control
- Paging
- Fire station alerting
- Emergency alarms and calls
- Patching between talkgroups and conventional resources
- Multiselect talkgroups and conventional resources
- Headset operation
- AES encryption
- P25 operation
- Emergency marker (10-33) tone ability
- Instant recall capability
- User alias information

The backup control stations provided alternate means of communications in the event of a console or microwave link failure to the P25 system control equipment. The control stations would be multi-band units allowing for operation on analog or P25 digital systems on VHF, UHF and/or 700/800 MHz channels.

The existing logging recorder must also be upgraded to capture P25 audio.

5.6 Radio Site Improvements

Based on the site visits conducted by **FE** and documentation from the County, there are some radio site upgrades needed to support the Alternative 1 conceptual design. These site improvements upgrades include the following items:

- Structural analysis for towers
- Site grounding updates
- Existing shelter modifications





- New prefabricated communications shelter
- New backup power generator
- New DC power plant

All the towers will require structural analysis to ensure they will support the existing loading as well as the new antennas required for the new LMR system and microwave backhaul solutions. While the costs for structural analysis are relatively low, there is a risk that additional tower modifications may be required to enhance the capability of the tower to support existing and new equipment within the guidelines of the current antenna support structure standard.

The costs estimates include the costs to perform grounding tests and audits at each of the RF sites and dispatch center as well as adding some additional grounding to equipment either lacking or missing grounding. Overall, the grounding at the sites were in relatively good condition but, some grounding connections did not meet the current industry best practices for site installation and grounding methods.

The conceptual design includes some key system component improvements at the Bronson site. The conceptual design costs include a replacement of the existing window unit to a dual HVAC industrial grade system, and an updated cable management system.

If the new dispatch consoles are deployed at the existing the dispatch center, the electronics room will require modifications including an upgrade to the cable entry and management system and electrical upgrades to support the new equipment.

The County has made significant improvements to the existing systems that will result in savings for the new system include the implementation of four prefabricated communications shelters. The County has acquired and implemented new shelters at the Cedar Key, Inglis, and Williston sites. The Bronson and Chiefland shelters will be reused and receive minor updates. A single site, Gulf Hammock, will receive a new communications shelter and backup power generator.

All sites will receive new DC power plant equipment properly sized to provide eight hours of run time.

5.7 Network Management System

The conceptual design includes a new Network Management System (NMS) to accomplish the following functions:





- Remotely monitor radio system and site performance and alarms (e.g., equipment failures, elevated temperatures, and intrusion)
- Troubleshoot system outages
- Administer and manage system security, functionality, and software licenses
- Page or send emails to report system alarms or outages to staff required to respond
- Manage subscriber radio equipment, allowing for remote changes or software license updates

The NMS software interface identifies the current operating status of the equipment and sites and would flag 'out of tolerance' conditions via an audio/visual indication. The indication would return to a normal indication after correction of the out of tolerance condition. Following are some of the events and functions that the NMS would monitor and manage:

- Transmitter low power output
- Antenna system high Voltage Standing Wave Ratio (VSWR)
- Transmitter power amplifier (PA) failure
- Base station power supply failure
- Router/switch failure
- Controller/gateway/server failure
- External interference detection
- Backhaul subsystem failure
- IP network intrusion and security
- Configuration database changes

The NMS would archive system data and would maintain a history of alarm events in a searchable database for a minimum of 180 days. Storage of alarm events enables root cause analysis on infrequent recurring events.

The NMS will also monitor and report repeater site environmental alarms. These alarms will include but not be limited to the following:

- Door alarm
- High temperature
- Low temperature
- Generator run
- Generator not in auto





- HVAC failure
- Smoke alarm

5.8 Subscriber Units

Most of the County's existing subscriber units operate in the VHF band or do not support P25 operation. The Sheriff's Office currently have 20 portable units which do operate in the 7/800 MHz band and are P25 ready, e.g., upgradeable. Levy DPS reported having 19 portable units and 14 mobile units capable of 7/800 MHz and P25 operation. The remaining subscriber units will need to be replaced with models operating in the 7/800 MHz band and equipped for P25 trunking operation. Table 16 provides the potential subscriber replacement counts by agency or department for Alternative 1.

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Table 16 - Alternative 1 Subscriber Replacement

Agency	Mobiles	Portables	Base/Control Stations	Pagers	Total
Levy County Sheriff's Office	84	129	6		219
Levy County School Board	100	100			200
Levy County DPS	48	88	0	10	146
Levy County Detention Facility		60			60
Levy County Road Department	25				25
Levy County Transit	20		1		21
Levy County Emergency Mgmt.	6	6	2		14
Levy County Animal Control		10			10
Bronson Fire	9	25			34
Cedar Key Police	7	7			14
Cedar Key Fire	8	16		5	29
Chiefland Police	11	17	1		29
Chiefland Fire	6	18		8	32
Fanning Springs Fire	5	8			13
Inglis Fire	6	9			15
Williston PD	16	19	1		36
Williston Fire	11	30			41
Totals	362	482	11	23	938

5.9 Cost Analysis

FE prepared high-level budgetary cost estimates using an in-house cost analysis tool for the County P25 radio system, licensed backhaul system, dispatch consoles, site improvements, and implementation services. The cost estimates are based on:

- Data collected from previous projects
- Our experience and publicly available industry information
- Information collected specifically for this project
- FE's experience designing comparable radio systems

Actual system costs are highly dependent upon final system design choices as well as conditions in the land mobile and microwave radio markets during the system procurement phase.





FE's budgetary estimates are intentionally conservative. Typically, vendor proposal pricing is unlikely to exceed *FE's* estimate, based on a comparable design as outlined in our assumptions. Our cost estimates are based upon recent non-discounted pricing. Frequently, system vendors provide discounts for large system and subscriber unit purchases, however dynamics in the competitive systems market make it impractical to forecast the specific discounts vendors may offer at the time of proposal submission.

5.9.1 Cost Assumptions

Based on results from the coverage studies, analysis of existing inventory and feedback provided by the County, *FE* developed the following set of equipment and service-related assumptions, shown in Table 17, for the Alternative 1 cost estimates.

Table 17 - Alternative 1 Cost Assumptions

Alt 1 Conceptual Design Assumptions	QTY	Notes
<i>Core & Network Management</i>		
P25 Trunking Control Equipment	1	New P25 Trunking Control equipment with redundant servers and networking equipment
Remote Terminal Unit (RTU)	7	New RTU's for equipment and site alarms (RF Sites and Dispatch Sites)
<i>Network Management System</i>		
Network Management Server	1	New 6-site, 6-channel simulcast cell (Redundant)
Network Management Terminal	1	Management Terminal (PC and network equip)
<i>Simulcast Control Equipment</i>		
Simulcast Control Equipment	2	New 6-site, 6-channel simulcast cell (Redundant)
Voting Equipment	2	New 6-site, 6-channel simulcast cell (Redundant)
GPS Frequency Standard	2	Required for each simulcast control equipment site
Networking Equipment	2	New, redundant routers and switches
<i>Simulcast Site Equipment</i>		
6-CH Simulcast P25 Trunking site equipment	6	Bronson, Chiefland, Cedar Key, Gulf Hammock, Inglis, Williston
GPS Frequency Standard	6	RF Sites
Networking Equipment	6	Redundant networking equipment
Antenna Network (7/800 MHz)	6	TX/RX antenna system with combiner, multicooupler and TTA
Interop Gateway (8 ports)	6	Interop Gateways at each RF Site
<i>Dispatch Site Equipment</i>		
Dispatch Console Position	6	6 new console positions
Control/Backup RF Station	6	New backup RF control station per dispatch console
Control Station Antenna System	6	New control station antenna system per dispatch site
Site Networking Equipment	1	New redundant routers and switches





Alt 1 Conceptual Design Assumptions	QTY	Notes
<i>Microwave Backhaul Equipment</i>		
Microwave Radios	14	New backhaul equipment for connecting LMR sites
Microwave Antennas	14	New antennas/dishes for new backhaul equipment
Coaxial Cable and Waveguide	14	New line & accessories for new backhaul equipment
<i>Site Improvements</i>		
Existing Structure with Available Space	6	Based on County provided documentation or input
Structural Analysis Needed	7	Based on County provided documentation or input
Existing Shelter/Bldg. with Available Space	6	Based on County provided documentation or input
Site Grounding Updates	7	Based on County provided documentation or input
Existing Shelter Mods Needed	2	Based on County provided documentation or input
New Prefab Shelter Needed	1	Based on County provided documentation or input
Commercial AC Power Available	7	Based on County provided documentation or input
New Generator Needed	1	Based on County provided documentation or input
New DC System Needed	6	Based on County provided documentation or input
<i>FCC Licensing and Coordination</i>		
LMR FCC License	30	New LMR site application(s) and/or existing license modification(s) for Conceptual Design
LMR Frequency Coordination	30	New LMR site application(s) and/or existing license modification(s) for Conceptual Design
LMR Engineering Services	30	New LMR site application(s) and/or existing license modification(s) for Conceptual Design
MW FCC License Coordination	7	New MW site application(s) and/or existing license modification(s) for Conceptual Design
MW FCC License	14	New MW site application(s) and/or existing license modification(s) for Conceptual Design
<i>Implementation Services</i>		
Spare / Test Equipment	5%	Based on <i>FE</i> historical / industry data
Project Management	10%	Based on <i>FE</i> historical / industry data
Installation	10%	Based on <i>FE</i> historical / industry data
Engineering	20%	Based on <i>FE</i> historical / industry data
Removal of Existing Equipment	2%	Based on <i>FE</i> historical / industry data
Training	1%	Based on <i>FE</i> historical / industry data
Staging	5%	Based on <i>FE</i> historical / industry data
Acceptance/Coverage Testing	1%	Based on <i>FE</i> historical / industry data
Documentation	1%	Based on <i>FE</i> historical / industry data
Contingency	10%	Based on <i>FE</i> historical / industry data





5.9.2 Radio System Cost

Table 18 shows the estimated cost for the new 700/800 MHZ LMR system equipment and implementation services needed for the Alternative 1 conceptual design.

Table 18 - Alternative 1 Radio System Cost Estimate

Radio System Cost Estimate			
<i>Core Network Equipment</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
P25 Control Equipment w/redundancy	1	\$738,000	\$738,000
Network Management Equipment	1	\$295,000	\$295,000
Subtotal - Core Network Equipment			\$1,033,000
<i>Simulcast Control Equipment</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Simulcast Control Equipment	2	\$150,000	\$300,000
Voting Equipment	2	\$160,000	\$320,000
GPS Frequency Standard	2	\$37,000	\$74,000
Networking Equipment	2	\$73,000	\$146,000
Subtotal - Simulcast Control Equipment			\$840,000
<i>Simulcast Site Equipment</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
6-CH Simulcast P25 Trunking site equipment	6	\$303,000	\$1,818,000
GPS Frequency Standard	4	\$37,000	\$148,000
Networking Equipment	6	\$73,000	\$438,000
Antenna Network (7/800 MHz)	6	\$30,000	\$180,000
Interop Gateway (8 ports)	6	\$10,000	\$60,000
Subtotal - Remote RF Site Equipment			\$2,644,000
Equipment Subtotal			\$4,517,000
<i>FCC Licensing and Coordination</i>		<i>Unit Cost</i>	<i>Extended Cost</i>
LMR FCC License Fees	36	\$100	\$3,600
LMR Frequency Coordination Fees	36	\$300	\$10,800
LMR Engineering Services Fees	36	\$125	\$4,500
Subtotal - FCC Licensing and Coordination (rounded)			\$19,000
<i>Implementation Services</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Project Management	10%		\$452,000
Installation	10%		\$452,000
Engineering	20%		\$904,000
Removal of Existing Equipment	2%		\$91,000
Training	1%		\$46,000
Staging	5%		\$226,000
Acceptance Testing	1%		\$46,000
Documentation	1%		\$46,000
Subtotal - Implementation Services			\$2,263,000
Services Subtotal			\$2,282,000
TOTAL - EQUIPMENT & SERVICES			\$6,800,000





5.9.3 Dispatch System Cost

Table 19 provides the estimated cost for the new dispatch system equipment and implementation services needed for the Alternative 1 conceptual design.

Table 19 - Alternative 1 Dispatch System Cost Estimate

Dispatch System Cost Estimate			
<i>Dispatch Equipment</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Dispatch Console Position	6	\$48,000	\$288,000
Control/Backup RF Station	6	\$7,000	\$42,000
Control Station Antenna System	6	\$18,000	\$108,000
Site Networking Equipment	1	\$13,000	\$13,000
Equipment Subtotal			\$451,000
<i>Implementation Services</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Project Management	10%		\$46,000
Installation	10%		\$46,000
Engineering	20%		\$91,000
Removal of Existing Equipment	2%		\$10,000
Training	1%		\$5,000
Staging	5%		\$23,000
Acceptance Testing	1%		\$5,000
Documentation	1%		\$5,000
Subtotal - Implementation Services			\$231,000
TOTAL - EQUIPMENT & SERVICES			\$690,000

5.9.4 Backhaul System Cost

Table 20 shows the estimated cost for the new backhaul system equipment and implementation services needed for the Alternative 1 conceptual design.

Table 20 - Alternative 1 Backhaul System Cost Estimate

Backhaul System Cost Estimate			
<i>Microwave Equipment</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Microwave Radios	14	\$30,000	\$420,000
Microwave Antennas	14	\$9,000	\$126,000
Coaxial Cable and Waveguide	14	\$2,000	\$28,000
Equipment Subtotal			\$574,000
<i>FCC Licensing and Coordination</i>		<i>Unit Cost</i>	<i>Extended Cost</i>
FCC License Coordination	7	\$1,700	\$11,900
FCC License	14	\$1,200	\$16,800
Subtotal - FCC Licensing and Coordination			\$29,000





Backhaul System Cost Estimate			
<i>Implementation Services</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Project Management	10%		\$58,000
Installation	10%		\$58,000
Engineering	20%		\$115,000
Removal of Existing Equipment	2%		\$12,000
Training	1%		\$6,000
Staging	5%		\$29,000
Acceptance Testing	1%		\$6,000
Documentation	1%		\$6,000
Subtotal - Implementation Services			\$290,000
Services Subtotal			\$319,000
TOTAL - EQUIPMENT & SERVICES			\$900,000

5.9.5 Site Improvements Cost

Table 21 shows the estimated cost for the site improvements and remediation services needed for the Alternative 1 conceptual design.

Table 21 - Alternative 1 Site Improvements Cost Estimate

Site Improvements Cost Estimate			
<i>Site Improvements</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Structural Analysis Needed	7	\$5,000	\$35,000
Site Grounding Updates	7	\$15,000	\$105,000
Existing Shelter Mods Needed	2	\$20,000	\$40,000
New Prefab Shelter Needed	1	\$109,000	\$109,000
New Generator Needed	1	\$30,000	\$30,000
New DC System Needed	6	\$50,000	\$300,000
Site Improvements Subtotal (rounded)			\$619,000
<i>Implementation Services*</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Project Management	10%		\$44,000
Installation	10%		\$44,000
Engineering	20%		\$88,000
Removal of Existing Equipment	2%		\$9,000
Training	1%		\$5,000
Staging	5%		\$22,000
Acceptance Testing	1%		\$5,000
Documentation	1%		\$5,000
Implementation Services Subtotal			\$222,000
TOTAL - IMPROVEMENTS & SERVICES			\$850,000





5.9.6 Subscriber Unit Costs

The cost estimate presented below includes the replacement of existing portables, mobiles, control/base stations, and pagers with new 700/800 MHZ, mid-tier models with software to operate in P25 Phase 1 trunking mode for public safety users and low-tier models for non-public safety users. The use of mid-tier and low-tier models provides a good average price point for budgetary purposes. Some departments may purchase low-tier models, while others may purchase high-tier models with added features. As part of the RFP, the County could specify the quantity and tier requirements for each department, which would allow the vendors to provide a more accurate cost proposal.

Table 22 shows the estimated costs for new 700/800 MHZ, mid-tier and low tier radios with software to operate in P25 Phase 1 trunking mode.

Table 22 - Alternative 1 Subscriber Units Cost Estimate

Subscriber type	Quantity	Extended Cost
Mobile Radios (Mid-Tier)	217	\$1,128,400
Mobile Radios (Low Tier)	145	\$449,500
Portable Radios (Mid-tier)	432	\$2,160,000
Portable Radios (Low tier)	110	\$286,000
Control Stations w/install	11	\$84,700
Subscriber Total		\$4,108,600

5.9.7 Capital Cost Summary

Table 23 shows the estimated total capital costs for Alternative 1, including the 700/800 MHZ radio system, microwave backhaul, dispatch equipment, site improvements, and subscriber units, rounded to the nearest \$10,000.

Table 23 - Alternative 1 Total Capital Cost Estimate

Alternative 1 Total Cost Estimate				
Item	Equipment	Services	Contingency	Total (rounded)
Radio System	\$4,517,000	\$2,282,000	\$680,000	\$7,480,000
Dispatch System	\$451,000	\$231,000	\$69,000	\$760,000
Backhaul System	\$574,000	\$319,000	\$90,000	\$990,000
Site Improvements	\$619,000	\$222,000	\$85,000	\$930,000
Spare Equipment	\$278,000			\$280,000
Subscriber Devices	\$4,108,600			\$4,110,000
Total	\$10,548,000	\$3,054,000	\$924,000	\$14,550,000





This round order of magnitude (ROM) cost estimate reflects non-discounted (list) pricing. Frequently, system vendors provide discounts for system purchases of this size. System discounts of 20% to 25% are common (and mirror many state contracts), but **FE** has seen higher levels of discounting take place in extremely competitive procurements. Large quantity subscriber purchases may be discounted at even higher rates. However, it is not possible to forecast the level of discount a vendor will offer at the time of proposal submission.

Based on recent competitive procurements, **FE** would expect vendor pricing for the Alternative 1 conceptual design and subscriber equipment to fall within the range of \$9.6M - \$11.6M.

5.9.8 Operational Costs

Table 24 shows the estimated annual operational cost for Alternative 1 over 10 years. The estimate does not include any current operational expenses such as LMR and microwave system maintenance contracts, site maintenance, site leases, staff salaries or other recurring expenditures. The cost estimate also does not include any optional extended warranty that vendors may offer beyond Year 3. The estimated cost includes only the new LMR, microwave backhaul, dispatch equipment, and subscriber equipment. The County may customize their service plan, which may be lower or higher than these projected costs.

Other assumptions for the operational costs are as follows:

- A 3-year manufacturer warranty period with technical support and software/hardware upgrade costs begin in Year 4
- A subscriber growth rate of 2%
- A subscriber attrition rate of 1%
- An inflation rate of 3%
- A 7-year subscriber unit lifecycle with all subscriber units replaced by Year 10, 7 years after the 3-year warranty period
- A 10-year lifecycle for backhaul and LMR equipment





Table 24 - 10 Year Operating Cost Estimate

10-Year Operating Cost Estimate	
Technical Support	\$458,000
Software/Hardware Upgrades	\$904,000
Onsite Support/Repair	\$1,352,000
Subscriber Growth	\$924,000
Subscriber Attrition	\$449,000
Total	\$4,087,000

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6. Alternative 2 – Hybrid SLERS-2/County System

Alternative 2 is a hybrid system where County and local public safety entities would use the new Florida statewide system, SLERS-2, when it is available and public service entities would use a new County owned and operated 7/800 MHz six site P25 system.

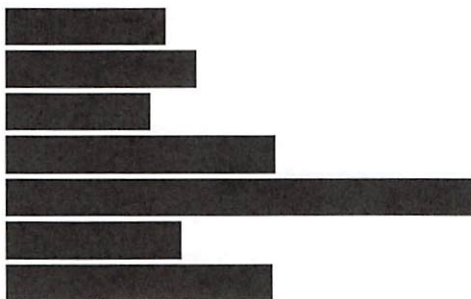
At this time, it is still unclear if the State will allow for non-public safety agencies to become SLERS-2 users, which is why we recommend a new County owned and operated system for these users, such as the following:

- Levy Road Department
- Levy Transit
- Levy School Board
- Levy Animal Control

Additionally, it is also unclear if SLERS-2 will allow any type of fire station alerting. Therefore, the County would still need to implement a County owned solution for fire station alerting. *FE* also assumed that the new County owned system would be a 7/800 MHz six site P25 system, so that radios purchased for operation on SLERS-2 could also work on the County owned system, for interoperability. The County owned system could also be upgraded to allow all County and local systems to operate on it, if SLERS-2 is delayed or does not meet County public safety users' needs.

6.1 SLERS System

SLERS currently utilizes seven sites to provide coverage in and around Levy County. The locations of the seven sites are in or near the following areas.



FE assumes that these same seven sites would be utilized to provide the anticipated coverage within Levy County from the SLERS-2 system.





6.2 SLERS-2 Coverage

6.2.1 Methodology

FE performed the coverage analysis for Alternative 2 using the same methodology as used for Alternative 1. See Section 5.2.1.2 for details.

6.2.2 Results

The coverage maps below show mobile, on-street portable and in-building portable radio coverage. Mobile radio coverage footprints tend to be larger than portable radio coverage footprints, as mobile power output is usually much higher than portable radios (typically 30-35 Watts for mobiles vs. 2.5-3 Watts for portables in 700/800 MHz systems). In addition, mobile radios in 700/800 MHz systems are often deployed with higher gain antennas (e.g., 3 dBd gain antennas), and portable radios are also subject to signal loss by being next to a user's body. On-street portable radio coverage exceeds in-building portable coverage due to the additional signal loss incurred when inside buildings. The coverage maps use the following colors to model coverage:

- Green - areas where users should be able to communicate using their portable radios when inside light-density and/or residential buildings. For these coverage prediction studies, FE used 10 dB to represent signal loss inside these types of buildings
- Yellow - areas where users should be able to communicate using their portable radios on the street (on-street portable coverage should also exist in all green areas)
- Purple - areas where users should be able to communicate using their mobile radios (mobile coverage should also exist in all green and yellow areas)

Note: The radio coverage portrayed by the maps in this section may vary from actual system coverage. Computer modeling cannot account for all variables, such as individual radio performance, electrical noise and radio RF interference. General loss factors are used for trees and buildings, but actual signal loss varies based on the type, height and density of the trees and buildings.

Figure 17 shows the composite "round-trip" coverage for the potential SLERS-2 system. Round-trip coverage is a good method for evaluating overall system performance, as coverage is only displayed in the areas where both talk-out (site to radio) and talk-in (radio to site) should meet the required signal thresholds.





FE made several assumptions when modeling the predicted coverage of the potential SLERS-2 system, as several factors such as transmit power from sites, antenna models used at the sites, and the exact site configuration of the system are still being determined.

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Levy County, FL - 700/800 MHz Coverage - Potential SLERS-2 System
P25 Phase 2 Coverage >= DAQ 3.4; Round-Trip Coverage (talk-out and talk-in); 95% Reliability

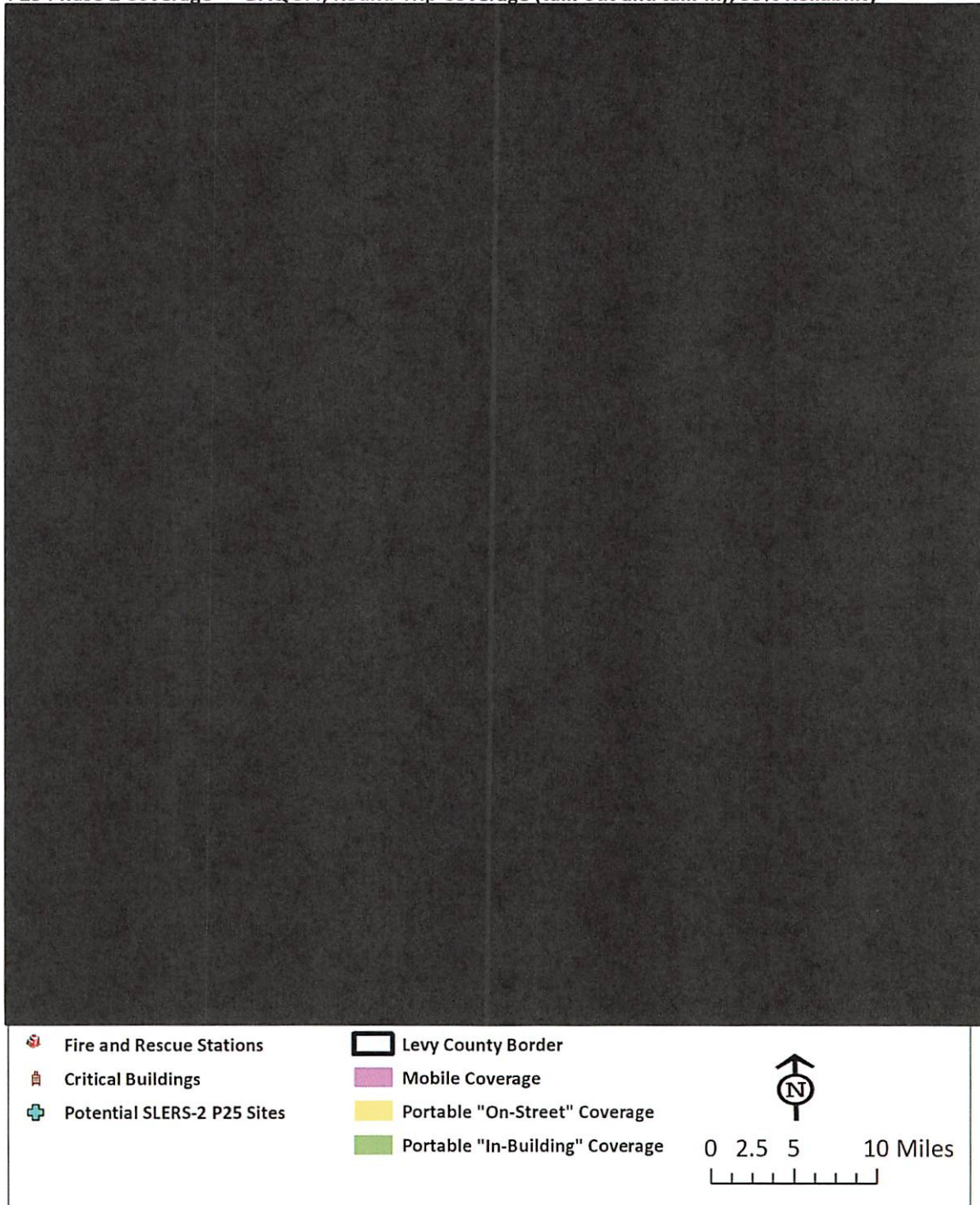


Figure 17 - Alternative 2 Predicted Round-Trip Coverage





The anticipated round-trip coverage percentages of the geographical boundaries of Levy County for the Alternative 2 design are as follows:

- Mobile > 99%
- Portable On-Street – 95%
- Portable In-Building – 66%

6.2.2.1 In-Building Coverage

FE also evaluated potential in-building portable radio coverage in the population centers for locations identified previously in *Table 10 - Fire Stations* and *Table 11 - Critical Buildings*.

The results of this analysis indicated that 6 of the 13 Fire and Rescue stations and 15 of the 31 critical buildings are within the light in-building coverage areas provided from the SLERS-2 system. Building construction and densities may require additional coverage enhancements for these facilities if the actual building losses are more than 10 dB

6.2.2.2 Additional Coverage Considerations

As stated earlier, the coverage displayed in Figure 17 is representative of what the anticipated SLERS-2 constellation of radio sites will provide inside Levy County. Should the County wish to pursue this alternative, the inclusion of additional radio sites, such as those currently used by the County, should be considered as well to increase coverage within the areas desired by the County.

Figure 18 shows the anticipated improvements to in-building coverage that could be realized if four of the existing County radio sites were added to the potential SLERS-2 system. The areas of light blue coverage show the areas where additional “in-building” coverage could be obtained beyond what is predicted to be provide by the SLERS-2 sites.

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Levy County, FL - Potential SLERS-2 System with Four Added County Sites
P25 Phase 2 Coverage >= DAQ 3.4; Round-Trip Coverage (talk-out and talk-in); 95% Reliability

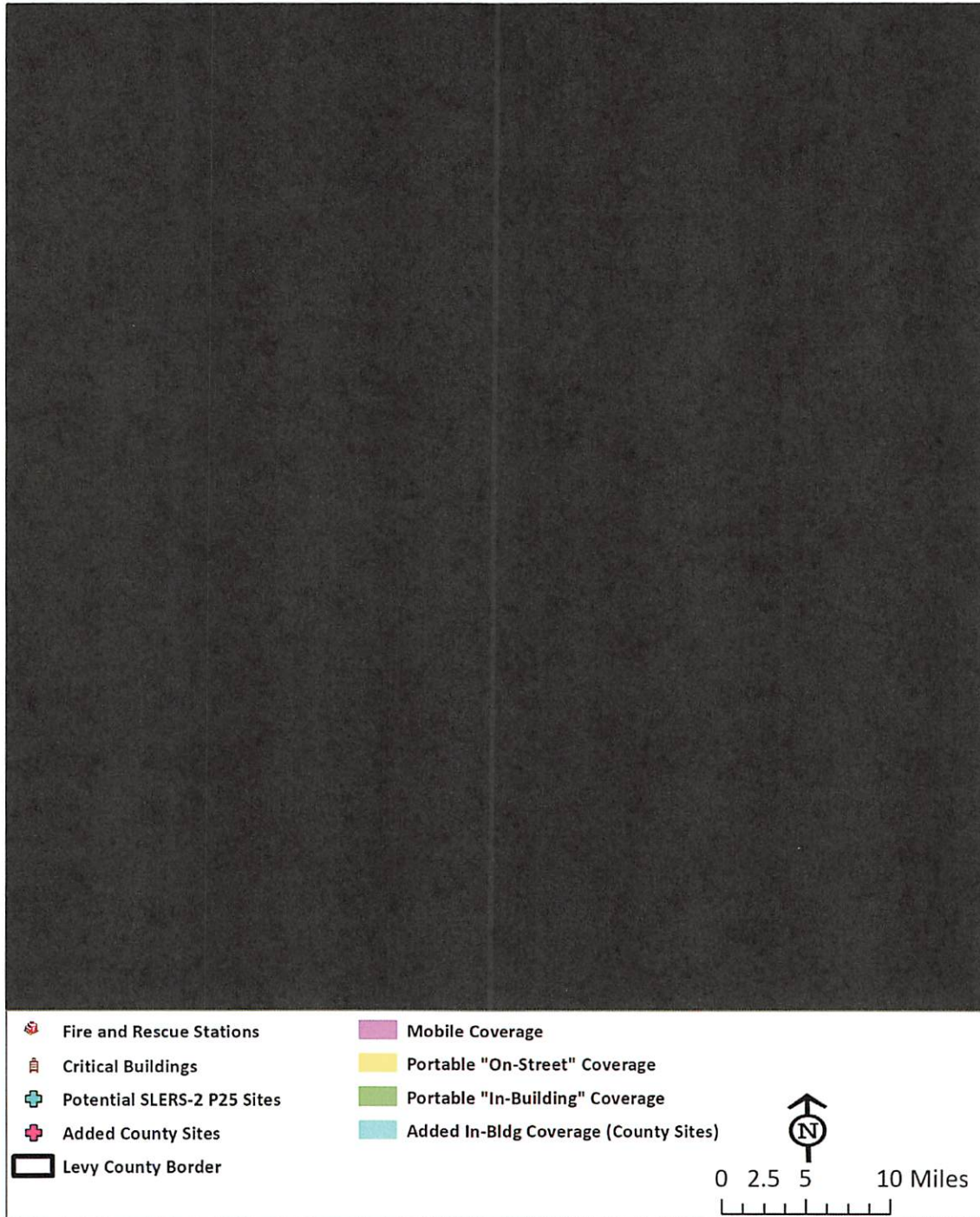


Figure 18 - Predicted In-Building Coverage Improvements with Four Additional County Sites





6.3 P25 System for Non-Public Safety Users

The LMR system for non-public safety users will be very similar to the system described in Alternative 1 with the following changes:

- The system will operate in P25 conventional simulcast, removing trunking operation.
- The channel count will be reduced from six channels to three channels.
- The simulcast and voting equipment will not contain the geographical redundant equipment contained in the Alternative 1 design.

The system would provide fire station alerting capabilities, would be available as a backup to the SLERS-2 system and provide for interoperability between public safety and non-public safety departments. The system will require the same backhaul system as described in Alternative 1 and contain the same control stations and interoperability gateways.

6.3.1 Channel Capacity

The replacement LMR system for non-public safety users will contain three conventional channels. These three channels will support the County's fire paging operation, road department, school board, animal control and transit department. The fire paging channel may need to be dedicated to fire paging and the other two channels would be shared between the departments.

6.3.2 P25 Conventional System Design Criteria

FE used the following criteria for the Alternative 2 - 700/800 MHZ P25 conventional system design:

- Implement a new standalone P25 conventional simulcast system that includes the following new equipment:
 - P25 Phase 1 conventional system control equipment
 - Simulcast control and voting equipment.
 - Site equipment (P25 conventional base stations/repeaters)
 - 700/800 MHZ antenna systems (i.e., antennas, transmission lines, transmitter combiners and receiver multicouplers)





- DC power systems
- Grounding and lightning protection systems
- Leverage existing sites to greatest extent possible; only adding new sites, including towers and shelters, as needed to provide the required radio coverage
- Utilize existing and available 700/800 MHZ channels
- System primary users are:
 - Fire Paging
 - Levy Road Department
 - Levy Transit
 - Levy School Board
 - Levy Animal Control
- County and local public safety users utilize SLERS-2 system

6.3.3 LMR System Architecture

Figure 19 shows high-level block diagram for the standalone P25 Phase 1 conventional system, including system control sites, simulcast control and voting sites, repeater sites, and dispatch equipment.

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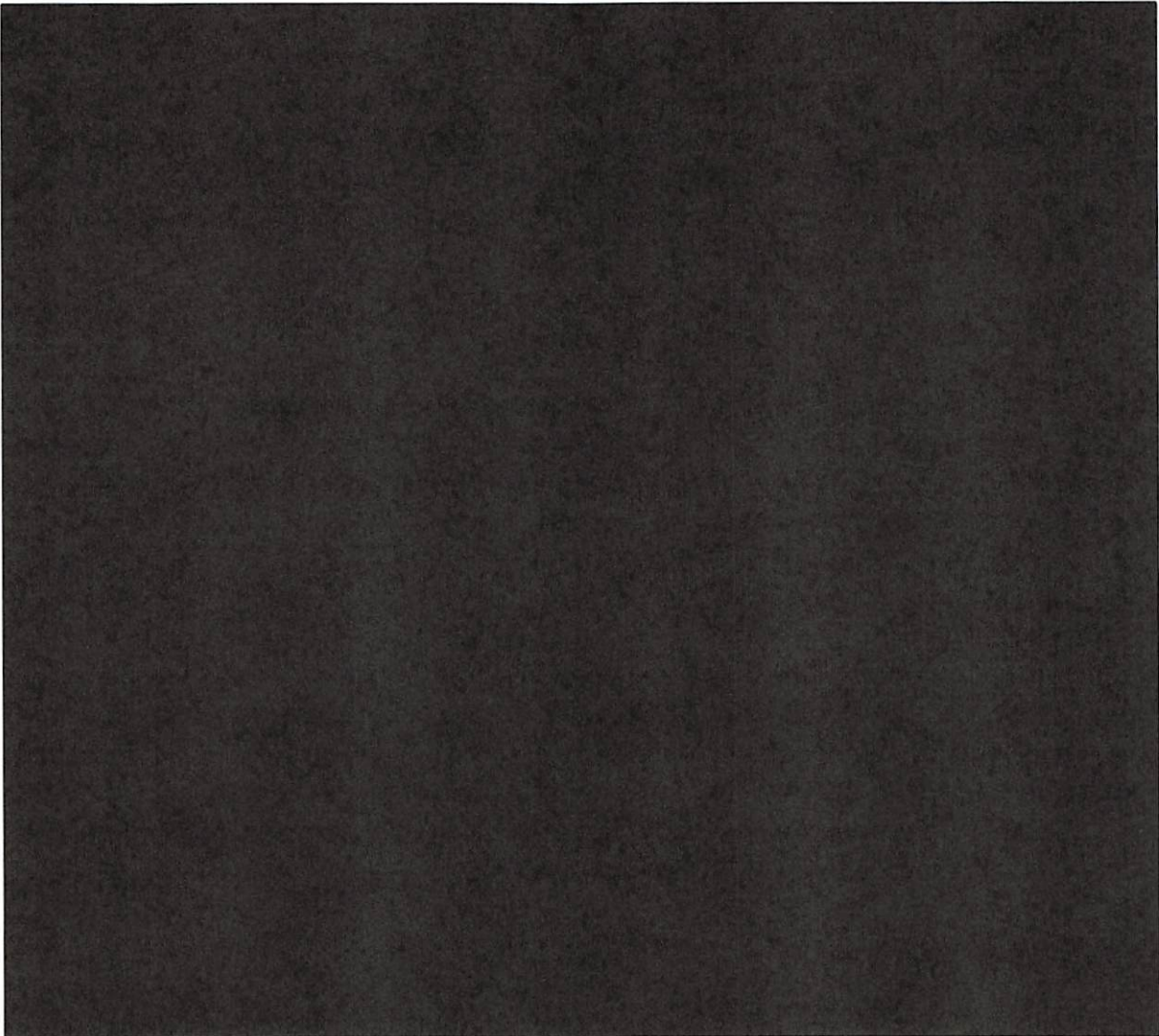


Figure 19 - Alternative 2 Conventional P25 System Architecture Diagram

6.3.4 LMR System Equipment

6.3.4.1 System Control Equipment

As with Alternative 1, the system will contain system control equipment. The main difference being that the system control equipment for Alternative 2 will not contain the trunking software and licensing. The system control equipment will contain the necessary licenses for P25 conventional operation. The placement of the equipment will match the location of Alternate 1, at the Bronson site.





6.3.4.2 Simulcast Control and Voting Equipment

The simulcast and voting equipment for Alternative 2 will be similar to the equipment utilized in Alternative 1. The exception being the removal of the geographically redundant simulcast control and voting equipment. The system will contain a single site containing the simulcast control and voting equipment. This equipment will be highly reliable and contain localized redundant features.

6.3.4.3 Base Station/Repeater Site Equipment

The base station/repeater site equipment for Alternative 2 is very similar to Alternative 1 the main difference being that the base station/repeater site equipment will be configured for conventional operation and not trunking and the antenna systems will need to support the three channels and not six channels as with Alternative 1.

6.3.5 Interoperability

Interoperability between public safety personnel will be handled through the SLERS-2 system. Interoperability between public safety and non-public safety users will occur on the three-channel system and via the gateway and control station devices as described in Alternative 1. Being that the three-channel system is in the same frequency band as the SLERS-2 system, public safety users will be able to configure their subscriber devices to operate on the three-channel conventional system.

6.3.6 System Features

The system features for alternative 2 will be similar to those of Alternative 1. Alternative 2 will support many of the features of Alternative 1 such as GPS/AVL location, encryption, emergency alert and improved coverage.

6.4 Backhaul System

Alternative 2 will be equipped with the same backhaul system as Alternative 1

6.5 Dispatch Equipment

Alternative 2 will also include a replacement of the dispatch center's dispatch consoles. These new consoles will be connected to both the SLERS-2 system and the new three-channel LMR system. The console design and architecture will remain the same for this alternative as well.





6.6 Radio Site Improvements

Due to Alternative 2 utilizing the same sites as Alternative 1 the same site improvements will apply to Alternative 2.

6.7 Network Management System (NMS)

The network management system will be provided just as Alternative 1.

6.8 Subscriber Units

As mentioned in Alternative 1, most of the County’s subscriber units either operate in the VHF or, do not support P25 operation. For Alternative 2, public safety users will require new P25 devices capable of operating in the 7/800 MHz band and configured for P25 trunking phase 2 operation. Non-public safety users, operating on the new County three-channel system will require only P25 conventional operation. The same totals from Alternative 1 will apply however, there is a slight reduction in the overall costs for subscriber units due to non-public safety users requiring only conventional operation.

6.9 Cost Analysis

FE performed the cost analysis for Alternative 2 using the same methodology as used for Alternative 1.

6.9.1 Cost Assumptions

Based on results from the coverage studies, analysis of existing inventory and feedback provided by the County, FE developed the following set of equipment and services related assumptions shown in Table 25 for the Alternative 2 cost estimates.

Table 25 – Alternative 2 Conceptual Design Assumptions

Alt 2 Conceptual Design Assumptions	QTY	Notes
Core & Network Management		
P25 Control Equipment	1	Redundant P25 conventional control equipment
Remote Terminal Unit (RTU)	7	New RTU's for equipment and site alarms (RF Sites and Dispatch Sites)
Network Management System		
Network Management Server	1	New 6-site, 3-channel NMS server
Network Management Terminal	1	Management Terminal (PC and network equip)
Simulcast Control Equipment		
Simulcast Control Equipment	1	New 6-site, 3-channel simulcast cell (local redundancy)





Alt 2 Conceptual Design Assumptions	QTY	Notes
Voting Equipment	1	New 6-site, 3-channel simulcast cell
GPS Frequency Standard	1	Required for each simulcast control equipment site
Networking Equipment	1	New routers and switches
<i>Simulcast Site Equipment</i>		
3-CH Simulcast P25 site equipment	6	Bronson, Chiefland, Cedar Key, Gulf Hammock, Inglis, Williston – Conventional operation
GPS Frequency Standard	6	One at each RF site
Networking Equipment	6	Redundant networking equipment
Antenna Network (7/800 MHz)	6	TX/RX antenna system with combiner, multicoupler and TTA (3 Channels)
Interop Gateway (8 ports)	6	Interop Gateways at each RF Site
<i>Dispatch Site Equipment</i>		
Dispatch Console Position	6	6 new console positions
Control/Backup RF Station	6	New backup RF control station per dispatch console
Control Station Antenna System	6	New control station antenna system per dispatch site
Site Networking Equipment	1	New redundant routers and switches
<i>Microwave Backhaul Equipment</i>		
Microwave Radios	14	New backhaul equipment for connecting LMR sites
Microwave Antennas	14	New antennas/dishes for new backhaul equipment
Coaxial Cable and Waveguide	14	New line & accessories for new backhaul equipment
<i>Site Improvements</i>		
Existing Structure with Available Space	6	Based on County provided documentation or input
Structural Analysis Needed	7	Based on County provided documentation or input
Existing Shelter/Bldg. with Available Space	6	Based on County provided documentation or input
Site Grounding Updates	7	Based on County provided documentation or input
Existing Shelter Mods Needed	2	Based on County provided documentation or input
New Prefab Shelter Needed	1	Based on County provided documentation or input
Commercial AC Power Available	7	Based on County provided documentation or input
New Generator Needed	1	Based on County provided documentation or input
New DC System Needed	6	Based on County provided documentation or input
<i>FCC Licensing and Coordination</i>		
LMR FCC License	18	New LMR site application(s) and/or existing license modification(s) for Conceptual Design
LMR Frequency Coordination	18	New LMR site application(s) and/or existing license modification(s) for Conceptual Design





Alt 2 Conceptual Design Assumptions	QTY	Notes
LMR Engineering Services	18	New LMR site application(s) and/or existing license modification(s) for Conceptual Design
MW FCC License Coordination	7	New MW site application(s) and/or existing license modification(s) for Conceptual Design
MW FCC License	14	New MW site application(s) and/or existing license modification(s) for Conceptual Design
Implementation Services		
Spare / Test Equipment	5%	Based on <i>FE</i> historical / industry data
Project Management	10%	Based on <i>FE</i> historical / industry data
Installation	10%	Based on <i>FE</i> historical / industry data
Engineering	20%	Based on <i>FE</i> historical / industry data
Removal of Existing Equipment	2%	Based on <i>FE</i> historical / industry data
Training	1%	Based on <i>FE</i> historical / industry data
Staging	5%	Based on <i>FE</i> historical / industry data
Acceptance/Coverage Testing	1%	Based on <i>FE</i> historical / industry data
Documentation	1%	Based on <i>FE</i> historical / industry data
Contingency	10%	Based on <i>FE</i> historical / industry data

6.9.2 Radio System Cost

Table 26 shows the estimated cost for the new 700/800 MHZ LMR system equipment and implementation services needed for the Alternative 2 conceptual design.

Table 26 - Alternative 2 Radio System Cost Estimate

Alternative 2 Radio System Cost Estimate			
	Quantity	Unit Cost	Extended Cost
Core Network Equipment			
P25 Control Equipment w/redundancy (Conventional)	1	\$147,000	\$147,000
Network Management Equipment	1	\$144,000	\$144,000
Subtotal - Core Network Equipment			\$291,000
Simulcast Control Equipment			
	Quantity	Unit Cost	Extended Cost
Simulcast Control Equipment	1	\$150,000	\$150,000
Voting Equipment	1	\$40,000	\$40,000
GPS Frequency Standard	1	\$37,000	\$37,000
Networking Equipment	1	\$37,000	\$37,000
Subtotal - Simulcast Control Equipment			\$264,000
Simulcast Site Equipment			
	Quantity	Unit Cost	Extended Cost
3-CH P25 Conventional site equipment	6	\$95,000	\$570,000
GPS Frequency Standard	5	\$15,000	\$75,000
Networking Equipment	6	\$13,000	\$78,000
Antenna Network (7/800 MHz)	6	\$22,000	\$132,000
Interop Gateway (8 ports)	6	\$10,000	\$60,000
Subtotal - Remote RF Site Equipment			\$915,000
Equipment Subtotal			\$1,470,000





Alternative 2 Radio System Cost Estimate			
FCC Licensing and Coordination		Unit Cost	Extended Cost
LMR FCC License Fees	18	\$100	\$1,800
LMR Frequency Coordination Fees	18	\$300	\$5,400
LMR Engineering Services Fees	18	\$125	\$2,250
Subtotal - FCC Licensing and Coordination (rounded)			\$10,000
Implementation Services	Quantity	Unit Cost	Extended Cost
Project Management	10%		\$147,000
Installation	10%		\$147,000
Engineering	20%		\$294,000
Removal of Existing Equipment	2%		\$30,000
Training	1%		\$15,000
Staging	5%		\$74,000
Acceptance Testing	1%		\$15,000
Documentation	1%		\$15,000
Subtotal - Implementation Services			\$737,000
Services Subtotal			\$747,000
TOTAL - EQUIPMENT & SERVICES			\$2,440,000

6.9.3 Dispatch System Cost

Table 27 provides the estimated cost for the new dispatch system equipment and implementation services needed for the Alternative 2 conceptual design.

Table 27 - Alternative 2 Dispatch System Cost Estimate

Dispatch System Cost Estimate			
Dispatch Equipment	Quantity	Unit Cost	Extended Cost
Dispatch Console Position	6	\$48,000	\$288,000
Control/Backup RF Station	6	\$7,000	\$42,000
Control Station Antenna System	6	\$18,000	\$108,000
Site Networking Equipment	1	\$13,000	\$13,000
Equipment Subtotal			\$451,000
Implementation Services	Quantity	Unit Cost	Extended Cost
Project Management	10%		\$46,000
Installation	10%		\$46,000
Engineering	20%		\$91,000
Removal of Existing Equipment	2%		\$10,000
Training	1%		\$5,000
Staging	5%		\$23,000
Acceptance Testing	1%		\$5,000
Documentation	1%		\$5,000
Subtotal - Implementation Services			\$231,000
TOTAL - EQUIPMENT & SERVICES			\$690,000





6.9.4 Backhaul System Cost

Table 28 shows the estimated cost for the new backhaul system equipment and implementation services needed for the Alternative 2 conceptual design.

Table 28 - Alternative 2 Backhaul System Cost Estimate

Backhaul System Cost Estimate			
<i>Microwave Equipment</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Microwave Radios	14	\$30,000	\$420,000
Microwave Antennas	14	\$9,000	\$126,000
Coaxial Cable and Waveguide	14	\$2,000	\$28,000
Equipment Subtotal			\$574,000
<i>FCC Licensing and Coordination</i>		<i>Unit Cost</i>	<i>Extended Cost</i>
FCC License Coordination	7	\$1,700	\$11,900
FCC License	14	\$1,200	\$16,800
Subtotal - FCC Licensing and Coordination (rounded)			\$29,000
<i>Implementation Services</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Project Management	10%		\$58,000
Installation	10%		\$58,000
Engineering	20%		\$115,000
Removal of Existing Equipment	2%		\$12,000
Training	1%		\$6,000
Staging	5%		\$29,000
Acceptance Testing	1%		\$6,000
Documentation	1%		\$6,000
Subtotal - Implementation Services			\$290,000
Services Subtotal			\$319,000
TOTAL - EQUIPMENT & SERVICES			\$900,000

6.9.5 Site Improvements Cost

Table 29 shows the estimated cost for the site improvements and remediation services needed for the Alternative 2 conceptual design.

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Table 29 - Alternative 2 Site Improvements Cost Estimate

Site Improvements Cost Estimate			
<i>Site Improvements</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Structural Analysis Needed	7	\$5,000	\$35,000
Site Grounding Updates	7	\$15,000	\$105,000
Existing Shelter Mods Needed	2	\$20,000	\$40,000
New Prefab Shelter Needed	1	\$109,000	\$109,000
New Generator Needed	1	\$30,000	\$30,000
New DC System Needed	6	\$30,000	\$180,000
Site Improvements Subtotal (rounded)			\$499,000
<i>Implementation Services*</i>	<i>Quantity</i>	<i>Unit Cost</i>	<i>Extended Cost</i>
Project Management	10%		\$32,000
Installation	10%		\$32,000
Engineering	20%		\$64,000
Removal of Existing Equipment	2%		\$7,000
Training	1%		\$4,000
Staging	5%		\$16,000
Acceptance Testing	1%		\$4,000
Documentation	1%		\$4,000
Implementation Services Subtotal			\$163,000
TOTAL - IMPROVEMENTS & SERVICES			\$670,000

6.9.6 Subscriber Units Cost

The cost estimate presented below includes the replacement of existing portables, mobiles, control/base stations, and pagers with new 700/800 MHZ, mid-tier models with software to operate in P25 Phase 1 trunking mode for public safety users and low-tier P25 conventional models for non-public safety users. The use of mid-tier and low-tier models provides a good average price point for budgetary purposes. Some departments may purchase low-tier models, while others may purchase high-tier models with added features. As part of the RFP, the County could specify the quantity and tier requirements for each department, which would allow the vendors to provide a more accurate cost proposal.

Table 30 shows the estimated cost for new 700/800 MHZ, mid-tier radios with SLERS-2 radios operating in P25 Phase 2 trunking mode and non-public safety radios operating in P25 conventional mode with low tier radios.





Table 30 - Alternative 2 Subscriber Units Cost Estimate

Subscriber type	Quantity	Extended Cost
Mobile Radios (Mid-Tier)	217	\$1,128,400
Mobile Radios (Low Tier)	145	\$304,500
Portable Radios (Mid-tier)	432	\$2,160,000
Portable Radios (Low tier)	110	\$198,000
Control Stations w/install	11	\$84,700
Subtotal (rounded)		\$4,108,600

6.9.7 Capital Cost Summary

Table 31 shows the estimated total cost for Alternative 2, including the 700/800 MHZ radio system, microwave backhaul, dispatch equipment, site improvements, and subscriber units, rounded to the nearest \$10,000.

Table 31 - Alternative 2 Total Cost Estimate

Alternative 1 Total Cost Estimate				
Item	Equipment	Services	Contingency	Total (rounded)
Radio System	\$1,470,000	\$747,000	\$222,000	\$2,440,000
Dispatch System	\$451,000	\$231,000	\$69,000	\$760,000
Backhaul System	\$574,000	\$319,000	\$90,000	\$990,000
Site Improvements	\$499,000	\$163,000	\$67,000	\$730,000
Spare Equipment	\$125,000			\$125,000
Subscriber Devices	\$3,876,000			\$3,880,000
Total	\$6,695,000	\$1,460,000	\$448,000	\$8,925,000

As noted earlier, this round order of magnitude (ROM) cost estimate reflects non-discounted (list) pricing. Frequently, system vendors provide discounts for system purchases of this size. System discounts of 20% to 25% are common (and mirror many state contracts), but *FE* has seen higher levels of discounting take place in extremely competitive procurements. Large quantity subscriber purchases may be discounted at even higher rates. However, it is not possible to forecast the level of discount a vendor will offer at the time of proposal submission.

Based on recent competitive procurements, *FE* would expect vendor pricing for the Alternative 2 conceptual design and subscriber equipment to fall within the range of \$5.9 M - \$7.2M. However, this alternative would not meet all the County public safety coverage requirements as SLERS-2 would need additional sites to do that, as noted in *Section 6.2.2.2 Additional Coverage Considerations*. Adding the four additional sites needed to





meet County public safety requirements could add an additional estimated \$3.9M to \$4.9 M to total capital costs for Alternative 2, bring the estimated total capital costs up to a range of \$9.8M – \$12.1M.

6.9.8 SLERS-2 User Fees

SLERS-2 will also charge for use of the system. The actual costs per unit per month are still unknown. Table 32 below details the estimated number of public safety mobiles, portable and control station users of SLERS-2 and associated estimated costs.

Table 32 - Alternative 2 Estimated SLERS-2 User Fees

Alternative 2 Estimated SLERS User Fees				
Item	Quantity	Monthly Fee	Monthly Fees	Annual Fees
Mobiles	215	\$20	\$4,300	\$52,000
Portables	266	\$41	\$10,906	\$131,000
Control Stations	6	\$34	\$204	\$3,000
Dispatch Console Connectivity	1	\$2500	\$2500	\$30,000
Total	493	\$95	\$15,416	\$216,000.00

6.9.9 Operational Costs

Table 33 shows the estimated annual operational cost for Alternative 1 for 10 years. The estimate does not include any current operational expenses such as LMR and microwave system maintenance contracts, site maintenance, site leases, staff salaries or other recurring expenditures. The cost estimate also does not include any optional extended warranty that vendors may offer beyond Year 3. The estimated cost includes only the new LMR, microwave backhaul, dispatch equipment, video surveillance, and subscriber equipment. The County may customize their service plan, which may be lower or higher than these projected costs.

Other assumptions for the operational costs are as follows:

- A 3-year manufacturer warranty period with technical support and software/hardware upgrade costs beginning in Year 4
- A subscriber growth rate of 2%
- A subscriber attrition rate of 1%
- An inflation rate of 3%





- A 7-year subscriber unit lifecycle with all subscriber units replaced by Year 10, 7 years after the 3-year warranty period
- A 10-year lifecycle for backhaul and LMR equipment

Table 33 - 10 Year Operational Cost Estimate

10-Year Operating Cost Estimate	
Technical Support	\$400,000
Software/Hardware Upgrades	\$778,000
Onsite Support/Repair	\$1,152,000
Subscriber Growth	\$1,514,000
Subscriber Attrition	\$715,000
SLERS-2 User Fees	\$2,160,000
Total	\$6,719,000

If the SLERS-2 system is enhanced by the County to add the four sites needed to meet public safety agency coverage requirements, then the operational costs would be higher as well.

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7. Alternatives Comparison

Alternative 1 provides a standalone, County owned and operated, 700/800 MHz P25 Phase 1, six site trunked shared radio system that could support all County and local public safety and public service agencies. Coverage for this system would be designed to meet County agency needs and the County would have direct control over all system features and functions. The County would also be directly responsible for all system costs and control the schedule for implementation.

Alternative 2 continues the current hybrid approach in the County, with County and local public safety entities using the new Florida statewide system, SLERS-2, when it is available, and public service entities using a new County owned and operated 7/800 MHz six site P25 conventional system. This option does move County and local fire agencies to SLERS-2 and moves all other users to the new County 7/800 MHz system, so that radios purchased for operation on SLERS-2 could also work on the County owned system, for interoperability. An upgrade to County owned system could allow all County and local systems to operate on it, if SLERS-2 is delayed or does not meet County public safety users' needs. Coverage for SLERS-2 will be designed to meet State agency needs and may require additional sites to meet County needs. There is an opportunity to share some costs with the State but since SLERS-2 is still in the initial system procurement phases, *FE* cannot quantify any potential savings at this time nor is the schedule for deployment in this area available now. Initial projections assume that SLERS-2 deployment will take 4 to 6 years. Features and functions available on SLERS-2 will be determined primarily by the State.

As indicated in Table 34, there are minor differences in the predicted total Countywide system coverage between Alternative 1 and the projected SLERS-2 coverage. However, as shown in Table 35, the SLERS-2 coverage may provide significantly less light inbuilding coverage in the areas where County public safety agencies need this type of coverage.

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Table 34 – Alternatives Comparison Countywide Coverage Summary

System Description	System Technology	Number of Sites	Geographic Coverage %s of Levy County		
			Mobile (Round-Trip)	Portable On-Street (Round-Trip)	Portable Light In-Building (Round-Trip)
Alternative 1 - County owned system	700/800 P25 Phase 1	6 TX, 6 RX	>99	96	65
Alternative 2 - SLERS-2	700/800 P25 Phase 2	Approx. 7 sites serving Levy	>99	95	66

Table 35 - Alternatives Comparison Fire Station & Critical Bldg. Coverage Summary

System Description	Total Number of Fire and Rescue Stations	Total Number of Critical Bldgs.	Fire and Rescue Stations (light in-building level coverage area)	Potential % of Stations Covered	Critical Bldgs. (light in-building level coverage area)	Potential % of Critical Bldgs. Covered
Alternative 1 - County owned system	13	31	12	92%	31	100%
Alternative 2 - SLERS-2	13	31	6	46%	15	48%

To bring the predicted SLERS-2 coverage potential light in-building coverage up to the same levels as the Alternative 1, the County would likely need to add four sites to SLERS-2. Table 36 provides a summary of the estimated 10-year total cost of ownership (TCO) for each alternative, assuming the County enhances SLERS-2 to meet the same in-building coverage levels as Alternative 1. The State and selected SLERS-2 vendor may also consider some of the County sites for use instead of existing SLERS sites, but this cannot be confirmed at this time.





Table 36 – Alternatives 10-Year TCO Estimates

Category	Alternative 1 County Owned PS and Non-PS		Alternative 2 SLERS-2 (PS) County Owned (Non-PS)	
	Lower (est.)	Upper (est.)	Lower (est.)	Upper (est.)
Capital Costs (Infrastructure and Subscribers)	\$9.6M	\$11.6M	\$9.8M	\$12.1M
10 Year System Costs	\$4M	\$4M	\$6.7M	\$6.7M
Total	\$13.6M	\$15.6M	\$16.5M	\$18.8M

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8. Next Steps

The two alternatives considered bring all County and local public safety and public service users onto the same frequency band and digital radio technology. This will increase the level of daily operability for all agencies and increase the level of interoperability with adjacent public safety systems in Alachua, Marion, and Citrus counties. Moving to public safety P25 standards-based systems also increases the potential to qualify for federal and state funding and grants.

Currently, Alternative 1, a standalone, County owned and operated, 700/800 MHz P25 Phase 1, six site trunked shared radio system provides the most certainty regarding costs, deployment schedule, and local system control and has the lowest estimated 10-year total cost of ownership. *FE* also recommends that the County consider an assessment of the viability of the current dispatch center for future operations, consistent with current industry standards and best practices. The current center may need to be significantly upgrade or replaced to meet the County's long-term needs and the County needs to address several existing facility deficiencies.

Once the County selects an alternative, *FE* recommends a competitive procurement process to replace the systems. The first step in this process would include the development of functional specifications, based on County requirements, but not limited to:

- System functional operational requirements
- Leveraging existing resources
- Infrastructure equipment
- Site subsystems (HVAC, shelters, generators, etc.)
- Dispatch equipment
- Spectrum usage
- Required coverage
- System maintenance and support functions
- Subscriber devices and accessories





FE would work with the County to combine these functional specifications with the County procurement requirements into a request for proposals (RFP) document. The RFP would allow for multiple vendors to provide proposals and pricing for the system expansion. The vendors would provide the detailed design of the system allowing for innovative approaches and placing system performance responsibilities on the vendors.

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