Commonwealth of Virginia
Next Generation 9-1-1

City of Alexandria
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **City of Alexandria** based on the Fairfax County contract with **AT&T**. **Robert Bloom** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Alexandria PSAP** will be able to implement the full NENA i3 standard without the need for any interim or transitional steps if they are able to install their new CHE at the new sites. The timing of the new equipment and relocation need to be closely coordinated. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at:

https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **VESTA Sentinel (Upgrade to a geo-diverse VESTA solution with Arlington in process. New CHE will be placed in locations different from where they are now.)**
- CHE version number (clients): **3.1**
- CHE version number (server): **3.1**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **Yes (Side B currently at 2003 Mill Rd., Alexandria)**
- Number of positions: **31**
- SIP capable: **No**

This CHE has been determined to not be SIP capable, and will require an upgrade to version 7.2 to implement the full i3 interface, which **Alexandria** is planning to accomplish by June 2019. This system replacement is being supported by an existing PSAP grant. The purchase and placement of two firewalls will be necessary to connect to the ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. Prior to this requirement, **Alexandria** has implemented the web-based solution for text to 9-1-1. While this meets the legislative requirement, the PSAP will be upgraded to the direct IP solution with the implementation of NG9-1-1. The new CHE version should be capable of the text to 9-1-1 direct IP solution.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system.

However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **TriTech**
- CAD software version: **Inform CAD 5.8.11**
- CAD interfaces: **ALI data interface**
- Method of data transfer: **Serial data to IP**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **TriTech (Integrated with CAD)**
- Dispatch Mapping Software Version: **5.8.11**
- Method of data transfer: **Serial (through CAD system)**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model: **Inform**
- Logging Recorder Software Version: **5.1.0.131**
- Audio Origination Point: **Position**

This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**

- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Everbridge** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space may be available.

Coordination with Open Grants

The PSAP currently has two open grants:

1. **FY17 – CHE ESInet – Shared Services Participating PSAP (Fairfax host) - $1,225,000**
2. **FY18 – CHE – Shared Services Participating (Arlington host) - $350,000**

GIS Data Preparation

GIS Data Sources

Currently, the **City of Alexandria** GIS Department maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the GIS department to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS

data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **97.3%**
- Address Point – **95.3%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.7%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **99.4%**. During July 2018, VITA will send each PSAP and GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **4**
- Road centerline has right or left side overlapping address range - **84**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **1**

- Address point Is duplicate, has no street name, or no address number - **9**
- Address point street name and road centerline street name mismatch - **128**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, the **City of Alexandria GIS Department** will need to resolve these issues through internal resources at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **one ESN** for their area of responsibility. **City of Alexandria** GIS maintains an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial

interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use, and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason,

this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE replacement in process and GIS data, it should be possible to implement geospatial routing initially with NG9-1-1, and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

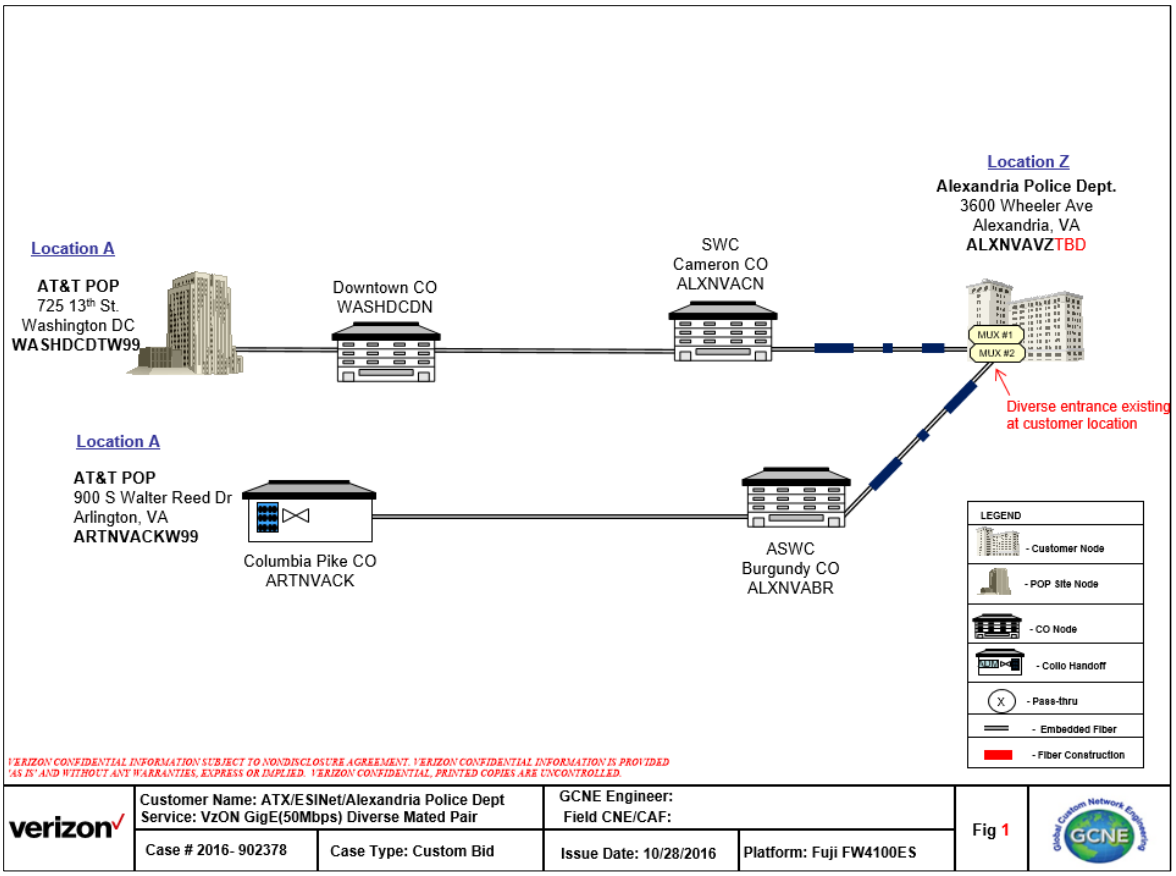
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Alexandria/Fairfax**
- Trunk counts (all): **58**
    - Wireline: **12**
    - Wireless: **16**
    - Administrative: **30**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Alexandria PSAP** are as follows:


Location Z
Alexandria Police Dept.
3600 Wheeler Ave
Alexandria, VA
ALXNVAVZTBD
Location A
AT&T POP
725 13th St.
Washington DC
WASHDCDTW99
Downtown CO
WASHDCDN
SWC
Cameron CO
ALXNVACN
MUX #1
MUX #2
Diverse entrance existing at customer location
Location A
AT&T POP
900 S Walter Reed Dr
Arlington, VA
ARTNVACKW99
Columbia Pike CO
ARTNVACK
ASWC
Burgundy CO
ALXNVABR
LEGEND
- Customer Node
- POP Site Node
- CO Node
- Collo Handoff
- Pass-thru
- Embedded Fiber
- Fiber Construction
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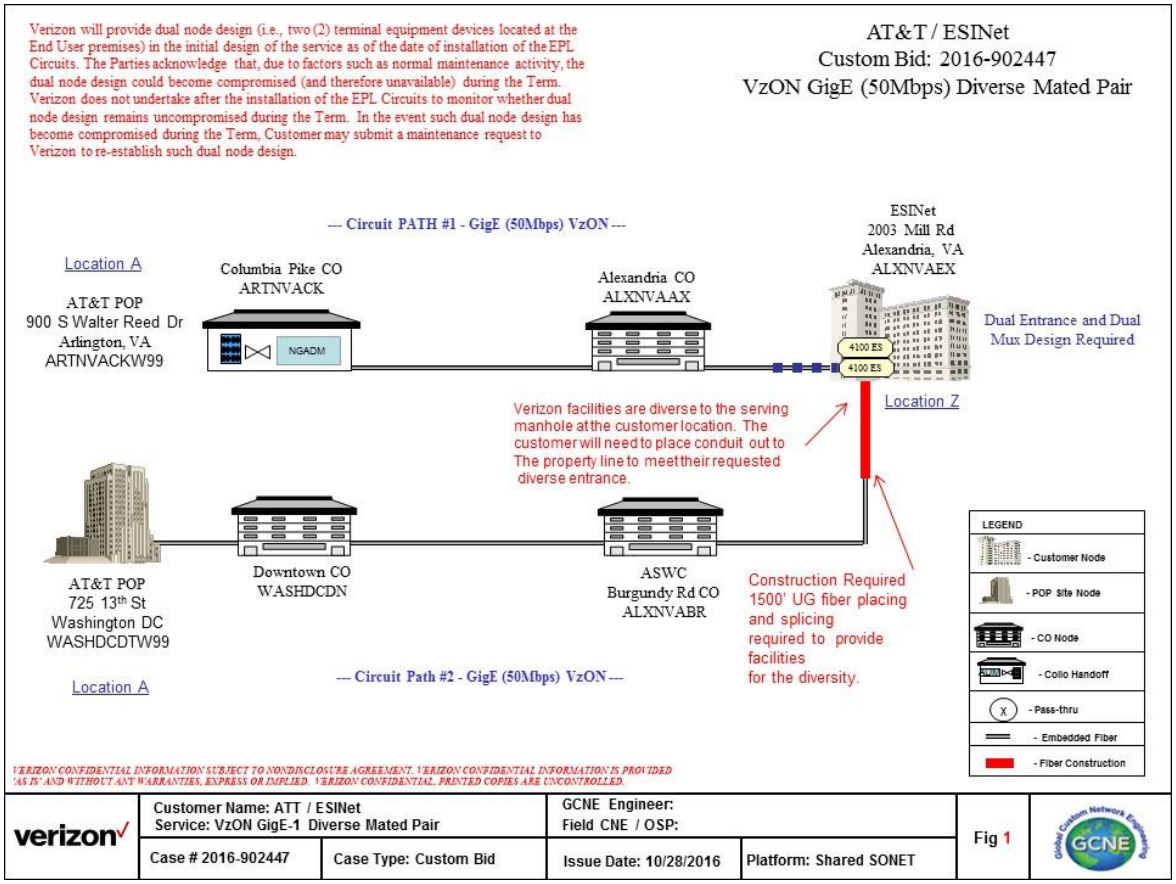
verizon
Customer Name: ATX/ESINet/Alexandria Police Dept
Service: VzON GigE(50Mbps) Diverse Mated Pair
GCNE Engineer:
Field CNE/CAF:
Case # 2016- 902378
Case Type: Custom Bid
Issue Date: 10/28/2016
Platform: Fuji FW4100ES
Fig 1
GCNE


Verizon will provide dual node design (i.e., two (2) terminal equipment devices located at the End User premises) in the initial design of the service as of the date of installation of the EPL Circuits. The Parties acknowledge that, due to factors such as normal maintenance activity, the dual node design could become compromised (and therefore unavailable) during the Term. Verizon does not undertake after the installation of the EPL Circuits to monitor whether dual node design remains uncompromised during the Term. In the event such dual node design has become compromised during the Term, Customer may submit a maintenance request to Verizon to re-establish such dual node design.
AT&T / ESINet
Custom Bid: 2016-902447
VzON GigE (50Mbps) Diverse Mated Pair
--- Circuit PATH #1 - GigE (50Mbps) VzON ---
ESINet
2003 Mill Rd
Alexandria, VA
ALXNVAEX
Location A
AT&T POP
900 S Walter Reed Dr
Arlington, VA
ARTNVACKW99
Columbia Pike CO
ARTNVACK
NGADM
Alexandria CO
ALXNVAAX
4100 ES
4100 ES
Dual Entrance and Dual Mux Design Required
Location Z
Verizon facilities are diverse to the serving manhole at the customer location. The customer will need to place conduit out to The property line to meet their requested diverse entrance.
AT&T POP
725 13th St
Washington DC
WASHDCDTW99
Downtown CO
WASHDCDN
ASWC
Burgundy Rd CO
ALXNVABR
Construction Required 1500' UG fiber placing and splicing required to provide facilities for the diversity.
Location A
--- Circuit Path #2 - GigE (50Mbps) VzON ---
LEGEND
- Customer Node
- POP Site Node
- CO Node
- Collo Handoff
- Pass-thru
- Embedded Fiber
- Fiber Construction
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verizon
Customer Name: ATT / ESINet
Service: VzON GigE-1 Diverse Mated Pair
GCNE Engineer:
Field CNE / OSP:
Case # 2016-902447
Case Type: Custom Bid
Issue Date: 10/28/2016
Platform: Shared SONET
Fig 1
GCNE

The total cost for this diverse connectivity is **$28,069**, which will be provided by the Board as part of the PSAP's funding submission. If the new CHE is installed in a different location another diversity study will be required. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, or should just the network be unavailable and the PSAP can still be occupied, operations move to a **back-up PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

The Metro Washington Airport Authority has been identified as a secondary PSAP within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	**Verizon**	**2,494,184**	**January 2019 – June 2019**
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Alexandria PSAP's** deployment window is **January 2019 – June 2019**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T; cover by grant
CHE replacement	$0	Currently using grant funds
CHE upgrade	$30,000	i3 deployment services; covered by grant
Text to 9-1-1	$30,000	Migration from web-based to IP
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Not required
Diverse connectivity costs	$28,069	Covered by grant
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None

GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$37,160.70	Verizon costs, covered by grant
Project management assistance	$0	None requested
Total	**$130,229.70**	

The monthly recurring cost for the AT&T solution is **$20,468.13,** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$18,418.50**. The estimated monthly increase to the PSAP after deployment is approximately **$2,049.63**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	**$130,229.70**
Covered by grant	$99,229.70
Board funding	$31,000.00
Recurring (over 24 months)	**$49,191.12**
Data Analytics (monthly)	**$415.12**

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Alleghany County
&
City of Covington
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Alleghany County and Covington PSAPs** based on the Fairfax County contract with **AT&T**. **Ryan Muterspaugh** and **Chief Anthony Morgan** shall be the primary contacts.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Alleghany County** and **City of Covington** PSAPs will need to have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the

need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call

delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. This CHE is configured as Alleghany County being the host and both Covington and Clifton Forge being clients on the Alleghany host. The current CHE has been identified as:

- CHE manufacturer: **West**
- CHE model: **Viper**
- CHE version number (clients): **Power911 v5.2.2.43**
- CHE version number (server): **Viper v2.0.0.8**
- CHE maintenance provider (channel): **West**
- CHE Geodiversity: **No**
- Number of positions: **6 (3 Alleghany; 2 Covington; 1 Clifton Forge)**
- SIP capable: **No**

This CHE has been determined to not be SIP capable, and will require an upgrade to implement the full i3 interface. Due to the age of the system and software a full replacement is necessary and should be accomplished by **June 30, 2019**. The new CHE must be i3 capable and should be tested to be connected to the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled just after the new deadline for text to 9-1-1 deployment, they will need to consider how to deploy before the deadline. The web-based service may be an option until the direct IP service integrated with their CHE can be deployed with NG9-1-1. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **ID Networks**
- CAD software version: **DaPro IBR Plus CAD v5.2**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

The CAD system is shared between Alleghany County and Covington. The localities are currently in the process of replacing this CAD system. No further upgrade or modification should be needed with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **GeoComm**
- Dispatch Mapping Software Version: **GeoLynx**
- Method of data transfer: **Serial**

The mapping system is shared between Alleghany County and Covington. This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The voice logging system is shared between Alleghany County and Covington and is currently in the process of being replaced. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model:
- Logging Recorder Software Version: **9.06 SP5**
- Audio Origination Point: **Trunks**

While the voice logging recorder system does not require any upgrade or modification with the deployment of NG9-1-1, if the PSAP wishes to maintain trunk-based recording, a span port will be provided by AT&T. The recording system may require an upgrade to receive and interpret the IP data. If desired, the cost of this upgrade would be covered by the Board. It is important to note that while this will allow audio to be pulled from the IP talk paths, it will not mirror current functionality. Currently,

with analog trunks, trunk-based recording allows the audio to be captured before the call is answered by the call taker and the call is still in queue. With an IP connection, the audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). The PSAP can choose to convert to position-based recording and the Board will cover the cost of reconfiguration.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **PowerMIS**
- Data Analytics Vendor: **West**

However, Alleghany County and Covington intend to utilize ECaTS with the replacement of their CHE. All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Motorola** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP indicates that rack space is not currently available at the Alleghany County PSAP. There is rack space available at the Covington PSAP and all equipment and operations may move there.

Coordination with Open Grants

The PSAP does not have any open grants.

GIS Data Preparation

GIS Data Sources

Currently, **Alleghany County and WorldView Solutions Inc.** maintain all of the GIS data for the PSAP. The **Alleghany PSAP** will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments, may contribute data or manage various processes. It is the responsibility of **Alleghany County and WorldView Solutions Inc.** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This

analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for Alleghany County and Covington combined determined the current match rate to be as follows:

- Road Centerline (RCL) – **82.6%**
- Address Point – **76.3%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **88.7%.** The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **81.1%.** During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for

a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **14**
- Road centerline has right or left side overlapping address range - **18**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **1**
- Address point Is duplicate, has no street name, or no address number - **388**
- Address point street name and road centerline street name mismatch - **48**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Alleghany County** and **Covington** will need to resolve these issues through internal and external resources, at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to

generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has 25 ESN for their area of responsibility. Alleghany County and Covington do not maintain an ESN boundary layer depicting this area. Since this layer is the same as the PSAP boundary layer it will be created at the same time. Once it is, they can utilize a GIS generated MSAG with the migration to NG9-1-1

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

Legacy PSAP Gateway - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Lumos Network**
- ALI database provider: **Verizon**
- Selective router pair(s): **Covington**
- Trunk counts (all): **16 (all trunks terminate at the Alleghany PSAP. The CHE directs appropriate incoming calls to Covington)**
    - Wireline: **8**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **4**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. Unfortunately, the results for the **Alleghany and Covington** PSAPs are that diversity is not currently available. Redundant connectivity will instead be provided. If a diversity option becomes available in the future, the funding for such a solution could be provided by the Board as part of the PSAP's funding submission.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAPs have a disaster recovery plan which states that if one of the PSAPs must be evacuated for any reason operations will move to the other PSAP. Should just the 9-1-1 network be unavailable and the PSAP can still be occupied calls roll over to a ten-digit administrative line.

Based on the current disaster recovery plan, no additional steps to be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	**Ntelos**	**21,556**	**January 2021 – June 2021**
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Alleghany** and **Covington PSAPs'** deployment window is **January 2021 – June 2021**, however the migration could be accelerated since the PSAP is connected to an independent selective router. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE Replacement	$150,000	Need system replacement in FY19
CHE Upgrade	$15,000	i3 deployment services
Text-to-911	$15,000	Implement direct-IP with migration.
CAD upgrade	$0	Not required

Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$2,000	Rack space is not currently available at the Alleghany PSAP but is available at the Covington PSAP.
Diverse connectivity costs	$0	Currently not available
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$30,000	
Legacy 9-1-1 transition costs	$0	None identified
Project management assistance	$0	None requested
Total	$217,000.00	Current total without connectivity

The monthly recurring cost for **Alleghany County** for the AT&T solution is **$4,263.65** which is set for the ten-year term of the Fairfax County contract. The current monthly **Alleghany County** recurring cost for the legacy E9-1-1 solution is approximately **$2,386.53**. The estimated monthly expense to the Alleghany County PSAP after deployment is approximately **$1,877.12**. The monthly recurring cost for the **City of Covington** for the AT&T solution is **$3,334.39** which is set for the ten-year term of the Fairfax County contract. The current monthly **City of Covington** recurring cost for the legacy E9-1-1 solution is approximately **$1,394.31**. The estimated monthly expense to the Alleghany County PSAP after deployment is approximately **$1,940.08**. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$217,000.00
Recurring (over 24 months)	$91,612.80
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Amelia County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Amelia County PSAP** based on the Fairfax County contract with **AT&T**. **Ranna Cope** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A migration proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Amelia County PSAP** will need to have i3-capable call handling equipment in place that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta**
- CHE version number (clients): **6.1 Build 1225**
- CHE version number (server): **6.1 Build 1225**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **4 (3 on main floor, 1 in backroom)**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in February 2020. This is after the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **ID Networks**
- CAD software version: **ID Dispatch 3.4.193.0**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **ID Networks (integrated with CAD)**
- Dispatch Mapping Software Version: **3.4.193.0**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Voice Print International**
- Logging Recorder Model: **Empower**
- Logging Recorder Software Version: **5.5**
- Audio Origination Point: **Both trunk-based and position-based**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

Outcall Notification Systems

The PSAP currently uses **Code Red** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP is uncertain if rack space is available so funding is included in the budget to add one.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY18 – NG9-1-1 GIS Data Preparation - $62,744**

To ensure the grant funds support the migration to NG9-1-1, the PSAP should, to the extent practical, use funding from the FY18 GIS grant to correct geospatial issues identified in the following section.

GIS Data Preparation

GIS Data Sources

Currently, a combination of the PSAP, the County Planning Department, and Timmons Group maintain all of the GIS data used in the PSAP. The **Amelia County PSAP** will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the PSAP to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against

the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **69.9%**
- Address Point – **72.3%**

One of the significant issues impact these results was 1,499 ALI records that were identified as Amelia County that were actually on Fort Pickett in Nottoway County. Removing these records from the calculation increased the match rate for RCL to **87.**0 and address point to **90.2%.** Additionally, there is an issue with the RCL data having differences in street names with the ALI. Correcting the street names so they match would increase the match rate for RCL to **92.6%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **91.1%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data.

These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **6**
- Road centerline has right or left side overlapping address range - **21**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - 1**0**
- Address point Is duplicate, has no street name, or no address number - **107**
- Address point street name and road centerline street name mismatch - **496**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Amelia County** will need to resolve these issues through their GIS contractor, at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has 47 ESNs for their

area of responsibility. The PSAP maintains an ESN boundary layer depicting this area so Amelia County will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI

lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Chester/Richmond Stuart**
- Trunk counts (all): **17**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **9**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast

busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP. Unfortunately, the results for the **Amelia County PSAP** are that diversity is not currently available. Redundant connectivity will instead be provided. If a diversity option becomes available in the future, the funding for such a solution could be provided by the Board as part of the PSAP's funding submission.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, or if the 9-1-1 network is unavailable and the PSAP can still be occupied, calls are routed to the **Dinwiddie County PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by

the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	**Verizon**	**1,660,182**	**January 2020 – June 2020**
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

Amelia County PSAP's deployment window will be **January 2020 – June 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE Replacement	$150,000	Replacement planned in 2020
CHE Upgrade	$30,000	i3 deployment services
Text-to-911	$30,000	Currently does not have text
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required

Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$2,000	Space may not be available
Diverse connectivity costs	$0	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Currently working with grant funds
Legacy 9-1-1 transition costs	$1,833.30	Verizon cost
Project management assistance	$0	None requested
Total	$218,833.30	

The monthly recurring cost for the AT&T solution is **$4,035.64** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$630.74**. The estimated monthly increase to the PSAP after deployment is approximately **$3,404.90**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$218,833.30
Recurring (over 24 months)	$81,717.60
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Amherst County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Amherst County PSAP** based on the Fairfax County contract with **AT&T**. **Sam Bryant** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Amherst County PSAP** will need to upgrade their current Vesta 911 software or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **6.1**
- CHE version number (server): **6.1**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **4**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **May 2020**, therefore funding is included in the budget in FY2020. This is during their planned NG9-1-1 migration so it must be coordinated and completed at least three months prior to their deployment date. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **ID Networks**
- CAD software version: **3.4.193**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **ID Networks**
- Dispatch Mapping Software Version: **Digital Data Technologies 3.0.3009.0**
- Method of data transfer: **None**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Exacom**
- Logging Recorder Model:
- Logging Recorder Software Version: **10.1.0.4**
- Audio Origination Point: **Both trunk-based and position-based**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS and Vesta Analytics**
- Data Analytics Vendor: **ECaTS and Motorola**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Everbridge** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP currently has no open grant.

GIS Data Preparation

GIS Data Sources

Currently, **Amherst County Public Safety** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **Amherst County** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **98.1%**
- Address Point – **94.9%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.4%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **96.9%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **54**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **393**
- Address point street name and road centerline street name mismatch - **6**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Amherst County** will need to resolve these issues through internal resources, at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **14 ESNs** for their area of responsibility. **Amherst County Public Safety** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

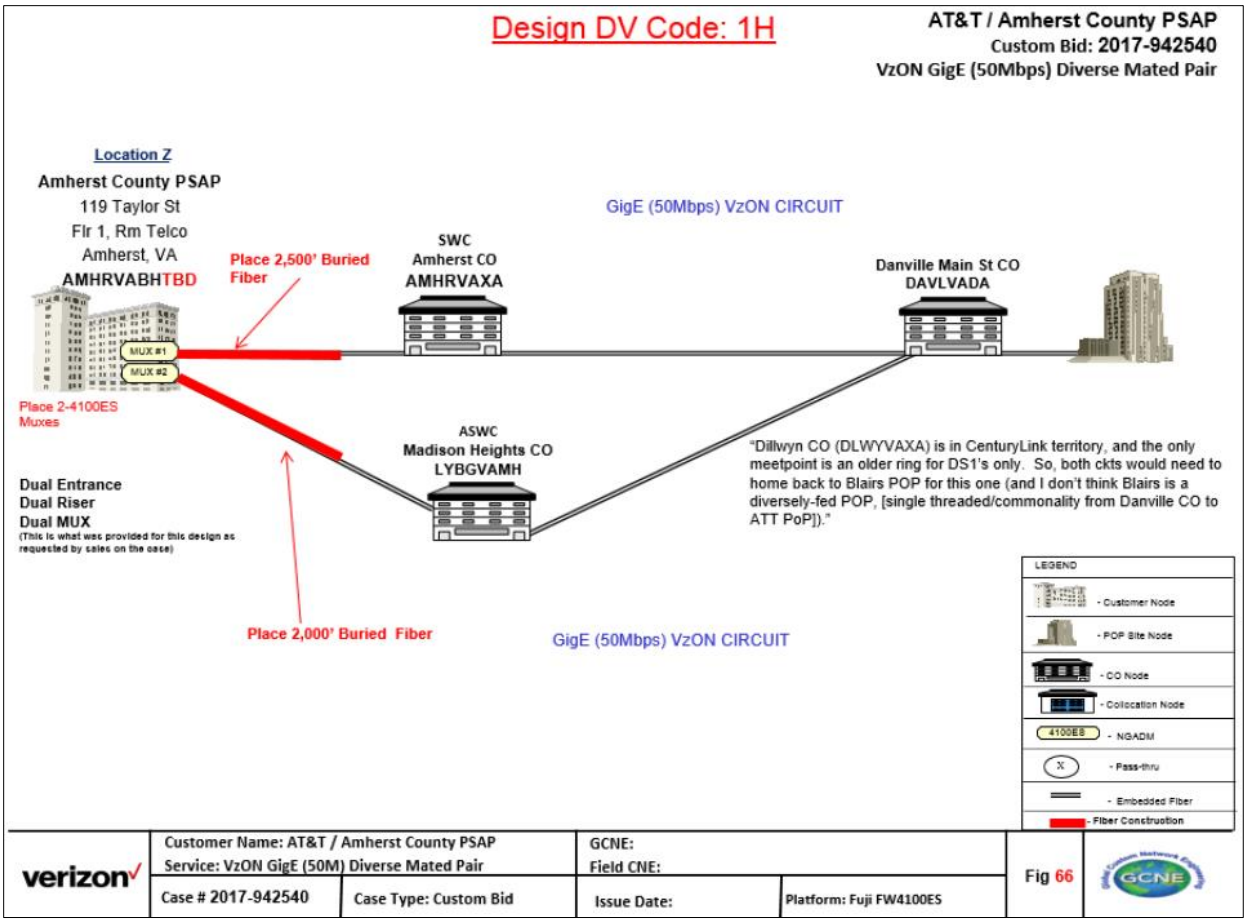
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Danville/Lynchburg**
- Trunk counts (all): **13**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **5**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Amherst County** PSAP are as follows:



The total cost for this diverse connectivity is **$40,415.53**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason, or should just the network be unavailable and the PSAP can still be occupied, incoming calls receive a fast busy signal.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this

migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.

- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	**Verizon**	**320,247**	**July 2020 – December 2020**
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Amherst County PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 deployment services
CHE Replacement	$150,000	Replacement in FY20
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$40,415.53	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$2,386.20	Verizon costs
Project management assistance	$0	None requested
Total	$257,801.73	

The monthly recurring cost for the AT&T solution is **$5,987.77** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$2,839.00**. The estimated monthly increase to the PSAP after deployment is approximately **$3,148.77**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines

approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$257,801.73
Recurring (over 24 months)	$75,570.48
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Appomattox County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Appomattox County PSAP** based on the Fairfax County contract with **AT&T**. **Bobby Wingfield** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Appomattox County PSAP** will need to upgrade their current Vesta software or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **Vesta 2.7**
- CHE version number (server): **Pallas 2.7**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **3**
- SIP capable: **No**

This CHE has been determined to not be SIP capable, and will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **September 2018** and currently has a PSAP grant for this project. This replacement is before their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **DaPro Systems**
- CAD software version: **IBR Plus v5.1.2**
- CAD interfaces: **Yes**
- Method of data transfer: **RS232**

The PSAP currently has grant funding to assist with the replacement of this CAD system. The PSAP must assure that the new system will not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **GeoComm**
- Dispatch Mapping Software Version: **GeoLynx**
- Method of data transfer: **RS232**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model:
- Logging Recorder Software Version: **5.1**
- Audio Origination Point: **Both trunk-based and position-based**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently does not have an outcall notification system. If one is implemented, AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP currently has two open grants:

1. **FY18 – CHE - $150,000**
2. **FY19 – CAD - $75,000**

GIS Data Preparation

GIS Data Sources

Currently, **Timmons Group** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **Appomattox County** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be

available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **99.5%**
- Address Point – **99.1%**

Appomattox County already meets both goals. If they desire a greater match rate, there are some differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.8%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **99.9%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when

routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed. Appomattox County did not have any error in the following categories:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **0**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **0**
- Address point street name and road centerline street name mismatch - **0**

All of this information was included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction. Though **Appomattox County** currently meets the goal for GIS data in NG9-1-1, this must be maintained using contracted resources to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **six ESNs** for their area of responsibility. **Appomattox County** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a

separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

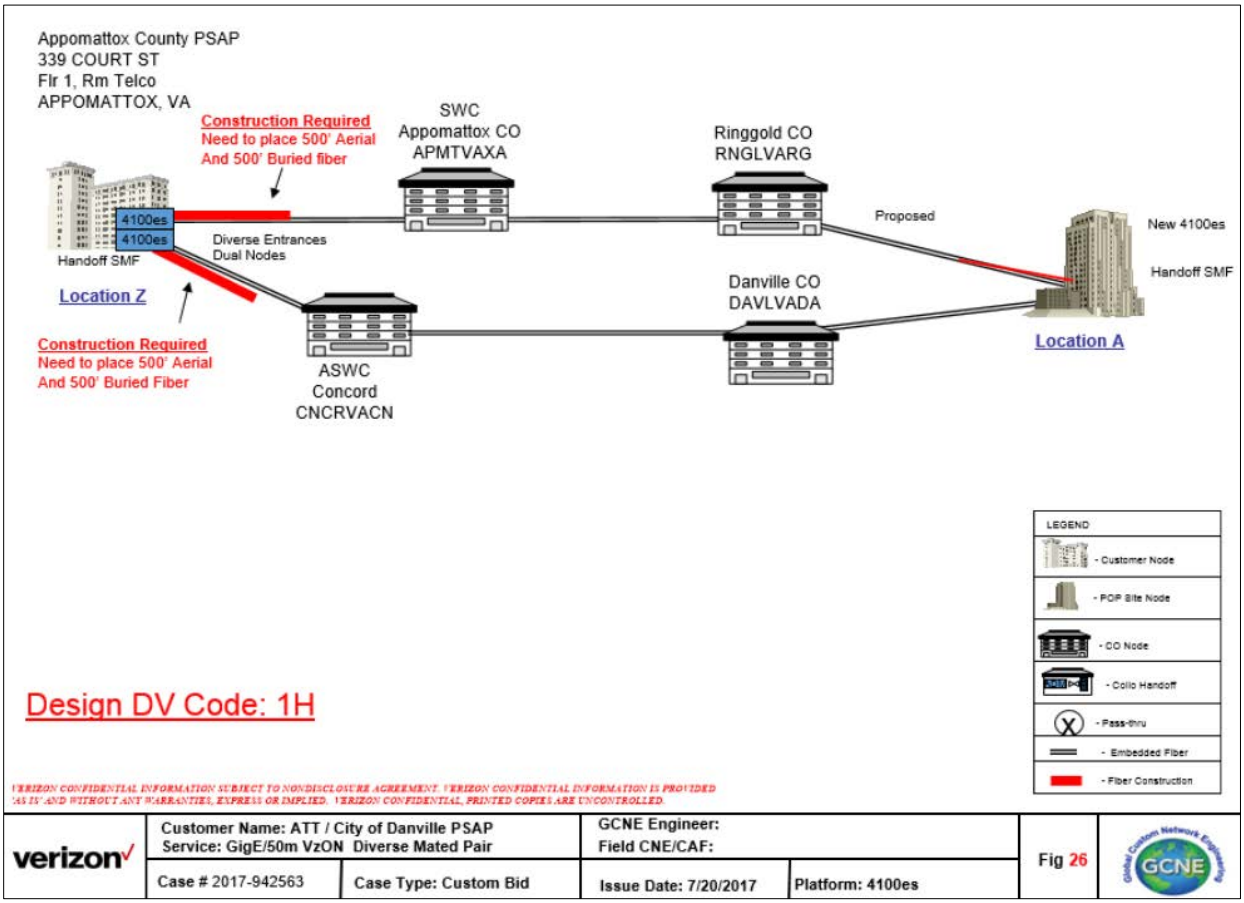
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Danville/Lynchburg**
- Trunk counts (all): **16**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **8**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999%

availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Appomattox County** PSAP are as follows:



The total cost for this diverse connectivity is **$347,496.83**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason, or should just the network be unavailable and the PSAP can still be occupied, incoming calls are redirected to the **City of Lynchburg PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.

- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	**Verizon**	**320,247**	**July 2020 – December 2020**
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Appomattox County PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 deployment services
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Currently using grant funds
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$347,496.83	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$2,386.20	Verizon costs
Project management assistance	$0	None requested
Total	$414,883.03	

The monthly recurring cost for the AT&T solution is **$4,272.56** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$1,444.93**. The estimated monthly increase to the PSAP after deployment is approximately **$2,827.63**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$414,883.03
Recurring (over 24 months)	$67,863.12
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

City of Arlington
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **City of Arlington** based on the Fairfax County contract with **AT&T**. **Angelina Candelas-Reese** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Arlington PSAP** will be able to implement the full NENA i3 standard without the need for any interim or transitional steps if they are able to install their new CHE at the new sites. The timing of the new equipment and relocation need to be closely coordinated. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at:

https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **VESTA Meridian (Upgrade to a geo-diverse VESTA solution with Alexandria in process. New CHE will be placed in locations different from where they are now.)**
- CHE version number (clients): **2.2**
- CHE version number (server): **Meridian 1000M**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **Yes**
- Number of positions: **30**
- SIP capable: **No**

This CHE has been determined to not be SIP capable, and will require an upgrade to version 7.2 to implement the full i3 interface, which **Arlington** is planning to accomplish by June 2019. This system replacement is being supported by an existing PSAP grant. The purchase and placement of two firewalls will be necessary to connect to the ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. Prior to this requirement, **Arlington** has implemented the web-based solution for text to 9-1-1. While this meets the legislative requirement, the PSAP will be upgraded to the direct IP solution with the implementation of NG9-1-1. The new CHE version should be capable of the text to 9-1-1 direct IP solution.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system.

However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **TriTech**
- CAD software version: **Inform CAD 2.9.1**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Maverick LVS Mapping**
- Dispatch Mapping Software Version: **5.3.2.106**
- Method of data transfer:

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model:
- Logging Recorder Software Version:
- Audio Origination Point:

This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**

- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Everbridge** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is available.

Coordination with Open Grants

The PSAP currently has two open grants:

1. **FY17 – CHE ESInet – Shared Services Participating PSAP (Fairfax host) - $1,225,000**
2. **FY18 – CHE – Shared Services (host) - $350,000**

GIS Data Preparation

GIS Data Sources

Currently, the **City of Arlington GIS Department** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **GIS department** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS

data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP (including the City of Falls Church) determined the current match rate to be as follows:

- Road Centerline (RCL) – **95.8%**
- Address Point – **96%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **97.5%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.6%**. During July 2018, VITA will send each PSAP and GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **206**
- Road centerline has right or left side overlapping address range - **5**

- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **1**
- Address point street name and road centerline street name mismatch - **1**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, the **City of Arlington GIS Department** will need to resolve these issues through internal resources at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has an **unknown number of ESNs** for their area of responsibility. If the **City of Arlington** GIS maintains an ESN boundary layer depicting this area, they will be able to utilize a GIS generated MSAG with the migration to NG9-1-1. If not, one will need to be created. If only one ESN exists, it is coincident with the PSAP boundary and will not need to be recreated.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use, and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE replacement in process and GIS data, it should be possible to implement geospatial routing initially with NG9-1-1, and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Alexandria/Fairfax**
- Trunk counts (all): **88**
    - Wireline: **16**
    - Wireless: **16**
    - VOIP: **16**
    - Administrative: **40**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999%

availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Arlington PSAP** are as follows:

Connectivity is being put into their NOC at 2780 S. Taylor Street. This is where the new shared CHE will be placed. Do not have a diagram for this site. Costs being covered by NoVA grant.

The total cost for this diverse connectivity is **$90,914**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, operations move to a **back-up PSAP**. Should just the network be unavailable and the PSAP can still be occupied, calls receive a fast busy signal.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

The **City of Falls Church** has been identified as a secondary PSAP within the service area of the primary PSAP. The Falls Church PSAP receives transferred 9-1-1 calls directly and therefore is connected to the Fairfax/Alexandria selective router pair. As a result, a separate migration proposal is being developed for that PSAPs.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by

the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	**Verizon**	**2,494,184**	**January 2019 – June 2019**
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Arlington PSAP's** deployment window is **January 2019 – June 2019**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T; covered by grant
CHE replacement	$0	Currently using grant funds
CHE upgrade	$30,000	i3 deployment services; covered by grant
Text to 9-1-1	$30,000	Migration from web-based to IP
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required

Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Not required
Diverse connectivity costs	$90,914	Covered by grant
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$111,482.10	Verizon costs, covered by grant
Project management assistance	$0	None requested
Total	**$267,396.10**	

The monthly recurring cost for the AT&T solution is **$30,555.20,** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$59,109.51**. The estimated monthly savings to the PSAP after deployment is approximately **$28,554.31**. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	**$267,396.10**
Covered by grant	$236,396.10
Board funding	$31,000.00
Recurring (over 24 months)	**$0**
Data Analytics (monthly)	**$415.12**

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Augusta County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Augusta County PSAP** based on the Fairfax County contract with **AT&T**. **Donna Good** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Augusta County PSAP** will need to upgrade their current Vesta 911 software to version 7.2, or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **VESTA 911**
- CHE version number (clients): **6.1**
- CHE version number (server): **6.1**
- CHE maintenance provider (channel): **Century Link**
- CHE Geodiversity: **No**
- Number of positions: **5**
- SIP capable: **Yes**

This CHE will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **August 2021**. This is after their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled just after the new deadline for text to 9-1-1 deployment, they will need to consider how to deploy before the deadline. The web-based service may be an option until the direct IP service integrated with their CHE can be deployed with NG9-1-1. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Superion**
- CAD software version: **16.4.0.2135**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Superion (integrated with CAD)**
- Dispatch Mapping Software Version: **OneSolution 16.4.0.2135**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **RevCord**
- Logging Recorder Model:
- Logging Recorder Software Version: **10**
- Audio Origination Point: **Both positions and trunks**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **Aurora**
- Data Analytics Vendor: **Motorola**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP. Any necessary upgrades to the native data analytics system will be the responsibility of the PSAP.

Outcall Notification Systems

The PSAP currently uses **Vesta Alert** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP does not currently have any open grants.

GIS Data Preparation

GIS Data Sources

Currently, the **Augusta County IT/GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **Augusta County IT/GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **95%**
- Address Point – **91.1%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **98.4%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **96.4%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **553**
- Road centerline has right or left side overlapping address range - **522**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **72**
- Address point Is duplicate, has no street name, or no address number - **442**
- Address point street name and road centerline street name mismatch - **1,701**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Augusta County IT/GIS** will need to resolve these issues through internal resources, at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **3 ESNs** for their area of responsibility. **Augusta County IT/GIS** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

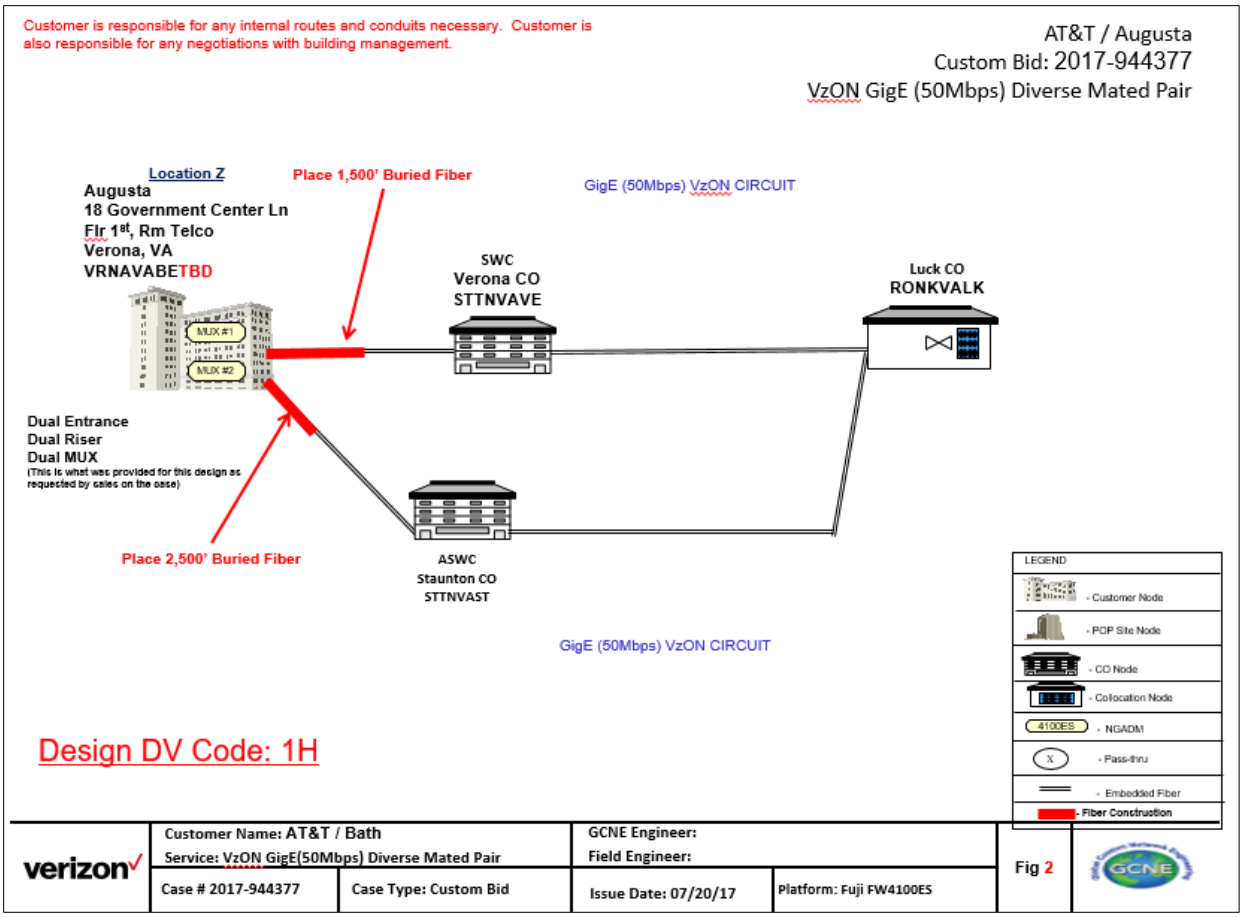
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Staunton/Salem**
- Trunk counts (all): **20**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **12**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Augusta County** PSAP are as follows:



The total cost for this diverse connectivity is **$131,810.44**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan that states if the PSAP must be evacuated for any reason or should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to the **City of Staunton PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a

neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.

- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	**Verizon**	**453,065**	**January 2021 – June 2021**
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Augusta County PSAP's** deployment window will be **January 2021 – June 2021**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 licenses and services
CHE replacement	$150,000	CHE replacement in FY2021
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$131,810.44	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$10,126.80	Verizon costs
Project management assistance	$0	None requested
Total	$356,937.24	

The monthly recurring cost for the AT&T solution is **$10,618.63** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$6,436.05**. The estimated monthly increase to the PSAP after deployment is approximately **$4,182.58**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines

approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$356,937.24
Recurring (over 24 months)	$100,381.92
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Bath County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Bath County PSAP** based on the Fairfax County contract with **AT&T**. **Teresa Philips** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Bath County PSAP** will need to upgrade their current Motorola CallWorks software or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **CallWorks CallStation**
- CHE version number (clients): **4.3.2**
- CHE version number (server): **4.3.2**
- CHE maintenance provider (channel): **Motorola/Teltronics**
- CHE Geodiversity: **No**
- Number of positions: **3**
- SIP capable: **Yes**

This CHE will require an upgrade to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **October 2022**. This is after their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled just after the new deadline for text to 9-1-1 deployment, they will need to consider how to deploy before the deadline. The web-based service may be an option until the direct IP service integrated with their CHE can be deployed with NG9-1-1. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Interact Public Safety Ssytems**
- CAD software version: **10.2.4.18438**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Interact and CallStation with Maps**
- Dispatch Mapping Software Version: **Interact GIS v5.14 and CallStation 4.3.2**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model: **Inform**
- Logging Recorder Software: **8.90.04.03**
- Audio Origination Point: **Trunks**

While the voice logging recorder system does not require any upgrade or modification with the deployment of NG9-1-1, if the PSAP wishes to maintain trunk-based recording, a span port will be provided by AT&T. The recording system may require an upgrade to receive and interpret the IP data. If desired, the cost of this upgrade would be covered by the Board. It is important to note that while this will allow audio to be pulled from the IP talk paths, it will not mirror current functionality. Currently, with analog trunks, trunk-based recording allows the audio to be captured before the call is answered by the call taker and the call is still in queue. With an IP connection, the audio is not present on the circuit

until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). The PSAP can choose to convert to position-based recording and the Board will cover the cost of reconfiguration.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **CodeRED** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP does not currently have any open grants.

GIS Data Preparation

GIS Data Sources

Currently, the **Timmons Group** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Bath County PSAP** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against

the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **99.1%**
- Address Point – **98.0%**

Bath County already meets both goals. If they desire a greater match rate, there are some differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.8%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **99.1%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **5**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **1**
- Address point Is duplicate, has no street name, or no address number - **8**
- Address point street name and road centerline street name mismatch - **20**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Bath County** will need to resolve these issues through external resources or through assistance of VITA, at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **13 ESNs** for their area of responsibility. **Bath County** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon/TDS Telecom**
- ALI database provider: **Verizon**
- Selective router pair(s): **New Castle (TDS Telecom)**
- Trunk counts (all): **13**
    - Wireline: **5**
    - Wireless: **5**
    - SIP: **0**
    - Administrative: **3**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP. Unfortunately, it appears that diversity is not available to the current location of the **Bath County** PSAP. Additional options for redundancy and diversity will continue to be developed for consideration by the PSAP.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan that states if the PSAP must be evacuated for any reason calls are rerouted to the **Augusta County PSAP**. Should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to a **ten-digit number**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality

- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established

for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	**TDS Telecom**	**5,158**	**January 2021 – June 2021**
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Bath County PSAP's** deployment window will be **January 2021 – June 2021**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$15,000	i3 licenses and services
Text-to-911	$15,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$147,380.44	
Disaster recovery upgrade	$0	Not required

Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$1,164.00	Verizon costs
Project management assistance	$0	None requested
Total	$183,544.44	

The monthly recurring cost for the AT&T solution is **$3,184.01** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$3,311.33**. The estimated monthly savings to the PSAP after deployment is approximately **$127.32**. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$183,544.44
Recurring (over 24 months)	$0
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Bedford County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Bedford County PSAP** based on the Fairfax County contract with **AT&T**. **Jeff Johnson** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Bedford County PSAP** will need to upgrade their current Vesta 911 software to version 7.2, or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **VESTA 911**
- CHE version number (clients): **6.1**
- CHE version number (server): **6.1**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **7**
- SIP capable: **Yes**

This CHE will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **March 2022**. This is after their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled just after the new deadline for text to 9-1-1 deployment, they will need to consider how to deploy before the deadline. The web-based service may be an option until the direct IP service integrated with their CHE can be deployed with NG9-1-1. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **TriTech**
- CAD software version: **Vision CAD 3.7.6**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial over RJ45**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **GeoComm**
- Dispatch Mapping Software Version: **GeoLynx Server 8.18.1**
- Method of data transfer: **Serial over RJ45**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Exacom**
- Logging Recorder Model: **Hindsight**
- Logging Recorder Software Version: **10.1.0.4**
- Audio Origination Point: **Both positions and trunks**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently does not have an outcall notification system. If one is implemented, AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP does not currently have any open grants.

GIS Data Preparation

GIS Data Sources

Currently, the **Bedford County GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **Bedford County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **99.2%**
- Address Point – **99.0%**

Bedford County currently meets both goals. If they would like to increase their match rate, one area with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.4%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **99.4%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no

duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **5**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **18**
- Address point Is duplicate, has no street name, or no address number - **0**
- Address point street name and road centerline street name mismatch - **0**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Bedford County GIS** will need to resolve these issues through internal resources, at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **15 ESNs** for their area of responsibility. **Bedford County GIS** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to

as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

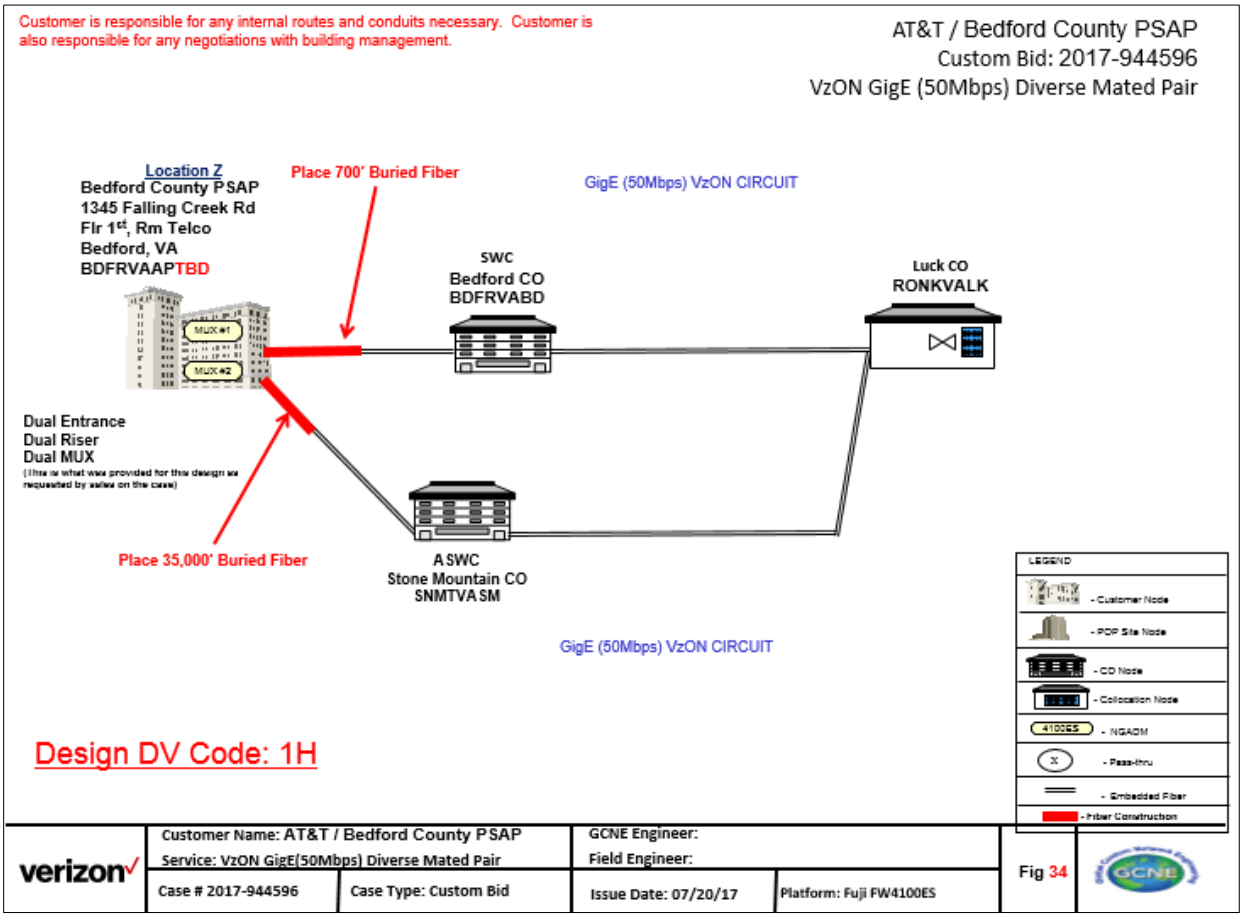
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Staunton/Salem (Danville/Lynchburg)**
- Trunk counts (all): **25**
    - Wireline: **8**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **13**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999%

availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Bedford County** PSAP are as follows:



The total cost for this diverse connectivity is **$362,260.49**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan that states if the PSAP must be evacuated for any reason or should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to **VoIP phones within the county**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.

- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	**Verizon**	**453,065**	**January 2021 – June 2021**
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Bedford County PSAP's** deployment window will be **January 2021 – June 2021**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 licenses and services
CHE Replacement	$150,000	Replacement in FY22
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$362,260.49	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$6,285.60	Verizon costs
Project management assistance	$0	None requested
Total	$583,546.09	

The monthly recurring cost for the AT&T solution is **$10,390.99** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$4,638.50**. The estimated monthly increase to the PSAP after deployment is approximately **$5,752.49**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines

approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$583,546.09
Recurring (over 24 months)	$138,059.76
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Bland County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Bland County PSAP** based on the Fairfax County contract with **AT&T**. **Jenna Dunn** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Bland County PSAP** through their shared system, is connected to West Viper CHE that is i3 capable, though an upgrade to Power911 v6.4 is recommended. Should this configuration change in the future the PSAP must have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be

able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call

delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. Currently the Bland County PSAP utilized a shared CHE with the Twin County and Wythe County PSAPs. CHE equipment resides at the two latter PSAPs with Bland County being connected as a remote node. The current CHE has been identified as:

- CHE manufacturer: **West**
- CHE model: **Viper**
- CHE version number (clients): **Power 911 v 6.1**
- CHE version number (server): **Viper 5.1**
- CHE maintenance provider (channel): **West/ProComm**
- CHE Geodiversity: **Yes; CHE cores located in Galax and Wytheville**
- Number of positions: **3**
- SIP capable: **Yes**

The host CHE should be upgraded to Power911 v6.4 or the latest version, to assure implementation of the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **August 2022**. This is after their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled just after the new deadline for text to 9-1-1 deployment, they will need to consider how to deploy before the deadline. The web-based service may be an option

until the direct IP service integrated with their CHE can be deployed with NG9-1-1. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Valor**
- CAD software version: **9.0.1.164**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **GeoComm**
- Dispatch Mapping Software Version: **GeoLynx v8.1.0.7**
- Method of data transfer: **DB9 Serial Cable**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **RevCord**
- Logging Recorder Model:
- Logging Recorder Software Version: **8**
- Audio Origination Point: **Both**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call

to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently does not have an outcall notification system. When on is in place, AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. Since CHE equipment is not located at Bland County rack space will not be required.

Coordination with Open Grants

The PSAP does not currently have any open grants.

GIS Data Preparation

GIS Data Sources

Currently, **Bland County** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **Bland County** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be

available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **98.0%**
- Address Point – **85.8%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **98.3%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **96.5%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in

two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **6**
- Road centerline has right or left side overlapping address range - **674**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **58**
- Address point street name and road centerline street name mismatch - **364**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Bland County** will need to resolve these issues through internal resources at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **six ESNs** for their area of responsibility. **Bland County** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to

as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Century Link**
- ALI database provider: **Century Link**
- Selective router pair(s): **Johnson City/Wytheville**
- Trunk counts (all): **8**
    - Wireline: **2**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **2**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999%

availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. Since Bland County is a node off of a shared system with Twin and Wythe Counties and has no on-site CHE, connectivity to this PSAP is not necessary.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason, or should just the 9-1-1 network be unavailable and the PSAP can still be occupied, incoming calls will be rerouted to **Wythe County**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019

High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	**CenturyLink**	**338,311**	**July 2021 – December 2021**

The **Bland County PSAP's** deployment window will be **July 2021 – December 2021**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$0	Not required
Text-to-911	$0	Not required
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$0	Not required
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$960.30	CenturyLink costs

Project management assistance	$0	None requested
Total	$5,960.30	

The monthly recurring cost for the AT&T solution is **$3,407.91** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$1,384.50**. The estimated monthly increase to the PSAP after deployment is approximately **$2,023.41**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$5,960.30
Recurring (over 24 months)	$48,561.84
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Botetourt County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Botetourt County PSAP** based on the Fairfax County contract with **AT&T**. **Nicole Manspile** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Botetourt County PSAP** will need to upgrade their current VIPER software or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **West**
- CHE model: **VIPER**
- CHE version number (clients): **Power911 5.2.1**
- CHE version number (server): **Viper 4.1.3**
- CHE maintenance provider (channel): **West (ProComm)**
- CHE Geodiversity: **No**
- Number of positions: **4**
- SIP capable: **Yes**

This CHE will require an upgrade to, at a minimum, Viper 5.1 and Power911 6.4 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **October 2020**. This is during their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The **Botetourt County PSAP** has implemented the direct-IP text to 9-1-1 solution. No additional upgrade or change is required with the deployment of NG9-1-1.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system.

However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Southern Software**
- CAD software version: **14.2.1.217**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Southern Software (integrated with CAD)**
- Dispatch Mapping Software Version: **14.2.1.217**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **RevCord**
- Logging Recorder Model:
- Logging Recorder Software Version: **10.0**
- Audio Origination Point: **Trunks and positions**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board

will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **West**
- Data Analytics Vendor: **PowerMIS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP. Any necessary upgrade to the native data analytics system is the responsibility of the PSAP.

Outcall Notification Systems

The PSAP currently uses **CodeRed** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP does not currently have any open grants.

GIS Data Preparation

GIS Data Sources

Currently, the **Botetourt County GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **Botetourt County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS

support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **99.9%**
- Address Point – **98.7%**

Botetourt County already meets both goals. If they desire a greater match rate, there are some differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **100%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **99.1%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **11**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **2**
- Address point street name and road centerline street name mismatch - **0**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Botetourt County** will need to resolve these issues through internal resources, at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **11 ESNs** for their area of responsibility. **Botetourt County** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Staunton/Salem**
- Trunk counts (all): **13**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **5**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Botetourt County** PSAP are that diversity is not currently available. Redundant

connectivity will instead be provided. If a diversity option becomes available in the future, the funding for such a solution could be provided by the Board as part of the PSAP's funding submission.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan that states if the PSAP must be evacuated for any reason, or should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to a **ten-digit number at their back-up location at 50 Sunset Ave, Troutville, VA 24175**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019

High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	**Verizon**	**453,065**	**January 2021 – June 2021**
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Botetourt County PSAP's** deployment window will be **January 2021 – June 2021**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$15,000	i3 licenses and services
	$150,000	CHE replacement in FY2021
Text-to-911	$0	Deployed direct-IP
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$0	Not currently available
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$6,256.50	Verizon costs
Project management assistance	$0	None requested

Total	$176,256.50	

The monthly recurring cost for the AT&T solution is **$6,172.02** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$6,978.41**. This results in monthly savings of **$806.39** to the PSAP after deployment. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$176,256.50
Recurring (over 24 months)	$0
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

City of Bristol
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **City of Bristol PSAP** based on the Fairfax County contract with **AT&T**. **Capt. Darryl Milligan** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **City of Bristol PSAP** will need to upgrade their current Vesta 911 software to version 7.2, or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **VESTA 911**
- CHE version number (clients): **7.0**
- CHE version number (server): **7.0**
- CHE maintenance provider (channel): **Mobile Communications America**
- CHE Geodiversity: **Yes; with Washington County PSAP**
- Number of positions: **4**
- SIP capable: **Yes**

This CHE will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **August 2022**. This is after their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled just after the new deadline for text to 9-1-1 deployment, they will need to consider how to deploy before the deadline. The web-based service may be an option until the direct IP service integrated with their CHE can be deployed with NG9-1-1. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Southern Software**
- CAD software version: **17.4.233.25**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **GeoComm**
- Dispatch Mapping Software Version: **GeoLynx v8.1.0.7**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **RevCord**
- Logging Recorder Model:
- Logging Recorder Software Version: **9.4**
- Audio Origination Point: **Both positions and trunks**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently does not use an outcall notification system. When one is in place, AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP currently has one open grant:

FY18 – NG9-1-1 GIS – Shared services participating – $182,000

GIS Data Preparation

GIS Data Sources

Currently, the **City of Bristol** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **City of Bristol** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be

available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **90.9%**
- Address Point – **87.4%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **91.2%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **93.0%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in

two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **0**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **66**
- Address point street name and road centerline street name mismatch - **50**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **City of Bristol** will need to resolve these issues through internal resources and current grant funds, at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **15 ESNs** for their area of responsibility. **City of Bristol** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to

as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

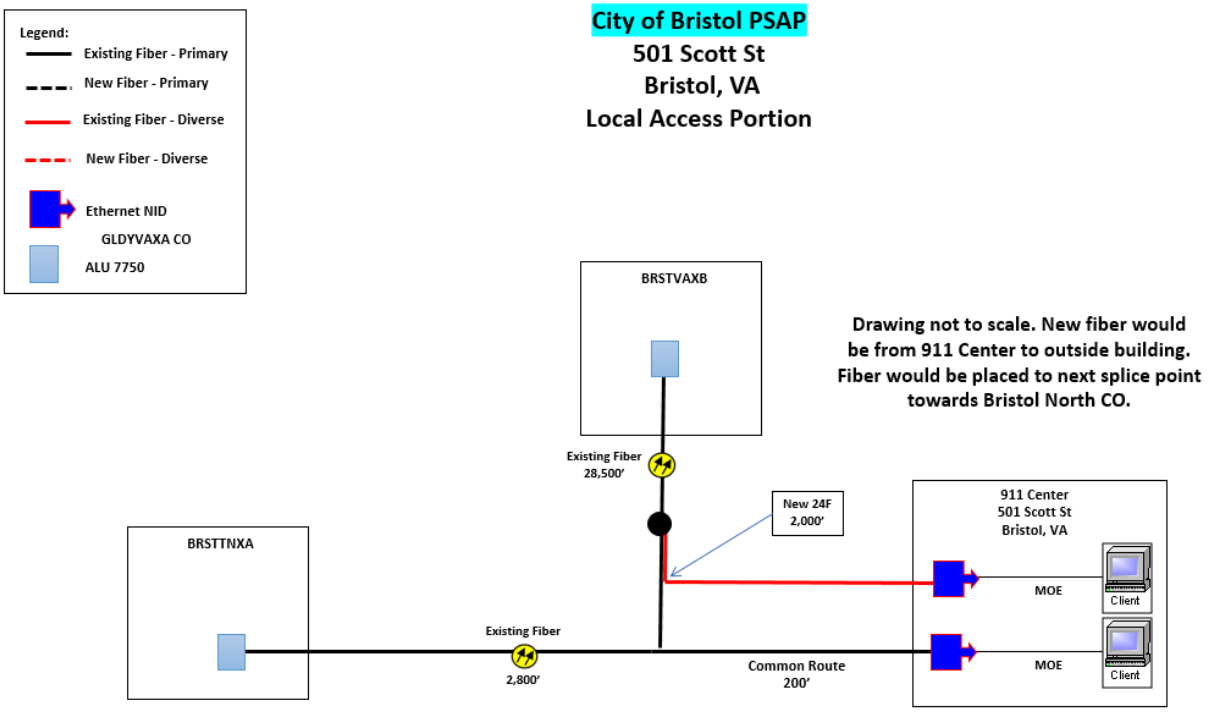
- Legacy E9-1-1 service provider: **Century Link**
- ALI database provider: **Century Link**
- Selective router pair(s): **Johnson City/Wytheville**
- Trunk counts (all): **18**
    - Wireline: **2**
    - Wireless: **4**
    - Administrative: **12**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not

available to all PSAPs. AT&T has conducted a diversity study for each PSAP. The results for the **City of Bristol PSAP** are as follows:



The total cost for this diverse connectivity is **$9,000**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan that states if the PSAP must be evacuated for any reason call will be rerouted to the **Washington County PSAP**. Should just the 9-1-1 network be unavailable incoming calls are routed to a 10-digit number.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be

answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.

- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	**CenturyLink**	**338,311**	**July 2021 – December 2021**

The **City of Bristol PSAP's** deployment window will be **July 2021 – December 2021**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that

the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 licenses and services
	$0	CHE replacement in August 2022
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$0	
Disaster recovery upgrade	$9,000	
Secondary PSAPs	$0	None
GIS data preparation	$0	Currently using grant funds
Legacy 9-1-1 transition costs	$2,560.80	CenturyLink costs
Project management assistance	$0	None requested
Total	$67,560.80	

The monthly recurring cost for the AT&T solution is **$4,635.62** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$3,050.90**. The estimated monthly increase to the PSAP after deployment is approximately **$1,584.72**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$67,560.80
Recurring (over 24 months)	$38,033.28
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Brunswick County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Brunswick County PSAP** based on the Fairfax County contract with **AT&T**. **Devon Clary** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A migration proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Brunswick County** will need to have i3-capable call handling equipment in place that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta**
- CHE version number (clients): **4.3**
- CHE version number (server): **4.3**
- CHE maintenance provider (channel): **Radio Communications of Virginia**
- CHE Geodiversity: **No**
- Number of positions: **4 (3 on main floor, 1 in director's office)**
- SIP capable: **No**

This CHE will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **December 2019**. This is during the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **OSSI**
- CAD software version: **17.5**
- CAD interfaces: **Yes**
- Method of data transfer: **D89 to Ethernet (digibox)**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **OSSI (integrated with CAD)**
- Dispatch Mapping Software Version: **17.5**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model: **Inform**
- Logging Recorder Software Version: **6.1**
- Audio Origination Point: **Both trunk-based and position-based.**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

Outcall Notification Systems

The PSAP currently uses **Everbridge** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP cannot confirm that space is currently available so funding has been included in the budget for additional rack space.

Coordination with Open Grants

The PSAP currently has two open grants:

1. **FY18 – NG9-1-1 GIS; Regional Grant with Mecklenburg and Halifax (host) - $45,000**
2. **FY18 – Mapping - $117,334**

To ensure the grant funds support the migration to NG9-1-1, the PSAP should, to the extent practical, use funding from the FY18 GIS grant to correct geospatial issues identified in the following section.

GIS Data Preparation

GIS Data Sources

Currently, the **Southside Planning District Commission (SSPDC)** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **SSPDC** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against

the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **96.8%**
- Address Point – **92.8%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **98%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **94.4%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **10**
- Road centerline has right or left side overlapping address range - **28**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **224**
- Address point street name and road centerline street name mismatch - **281**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Brunswick County** will need to resolve these issues through the **SSPDC**, at least 3 months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has 22 ESN~~s~~ for their area of responsibility. **Brunswick County GIS/SSPDC** does not maintain an ESN boundary layer depicting this area. This layer will either need to be created or the number of ESNs can be reduced to one which will make the ESN boundary and PSAP boundary the same. They can then be created at the same time.

Regardless of which option is selected, once created, they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI

lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

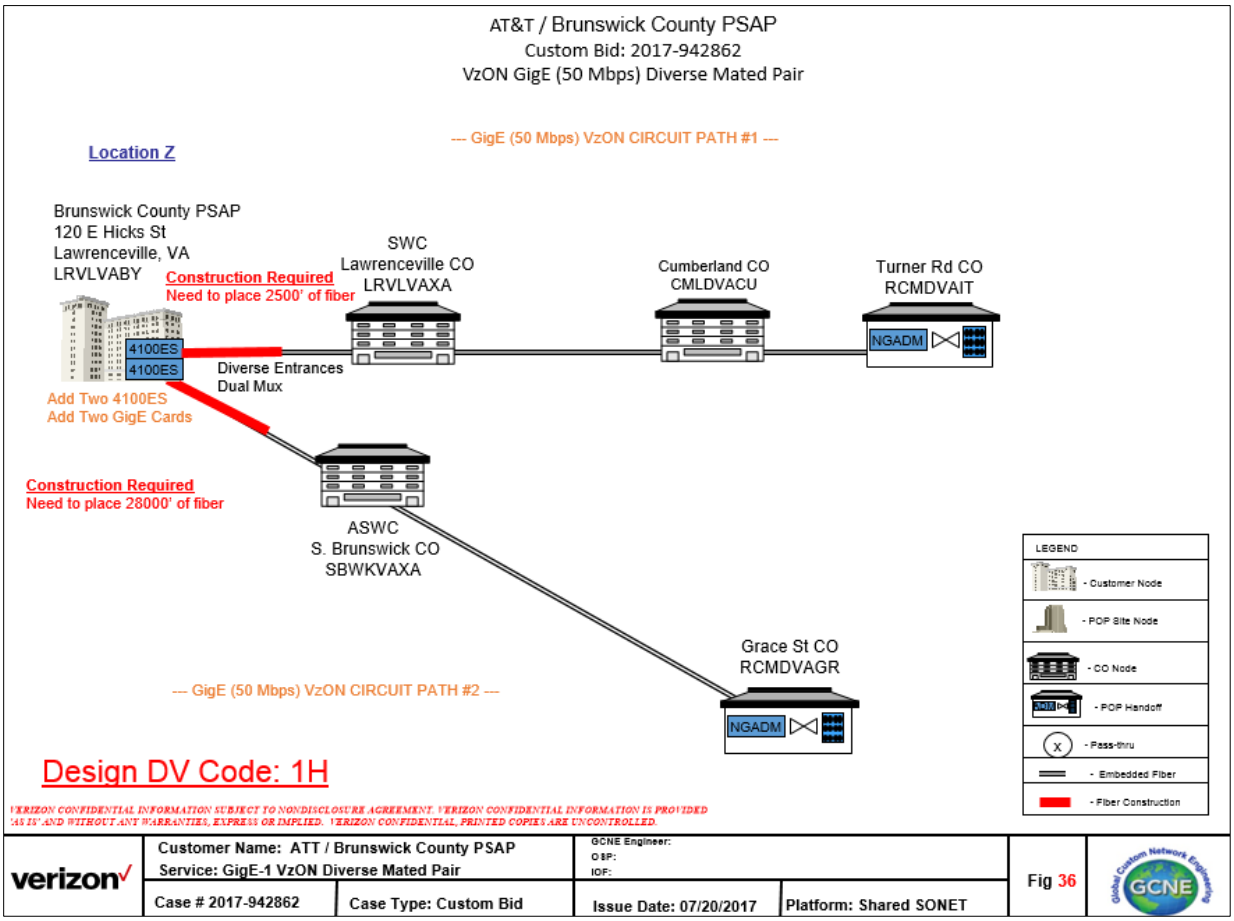
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Chester/Richmond Stuart**
- Trunk counts (all): **18**
    - Wireline: **6**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **8**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast

busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Brunswick County** PSAP are as follows:



The total cost for this diverse connectivity is $**521,920.98**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, or if the 9-1-1 network is unavailable and the PSAP can still be occupied, calls are routed to the **Mecklenburg County PSAP**. Should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to a 10-digit number within the PSAP.

Based on the current disaster recovery plan, no additional steps be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DDoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than

supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	**Verizon**	**1,660,182**	**January 2020 – June 2020**
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021

Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Brunswick County PSAP's** deployment window will be **January 2020 – June 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 deployment services
CHE Replacement	$150,000	Planned for December 2019 (FY2020)
Text-to-911	$30,000	Currently not deployed
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$2,000	Rack space may not be available
Diverse connectivity costs	$521,120.98	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Using grant funds
Legacy 9-1-1 transition costs	$1,484.10	Verizon costs
Project management assistance	$0	None requested
Total	$739,605.08	

The monthly recurring cost for the AT&T solution is **$4,405.51** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$572.38**. The estimated monthly increase to the PSAP after deployment is approximately **$3,833.13**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows

and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

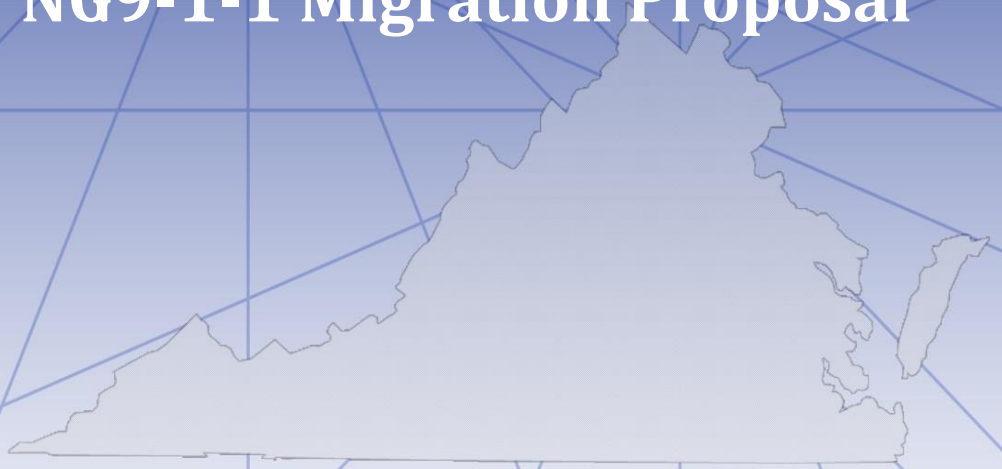
The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$739,605.08
Recurring (over 24 months)	$91,995.12
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Buchanan County
PSAP/GIS Specific
NG9-1-1 Migration Proposal



November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Buchannan County** based on the Fairfax County contract with **AT&T**. **Kenneth Ratliff** shall be the contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Buchanan County PSAP** will be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1

PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at:

https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Airbus**
- CHE model: **Vesta**
- CHE version number (clients): **7.0 Build 406**
- CHE version number (server): **7.0.406 Build 1656**
- CHE maintenance provider (channel): **Mobile Communications America (formerly Wireless Communications)**
- CHE Geodiversity: **No**
- Number of positions: **4**
- SIP capable: **Yes, firewall needed**

This CHE has been determined to be SIP capable, but will require an upgrade to version 7.2 to implement the full i3 interface. This upgrade from version 7.0 should be at no cost, but will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in September 2020. Since this is before the planned NG9-1-1 migration, any new CHE will need to be i3 capable and tested on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. Buchanan County plans to deploy text to 9-1-1 by the

end of 2018 utilizing the integrated solution as part of the Tazewell Shared Services Grant. If this occurs, no additional upgrade or change is required with the deployment of NG9-1-1.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Southern Software**
- CAD software version: **17.1.25.229**
- CAD interfaces: **ALI data interface**
- Method of data transfer: **Serial data**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Southern Software**
- Dispatch Mapping Software Version: **MDS Mapviewer 2.103.7.0**
- Method of data transfer: **Through CAD interface.**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Eventide**
- Logging Recorder Model: **NexLog**
- Logging Recorder Software Version: **Mediaworks Plus - 2.7.3[216]**
- Audio Origination Point: **Position-based.**

This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **West/ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Wireless Emergency Notification System (WENS)** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has not confirmed that this space is currently or will be available. Additional rack will be budgeted, but the PSAP will determine if space is available prior to deployment.

Coordination with Open Grants

The PSAP currently has open grants, as of April 1, 2018, as follows with the noted status:

1. **FY17 – Shared services with Tazewell for text to 9-1-1**
2. **FY18 – NG9-1-1 GIS – Shared services participating – $182,000**

To ensure the grant funds support the migration to NG9-1-1, the PSAP should, to the extent practical, use funding from the FY18 share services GIS grant to correct geospatial issues identified in the following section.

GIS Data Preparation

GIS Data Sources

Currently, the 9-1-1 Coordinator maintains all of the GIS data for its use and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the 9-1-1 Coordinator to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address

guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **98.1%**
- Address Point – **95.7%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **98.3%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.2%**. During July 2018, VITA will send each PSAP and GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.

4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **6**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **396**
- Address point street name and road centerline street name mismatch - **2**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, the **Buchanan County 9-1-1 coordinator** will need to resolve these issues through internal resources at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing

MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has eleven ESNs for their area of responsibility. The PSAP maintains an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement to geospatial (i3) routing when the GIS data suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI

lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 as long as the CHE is maintained to the new version of at least version 7.2 of Vesta. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

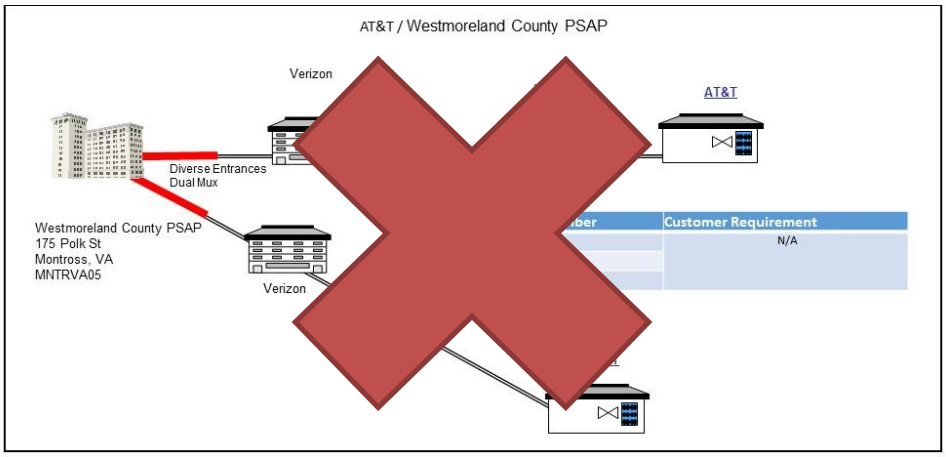
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Norton/Blacksburg**
- Trunk counts (all): **14**
    - Wireline: **4**
    - Wireless: **4**
    - Administrative: **6**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast

busy signal, routing the call to another PSAP or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results are as follows:



The total cost for this diverse connectivity is $##,###, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, the calls all transferred to the **Russell County PSAP**. Should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to a 10-digit number within the PSAP.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a

neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables us to authenticate users and traffic. Rather than supporting signaling or voice encryption, we rely on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.

- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	**Verizon**	**340,101**	**July 2021 – December 2021**
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Buchanan PSAP's** deployment window will be **July 2021 – December 2021**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T developed the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided above in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 deployment services
CHE replacement	$150,000	CHE replacement in FY2021
Text to 9-1-1	$0	Already deployed
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$2,000	Not required
Diverse connectivity costs	$0	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Included in FY18 shared services grant.
OSP transition cost	$0	No costs identified
Legacy 9-1-1 transition costs	$2,240.70	Verizon costs
Project management assistance	$0	None requested
Total	$189,240.70	

The monthly recurring cost for the AT&T solution is **$5,011.71**, which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$1,367.50**. The estimated monthly increase to the PSAP after deployment is approximately **$3,644.21**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$189,240.70
Recurring (over 24 months)	$87,461.04
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Buckingham County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Buckingham County PSAP** based on the Fairfax County contract with **AT&T**. **Jamie Shumaker** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Buckingham County PSAP** will need to upgrade their current Vesta software or have in place an i3 capable CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **4.2**
- CHE version number (server): **4.2**
- CHE maintenance provider (channel): **Century Link**
- CHE Geodiversity: **No**
- Number of positions: **5**
- SIP capable: **No**

This CHE has been determined to be SIP capable, but will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **June 2019**. This is before their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **SOMA Global**
- CAD software version: **4.52**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **SOMA Global (integrated with CAD)**
- Dispatch Mapping Software Version: **4.52**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Equature**
- Logging Recorder Model:
- Logging Recorder Software Version: **1.71 (11158)**
- Audio Origination Point: **Trunks**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Reverse911** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY19 – NG9-1-1 GIS - $19,400**

To ensure the grant funds support the migration to NG9-1-1, the PSAP should, to the extent practical, use funding from the FY19 GIS grant to correct geospatial issues identified in the following section.

GIS Data Preparation

GIS Data Sources

Currently, **King Moore Inc.** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Buckingham County PSAP** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against

the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **86.8%**
- Address Point – **78.2%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **90.5%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **83.3%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **3**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **333**
- Address point street name and road centerline street name mismatch - **41**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Buckingham County** will need to resolve these issues through contractor resources, at least three months prior to the targeted deployment date. Buckingham County currently has grant funds to improve the quality of their GIS data.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **21 ESNs** for their area of responsibility. **Buckingham County** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

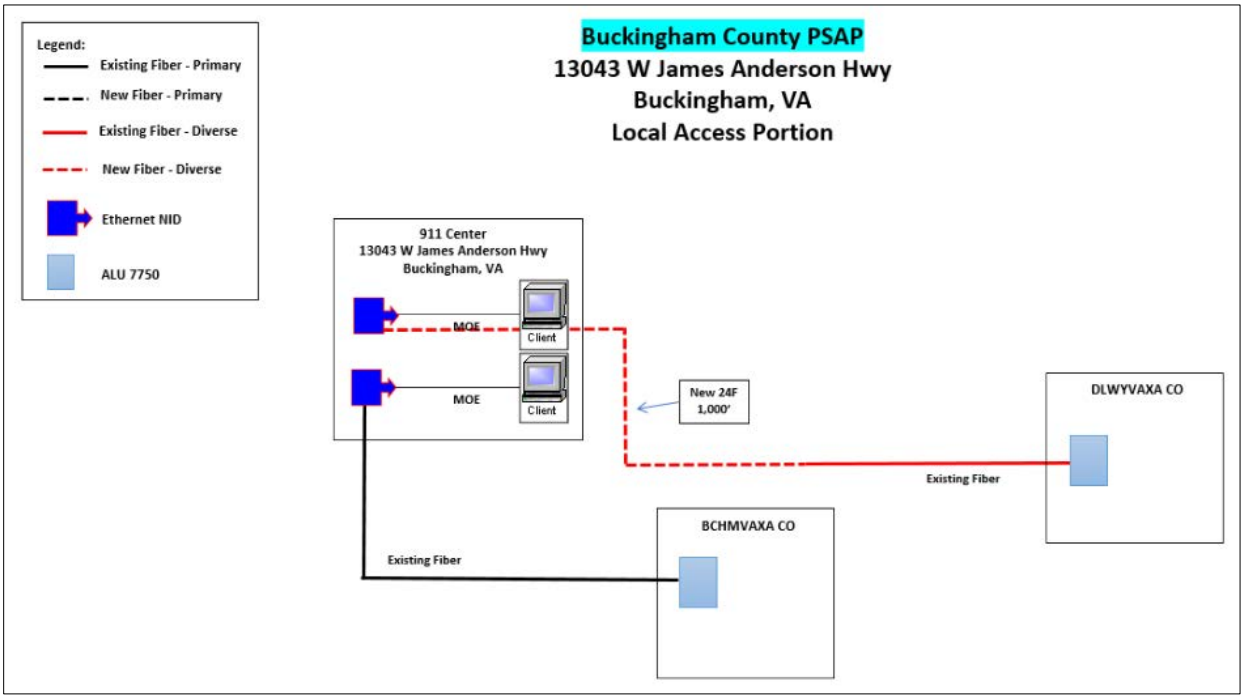
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **CenturyLink**
- ALI database provider: **CenturyLink**
- Selective router pair(s): **Charlottesville/Farmville**
- Trunk counts (all): **9**
    - Wireline: **4**
    - Wireless: **2**
    - SIP: **0**
    - Administrative: **3**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Buckingham County** PSAP are as follows:



The total cost for this diverse connectivity is **$14,000**, which will be provided by the Board as part of the PSAP's funding submission. Also, there is a one-time $82,000 charge for all CenturyLink sites. That cost will be provided by the Board as part of the first PSAP's funding submission that choses the AT&T solution. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason, or should just the network be unavailable and the PSAP can still be occupied, incoming calls receive a **fast busy signal**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan

during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.

- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	**CenturyLink**	**403,369**	**July 2020 – December 2020**
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Buckingham County PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not

completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 licenses and professional services
CHE Replacement	$150,000	Replacement planned in FY2019
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$14,000	+$82,000 if first CenturyLink PSAP
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Currently using grant funds
Legacy 9-1-1 transition costs	$2,473.50	Verizon costs
Project management assistance	$0	None requested
Total	$231,473.50	

The monthly recurring cost for the AT&T solution is **$4,461.31** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$2,945.05**. The estimated monthly increase to the PSAP after deployment is approximately **$1,516.26**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$231,473.50
Recurring (over 24 months)	$36,390.24
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Campbell County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Campbell County PSAP** based on the Fairfax County contract with **AT&T**. **Jonaaron Evans** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Campbell County PSAP** will need to upgrade their current Vesta 911 software or have in place an i3 capable CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **6.1**
- CHE version number (server): **6.1**
- CHE maintenance provider (channel): **Century Link**
- CHE Geodiversity: **No**
- Number of positions: **5**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **January 2021**. This is after their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **DaPro**
- CAD software version: **IBR Plus 5.3.1**
- CAD interfaces: **No**
- Method of data transfer: **None**

The PSAP currently has a grant to replace this CAD system. It is the responsibility of the PSAP to determine any upgrades or modifications the new system may need with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **GeoComm**
- Dispatch Mapping Software Version: **GeoLynx v8.18.0**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Synergon Solutions**
- Logging Recorder Model: **Vault Player**
- Logging Recorder Software Version: **3.0**
- Audio Origination Point: **Positions**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **CodeRed** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP indicates that this space may be available.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY19 – CAD - $75,000**

GIS Data Preparation

GIS Data Sources

Currently, **Campbell County GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Campbell County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be

available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **99.8%**
- Address Point – **97.9%**

Campbell County already meets the RCL goal. For the address points, the analysis determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.5%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no

duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **3**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **6**
- Address point street name and road centerline street name mismatch - **4**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Campbell County** will need to resolve these issues through internal resources, at least three months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **32 ESNs** for their area of responsibility. **Campbell County** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to

as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

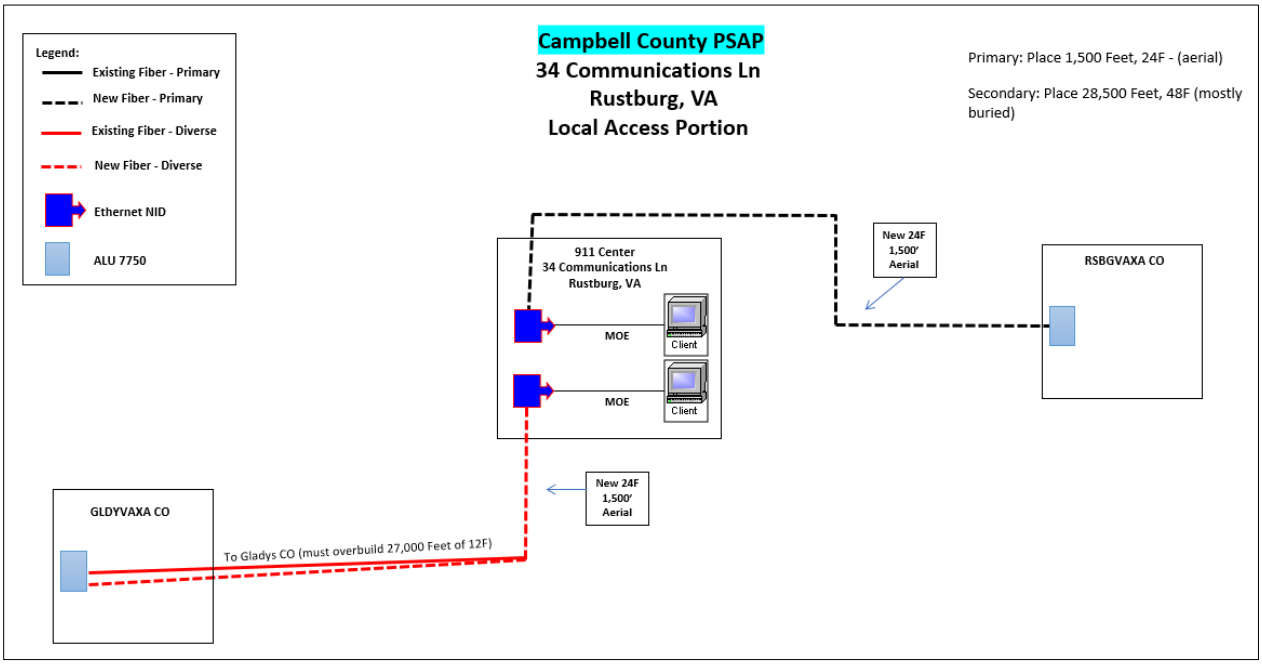
- Legacy E9-1-1 service provider: **CenturyLink**
- ALI database provider: **CenturyLink**
- Selective router pair(s): **Charlottesville/Farmville**
- Trunk counts (all): **19**
    - Wireline: **5**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **10**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999%

availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Campbell County** PSAP are as follows:



The total cost for this diverse connectivity is **$168,000**, which will be provided by the Board as part of the PSAP's funding submission. Also, there is a one-time $82,000 charge for all CenturyLink sites. That cost will be provided by the Board as part of the first PSAP's funding submission that choses the AT&T solution. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason calls are routed to the **City of Lynchburg PSAP**. Should just the network be unavailable and the PSAP can still be occupied, incoming calls receive a fast busy signal.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be

answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.

- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	**CenturyLink**	**403,369**	**July 2020 – December 2020**
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Campbell County PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that

the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 licenses and professional services
	$150,000	Replacement in FY21
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$168,000	+$82,000 if first CenturyLink PSAP
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$8,177.10	
Project management assistance	$0	None requested
Total	$388,000	

The monthly recurring cost for the AT&T solution is **$8,384.46** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$6,394.06**. The estimated monthly increase to the PSAP after deployment is approximately **$1,990.40.** This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$388,000.00

Recurring (over 24 months)	$47,769.06
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Caroline County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Caroline County PSAP** based on the Fairfax County contract with **AT&T**. **Lisa Harvey and Scott Moser** shall be the primary contacts.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network. Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Caroline County PSAP** will need to have i3-capable call handling equipment in place that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta**
- CHE version number (clients): **4.3 Build 317**
- CHE version number (server): **4.3 Build 317**
- CHE maintenance provider (channel): **Radio Communications of Virginia**
- CHE Geodiversity: **No**
- Number of positions: **6**
- SIP capable: **Unknown**

This CHE will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **January 2020**. This is after the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Interact Public Safety Systems**
- CAD software version: **10.5.4.129**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Interact Public Safety Systems (integrated with CAD)**
- Dispatch Mapping Software Version: **10.5.4.129**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model: **Inform**
- Logging Recorder Software Version: **67.1.0.175**
- Audio Origination Point: **Both trunk-based and position-based.**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently does not have an outcall notification system. If one is put in place, AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY18 – NG9-1-1 GIS - $ 53,590**

To ensure the grant funds support the migration to NG9-1-1, the PSAP should, to the extent practical, use funding from the FY18 GIS grant to correct geospatial issues identified in the following section.

GIS Data Preparation

GIS Data Sources

Currently, utilizing grant funds, new **Caroline County GIS** staff, working with WorldView Solutions, maintains all of the GIS data for the PSAP. In the near future, **Caroline County GIS** will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Caroline County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is

recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP, which was based on data provided by **MSAG Data, LLC,** determined the current match rate to be as follows:

- Road Centerline (RCL) – **94.7%**
- Address Point – **85.1%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **98.3%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **94.6%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **39**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **69**
- Address point street name and road centerline street name mismatch - **50**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Caroline County** will need to resolve these issues through internal resources, at least 3 months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has 6 ESNs for their area of responsibility. **Caroline County GIS** maintains an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

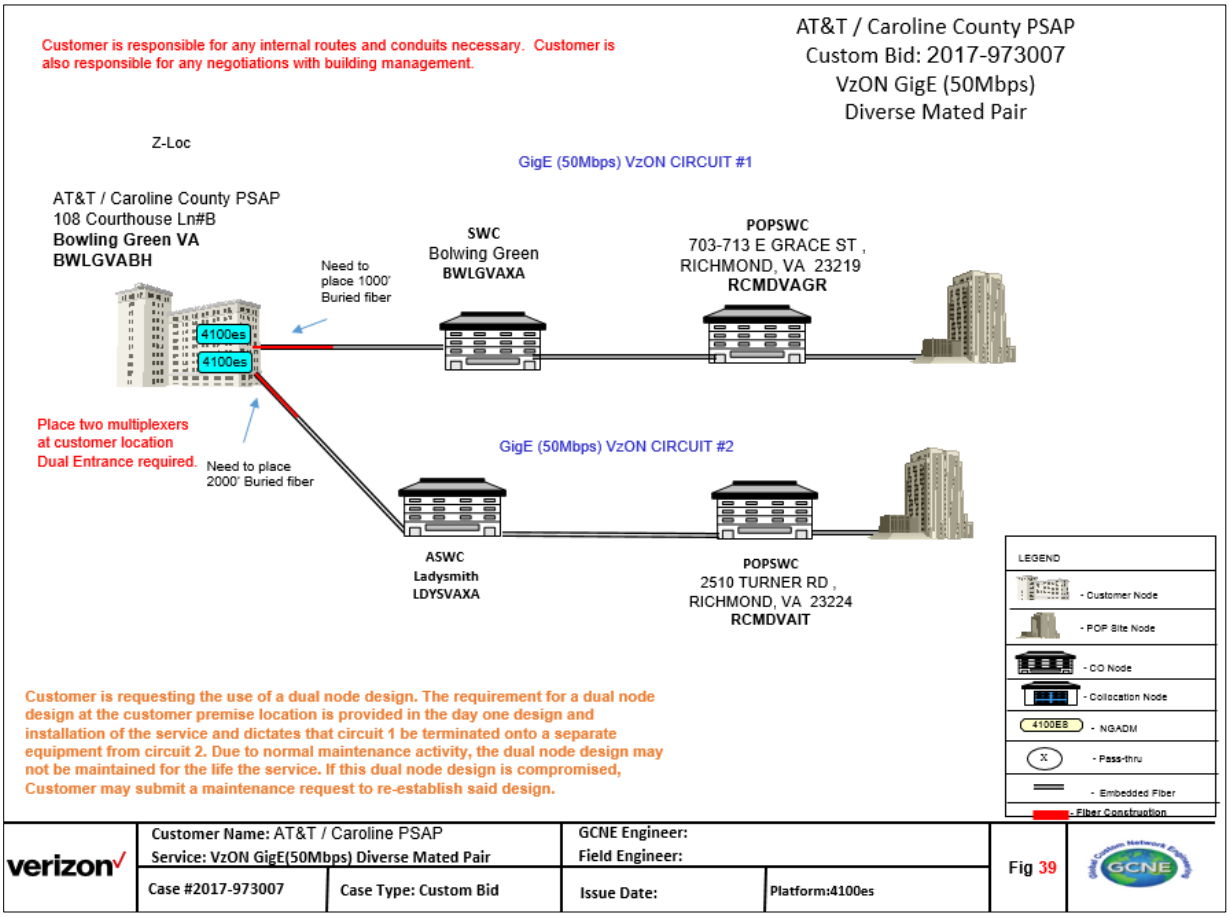
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Chester/Richmond Stuart**
- Trunk counts (all): **19**
    - Wireline: **6**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **9**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Caroline County** PSAP are as follows:



The total cost for this diverse connectivity is $**87,846.00**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, or if the 9-1-1 network is unavailable and the PSAP can still be occupied, calls are routed to a 10-digit number.

Based on the current disaster recovery plan, no additional steps be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

Fort AP Hill has been identified as a secondary PSAP(s) within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than

supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	**Verizon**	**1,660,182**	**January 2020 – June 2020**
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021

Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Caroline County** PSAP's deployment window will be **January 2020 – June 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 deployment services
CHE replacement	$150,000	Estimated replacement January 2020
Text-to-911	$30,000	Not currently deployed
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Space available
Diverse connectivity costs	$**87,846**	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	Fort AP Hill
GIS data preparation	$0	Currently using grant funds
Legacy 9-1-1 transition costs	$1,687.80	Verizon costs
Project management assistance	$0	None requested
Total	$304,533.80	

The monthly recurring cost for the AT&T solution is **$5,796.57** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$2,083.33**. The estimated monthly increase to the PSAP after deployment is approximately **$3,713.24**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$304,533.80
Recurring (over 24 months)	$89,117.76
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Charles City County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Charles City County PSAP** based on the Fairfax County contract with **AT&T**. **Harry French** shall be the primary contacts.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Charles City County** PSAP will need to have i3-capable call handling equipment in place that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta**
- CHE version number (clients): **4.0**
- CHE version number (server): **4.0**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **2**
- SIP capable: **No**

This CHE will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **January 2019**. This is before the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **ID Networks**
- CAD software version: **Upgrade to latest version scheduled 8/2018**
- CAD interfaces: **Yes**
- Method of data transfer: **Ethernet**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **ID Networks (integrated with CAD)**
- Dispatch Mapping Software Version: **Upgrade to latest version scheduled 8/2018**
- Method of data transfer: **Ethernet**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model: **NRX with Inform Essential**
- Logging Recorder Software Version:
- Audio Origination Point: **Both trunk-based and position-based.**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Wireless Emergency Notification System (WENS)** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has four open grants:

1. **FY18 – Voice Logging System -$30,000**
2. **FY19 – Mapping System - $25,000**
3. **FY19 – CAD - $75,000**
4. **FY19 – NG9-1-1 GIS - $83,732**

To ensure the grant funds support the migration to NG9-1-1, the PSAP should, to the extent practical, use funding from the FY19 GIS grant to correct geospatial issues identified in the following section.

GIS Data Preparation

GIS Data Sources

Currently, the **Charles City County Community Development Department** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Charles City County** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used

by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows (note: this analysis was performed on June 2017 data since new GIS data was not provided by the locality in January 2018):

- Road Centerline (RCL) – **95.8%**
- Address Point – **82.5%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **98.6%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **94.3%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.

4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **25**
- Road centerline has right or left side overlapping address range - **4**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **41**
- Address point street name and road centerline street name mismatch - **371**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Charles City County** will need to resolve these issues through internal resources, at least 3 months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing

MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has an unknown number of ESNs for their area of responsibility, but **Charles City County GIS** maintains an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG911.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice

data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

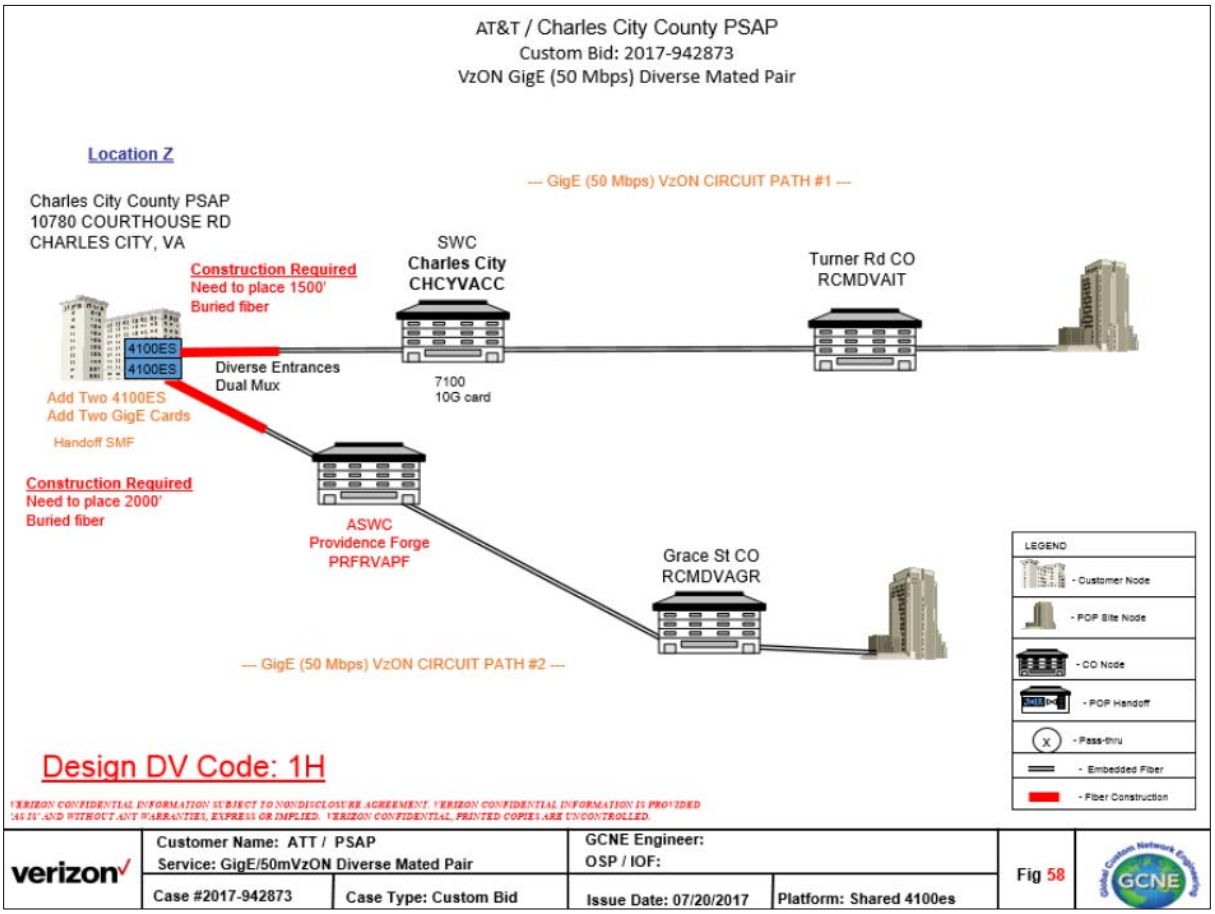
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Chester/Richmond Stuart**
- Trunk counts (all): **10**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **2**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be

discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Charles City County** PSAP are as follows:



The total cost for this diverse connectivity is $**99,752.66**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still

operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, or if the 9-1-1 network is unavailable and the PSAP can still be occupied, calls are routed to the **New Kent County PSAP**.

Based on the current disaster recovery plan, no additional steps be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	**Verizon**	**1,660,182**	**January 2020 – June 2020**
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021

Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Charles City County** PSAP's deployment window will be **January 2020 – June 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 deployment services
CHE replacement	$150,000	Estimated January 2019
Text-to-911	$30,000	Currently not deployed
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	
Diverse connectivity costs	$99,752.66	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Using existing grant
Legacy 9-1-1 transition costs	$756.60	Verizon costs
Project management assistance	$0	None requested
Total	$315,509.26	

The monthly recurring cost for the AT&T solution is **$3,487.21** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$871.84**. The estimated monthly increase to the PSAP after deployment is approximately **$2,615.37**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$315,509.26
Recurring (over 24 months)	$62,768.88
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Charlotte County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Charlotte County PSAP** based on the Fairfax County contract with **AT&T**. **Lisa Myers** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Charlotte County PSAP** will need to upgrade their current Vesta 911 software or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **6.1 Build 340**
- CHE version number (server): **6.1 Build 340**
- CHE maintenance provider (channel): **Radio Communications of Virginia**
- CHE Geodiversity: **No**
- Number of positions: **2**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **December 2021**. This replacement is after their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **DaPro Systems**
- CAD software version: **IBR Plus v5.2**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

The PSAP has an FY18 PSAP grant to assist with the replacement of this CAD system. The PSAP must ensure that the new system will not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **GeoComm**
- Dispatch Mapping Software Version: **GeoLynx 8.1.1**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Versadial Solutions**
- Logging Recorder Model: **VS Logger**
- Logging Recorder Software Version: **4.1.3.1**
- Audio Origination Point: **Position-based**

This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board

will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently does not have an outcall notification system. If one is implemented, AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space may be available, but funding is included in the budget in case it is not.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY18 – CAD – $150,000**

GIS Data Preparation

GIS Data Sources

Currently, **GeoComm** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It will be the responsibility of **Charlotte County or their GIS data maintenance contractor** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **97.1%**
- Address Point – **96.8%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **98.1%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.0%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **2**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **543**
- Address point street name and road centerline street name mismatch - **34**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Charlotte County** will need to resolve these issues through **their GIS contractor**, at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **18 ESNs** for their area of responsibility. **Charlotte County** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

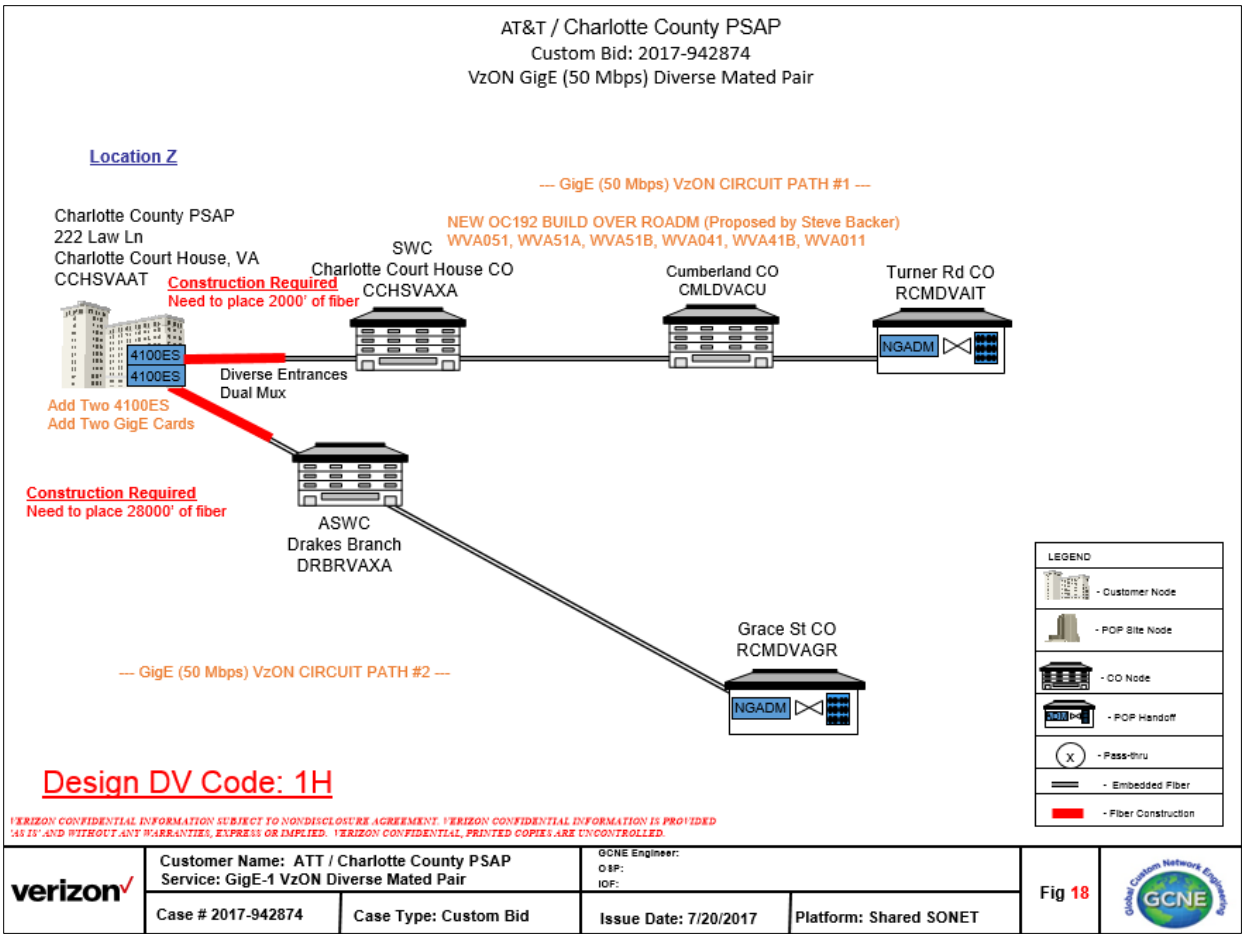
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Danville/Lynchburg**
- Trunk counts (all): **7**
    - Wireline: **4**
    - Wireless: **2**
    - SIP: **0**
    - Administrative: **1**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Charlotte County** PSAP are as follows:



The total cost for this diverse connectivity is **$469,362.77**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason, or should just the network be unavailable and the PSAP can still be occupied, incoming calls are redirected to **ten-digit administrative lines** then to the **Lunenburg County PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this

migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DDoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.

- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	**Verizon**	**320,247**	**July 2020 – December 2020**
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Charlotte County PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE replacement	$150,000	Replacement planned for FY22
CHE upgrade	$30,000	i3 deployment services
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$2,000	
Diverse connectivity costs	$469,362.77	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$873.00	Verizon costs
Project management assistance	$0	None requested
Total	$687,235.77	

The monthly recurring cost for the AT&T solution is **$3,948.51** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$1,405.91**. The estimated monthly increase to the PSAP after deployment is approximately **$2,542.60**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines

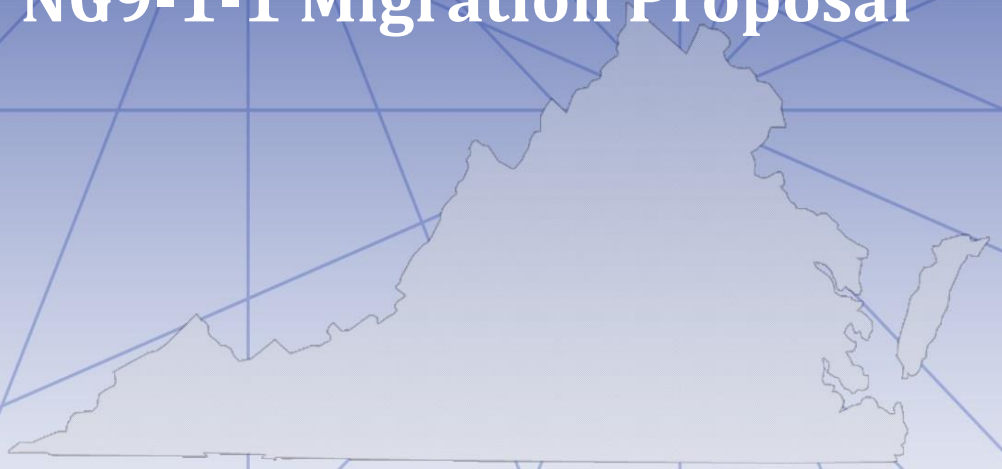
approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$687,235.77
Recurring (over 24 months)	$61,022.40
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Charlottesville-UVA-Albemarle
PSAP/GIS Specific
NG9-1-1 Migration Proposal



November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for **Charlottesville-UVA-Albemarle** based on the Fairfax County contract with **AT&T**. **Gerald Smith** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Charlottesville-UVA-Albemarle PSAP** will be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1

PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at:

https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Airbus**
- CHE model: **Vesta**
- CHE version number (clients): **Vesta 6.1.0**
- CHE version number (server): **Vesta 6.1.0**
- CHE maintenance provider (channel): **CenturyLink**
- CHE Geodiversity: **Yes, 1600 5th Street, Charlottesville, VA**
- Number of positions: **13 PSAP, 6 Back-up, 3 Command Post**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to version 7.2 to implement the full i3 interface. This upgrade from version 6.1 should be at no cost, but will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the integrated solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes. Since there are a CHE server at two, geodiverse locations serving this PSAP, diverse, redundant IP connectivity needs to be provided to both locations. This will ensure 99.999% availability at either location should one location fail.

Additionally, the PSAP indicates the planned replacement of their CHE in February 2021. Since this is after their planned NG9-1-1 migration, any new CHE will need to be i3 capable and tested on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will

be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP plans to deploy text to 9-1-1 utilizing the integrated solution and has capable CHE. If it is deployed prior to NG9-1-1 migration, no additional upgrade or change will be required.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Tyler (formerly New World Systems)**
- CAD software version: **Aegis CAD2017.1 SP1 HF3**
- CAD interfaces: **ALI data interface**
- Method of data transfer: **Serial data**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Tyler (formerly New World Systems)**
- Dispatch Mapping Software Version: **Aegis CAD 2017.1 SP1 HF3**
- Method of data transfer: **through the CAD interface**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE Systems**
- Logging Recorder Model: **Inform v8**
- Logging Recorder Software Version: **8.90.02.01**
- Audio Origination Point: **Position-based through CHE.**

This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **West/ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Code Red** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment at each of the geodiverse locations. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has no open grants, as of April 1, 2018, that would impact NG9-1-1 deployment.

GIS Data Preparation

GIS Data Sources

The **Charlottesville-UVA-Albemarle PSAP** is responsible for providing all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing. The **City of Charlottesville** and **Albemarle County** create and maintain geospatial data and provide it to the PSAP, who aggregates it to a single data file. While other departments within each locality may contribute data or manage various processes, the GIS departments are responsible for aggregating the GIS data within the locality and providing it to the PSAP. The PSAP will provide the data for NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode

against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **97.4%**
- Address Point – **86.9%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.4%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **90.9%**. During July 2018, VITA will send each PSAP and GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data.

These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **121**
- Road centerline has right or left side overlapping address range - **118**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **45**
- Address point Is duplicate, has no street name, or no address number - **2919**
- Address point street name and road centerline street name mismatch - **11**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, the **City of Charlottesville GIS and Albemarle County GIS** will need to resolve these issues through internal resources at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created.

The PSAP has an unknown number of ESNs for their area of responsibility and does not have an ESN boundary GIS layer. As a result, an ESN layer will need to be developed or the PSAP will need to continue to maintain their existing MSAG after the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

Legacy PSAP Gateway - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, if the CHE can be upgraded to meet the deployment schedule, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

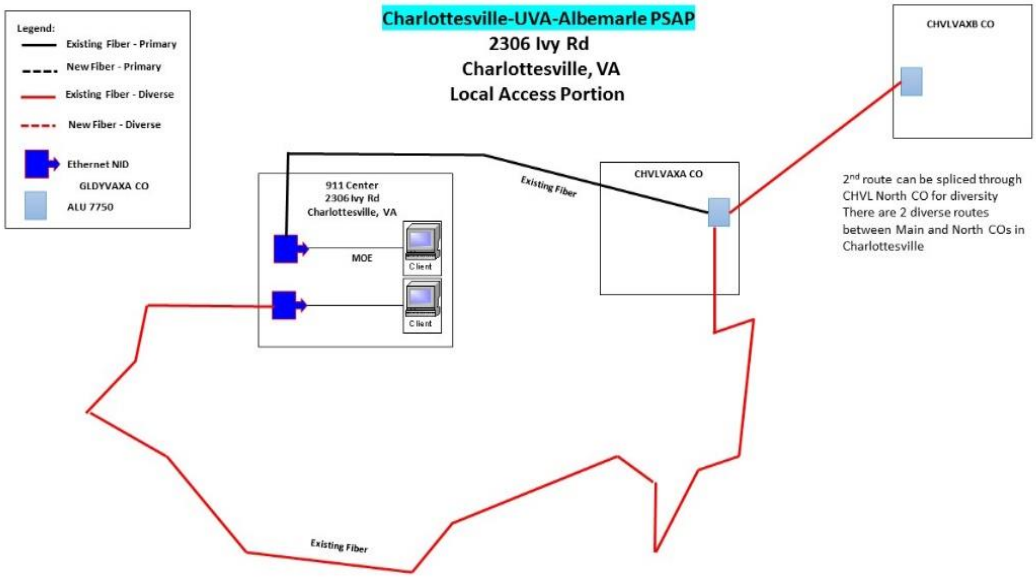
- Legacy E9-1-1 service provider: **CenturyLink**
- ALI database provider: **CenturyLink**
- Selective router pair(s): **Charlottesville/Farmville (Danville/Lynchburg, Fredericksburg/Winchester, Salem/Staunton)**
- Trunk counts (all): **40**
    - 9-1-1: **16**
    - 10-digit Emergency: **11**

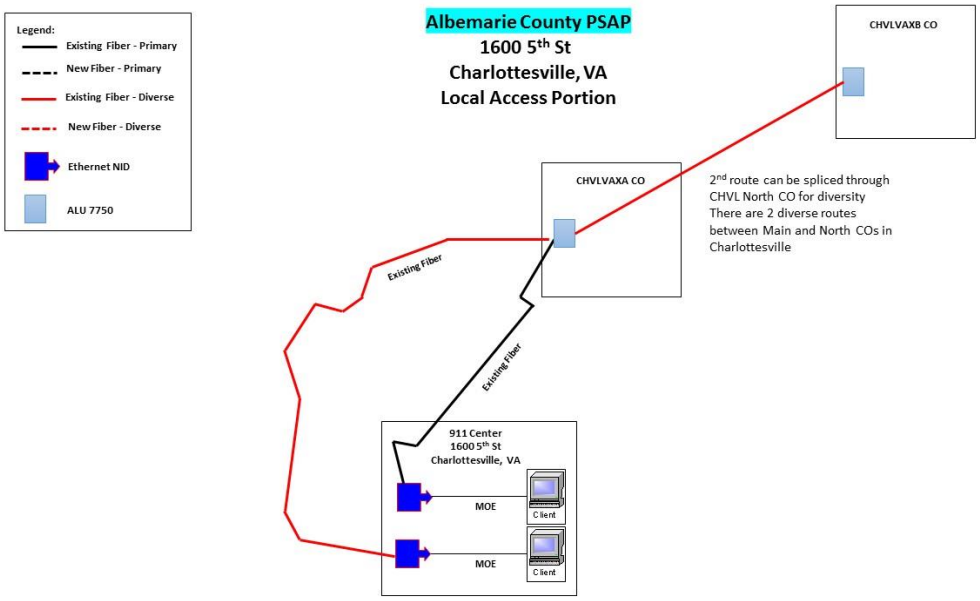
- Administrative: **13**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (9-1-1 trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results are as follows (since the CHE is geodiverse a drawing is provided for each location):





There is no additional cost for this diverse connectivity; however, there is a one-time $82,000 charge for all CenturyLink sites. That cost will be provided by the Board as part of the first PSAP's funding submission that choses the AT&T solution.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, operations move to a back-up PSAP located with the geodiverse CHE server. Should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to a 10-digit number within the PSAP.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup

or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	**CenturyLink**	**403,369**	**July 2020 – December 2020**
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Charlottesville-UVA-Albemarle PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least three months before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided above in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE replacement	$150,000	CHE replacement in FY2021
CHE upgrade	$30,000	i3 deployment services
Text to 9-1-1	$0	Not required
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Not required
Diverse connectivity costs	$0	$82,000 if first CenturyLink PSAP
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$22,290.60	CenturyLink costs
Project management assistance	$0	None requested
Total	$207,290.60	

The monthly recurring cost for the AT&T solution is **$18,589.40**, which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$22,892.47**. The estimated monthly savings to the PSAP after deployment is approximately **$4,303.07**. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$207,290.60
Recurring (over 24 months)	$0
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and

contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

City of Chesapeake
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **City of Chesapeake** based on the Fairfax County contract with **AT&T**. **Richard Huttenbrauck** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Chesapeake PSAP** will be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at:

https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta**
- CHE version number (clients): **7.1**
- CHE version number (server): **7.1**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **24**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to version 7.2 to implement the full i3 interface. This upgrade from version 7.1 should be at no cost, but will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **FY2020**. This is after the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this on the new CHE will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Tyler Technologies (Formerly New World Systems)**
- CAD software version: **ECAD 2017.2**
- CAD interfaces: **ALI data interface**
- Method of data transfer: **Serial data**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Tyler Technologies (Formerly New World Systems)**
- Dispatch Mapping Software Version: **ECAD 2017.2**
- Method of data transfer: **Through CAD**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Voice Print International, Inc**
- Logging Recorder Model: **VPI EMPOWER**
- Logging Recorder Software Version: **6.0.17192.2**
- Audio Origination Point: **Both trunk-based or position-based.**

This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1. It is important to note that while trunk-based recording is possible with NG9-1-1, it will not mirror current functionality. Currently, with analog trunks, trunk-based recording allows the audio to be captured before the call is answered by the call taker and the call is still in queue. With an IP connection, the audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio

message is played for the caller (which technically requires the CHE to answer the call to play the message).

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS/Vesta Analytics 3.1**
- Data Analytics Vendor: **West/Motorola**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP and no required upgrades to the Motorola system had been identified.

Outcall Notification Systems

The PSAP currently does not use an outcall notification system. If one is implemented, AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has no open grants, as of April 1, 2018, that would impact NG9-1-1 deployment.

GIS Data Preparation

GIS Data Sources

Currently, the **City of Chesapeake GIS** staff in the Information Technology and Planning Departments maintain all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Chesapeake PSAP** to aggregate the GIS data from the two sources required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against

the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **96.7%**
- Address Point – **80.4%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.6%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **97.4%**. During July 2018, VITA will send each PSAP and GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty routing a

9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **577**
- Road centerline has right or left side overlapping address range - **37**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **371**
- Address point Is duplicate, has no street name, or no address number - **415**
- Address point street name and road centerline street name mismatch - **429**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, the **City of Chesapeake** will need to resolve these issues through internal resources at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **one** ESNs for their area of responsibility. Though the **City of Chesapeake** does not maintain an ESN boundary layer, since the single ESN would be coincident, the PSAP boundary can be used to define the ESN boundary. As a result, they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not

part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

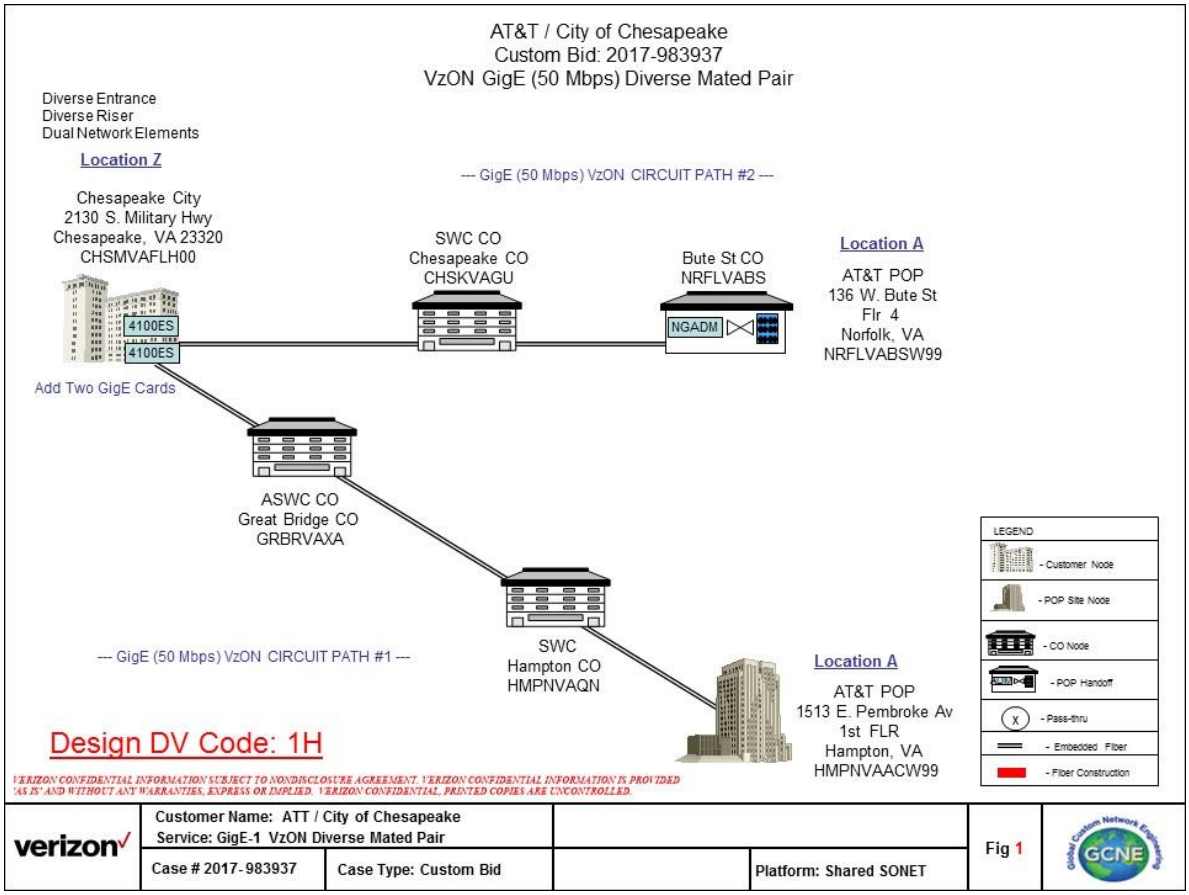
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **High Street/Jefferson Avenue**
- Trunk counts (all): **20**
    - Wireline: **10**
    - Wireless: **10**
    - Administrative: **20**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Chesapeake PSAP** are as follows:



The total cost for this diverse connectivity is **$3,838.00**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, the calls all transferred to a **portable backup PSAP**. Should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to a 10-digit number within the PSAP.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	**Verizon**	**1,662,247**	**July 2019 – December 2019**
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Chesapeake PSAP's** deployment window will be **July 2019 – December 2019**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not

completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	Firewalls for ESInet
CHE replacement	$150,000	Replacement planned for FY20
Text to 9-1-1	$30,000	Text to 9-1-1 Installation
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Not required
Diverse connectivity costs	$3,838.00	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Included in FY18 shared services grant.
Legacy 9-1-1 transition costs	$40,419.90	Verizon costs
Project management assistance	$0	None requested
Total	$259,257.90	

The monthly recurring cost for the AT&T solution is **$27,949.50**, which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$14,508.92**. The estimated monthly increase to the PSAP after deployment is approximately **$13,440.58**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$259,257.90
Recurring (over 24 months)	$322,573.92
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Chesterfield County
PSAP/GIS Specific
Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Chesterfield County PSAP** based on the Fairfax County contract with **AT&T**. **Allan Weese** shall be the primary contacts.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Chesterfield County PSAP** will need to have i3-capable call handling equipment in place that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **TriTech**
- CHE model: **Inform 911**
- CHE version number (clients): **Tri-Tech 3.6**
- CHE version number (server): **Avaya 5.2 / Inform 3.6**
- CHE maintenance provider (channel): **Radio Communications of Virginia**
- CHE Geodiversity: **Yes; Side B at 9901 Lori Rd. Chesterfield Va 23832**
- Number of positions: 3**0 (+6 at backup center)**
- SIP capable: **Unknown**

This CHE will need to be tested on the AT&T ESInet to determine compatibility with the i3 protocols.

The PSAP indicates the planned replacement of their CHE in **October 2018**. This is before the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. Prior to this requirement, **Chesterfield County** has implemented the direct IP solution for text to 9-1-1. No additional upgrade or change is required with the deployment of NG9-1-1.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense.

Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Motorola**
- CAD software version: **Premier CAD 7**
- CAD interfaces: **Yes**
- Method of data transfer: **RS232/IP**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Motorola (integrated with CAD)**
- Dispatch Mapping Software Version: **Premier CAD 7**
- Method of data transfer: **RS232/IP**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **HigherGround**
- Logging Recorder Model: **Capture911**
- Logging Recorder Software Version: **8.9.1**
- Audio Origination Point: **Both trunk-based and position-based**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **TASKE Technology (to be installed 10/18) and ECaTS will be used equally**
- Data Analytics Vendor: **TASKE Technology and ECaTS**

Outcall Notification Systems

The PSAP currently does not use an outcall notification system. If one is put in place, AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY18 – CHE – $150,000**

GIS Data Preparation

GIS Data Sources

Currently, **Chesterfield County GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Chesterfield County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS

data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **94.5%**
- Address Point – **89.5%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **95.9%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **95.1%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **859**
- Road centerline has right or left side overlapping address range - **18**

- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **488**
- Address point Is duplicate, has no street name, or no address number - **3**
- Address point street name and road centerline street name mismatch - **4,356**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Chesterfield County** will need to resolve these issues through internal resources, at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has one ESN for their area of responsibility. **Chesterfield County GIS** does not maintain an ESN boundary layer depicting this area. Since this layer is the same as the PSAP boundary layer it will be created at the same time. Once it is, they will utilize a GIS generated MSAG with the migration to NG9-1-1.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and

resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the

PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

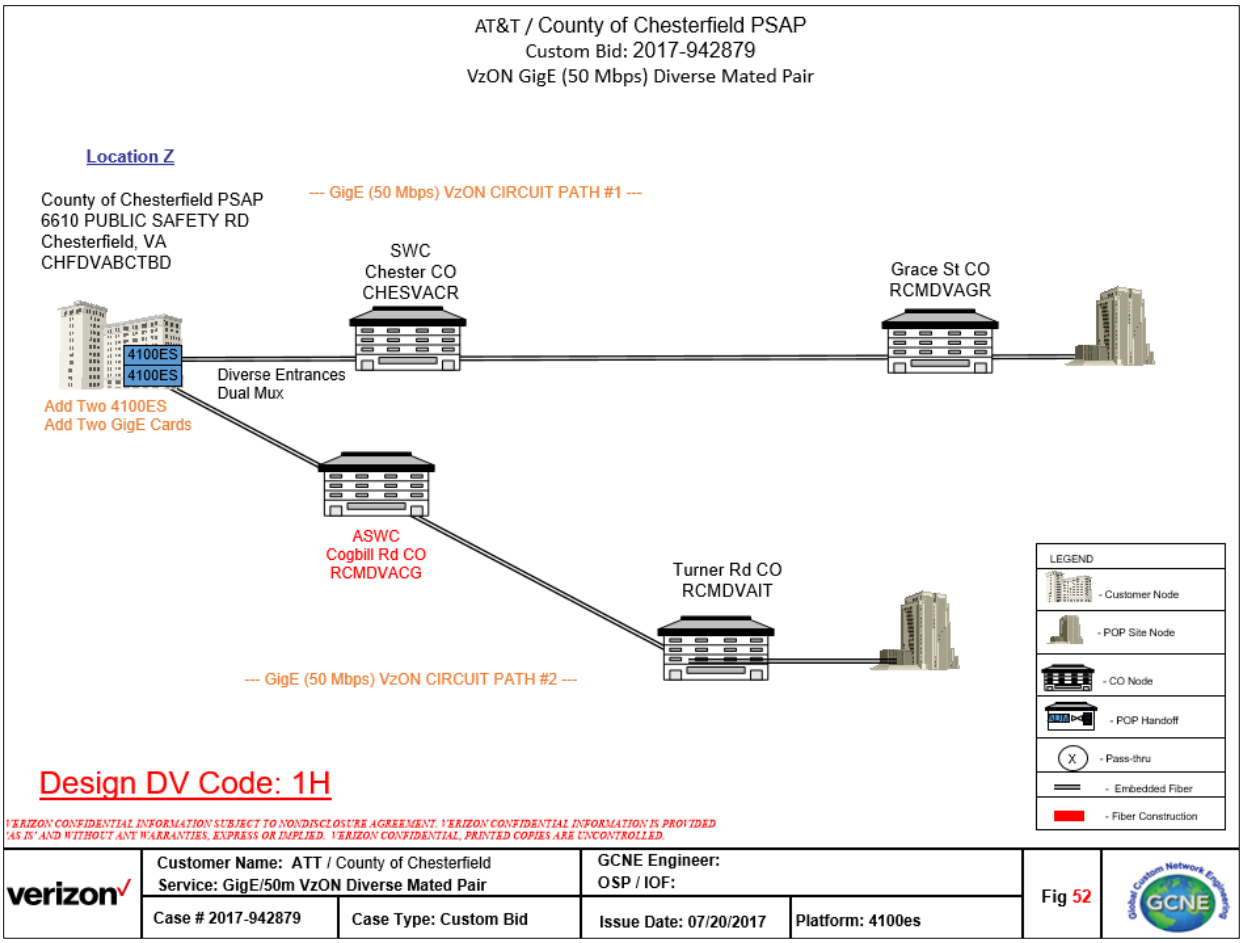
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Chester/Richmond Stuart**
- Trunk counts (all): **48**
    - Wireline: **10**
    - Wireless: **10**
    - SIP: **0**
    - Administrative: 2**8**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Chesterfield County** PSAP are as follows: **Chesterfield is geodiverse. Side B location is 9901 Lori Rd. Chesterfield Va 23832. Need diagram and costs.**



The total cost for this diverse connectivity is $**18,305.64** which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan. If the PSAP must be evacuated for any reason, or if the 9-1-1 network is unavailable and the PSAP can still be occupied, calls will be routed to the **Chesterfield County** backup center.

Based on the current disaster recovery plan, no additional steps need to be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this

migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.

- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	**Verizon**	**1,660,182**	**January 2020 – June 2020**
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Chesterfield County** PSAP's deployment window will be **January 2020 – June 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 deployment services
Text-to-911	$0	Deployed Direct IP
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Not required
Diverse connectivity costs	$18,305.64	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$47,142.00	Verizon costs
Project management assistance	$0	None requested
Total	$100,447.64	

The monthly recurring cost for the AT&T solution is **$41,264.71** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$16,069.11**. The estimated monthly increase to the PSAP after deployment is approximately **$25,195.60**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$100,447.64
Recurring (over 24 months)	$604,694.40
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Clarke County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Clarke County PSAP** based on the Fairfax County contract with **AT&T**. **Pam Hess** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Clarke County PSAP** will need to upgrade their current Vesta 911 software or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **7.1**
- CHE version number (server): **7.1**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **3**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **January 2023**. This is before their planned NG9-1-1 migration, therefore funding is included in the budget in FY2020. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Southern Software**
- CAD software version: **17.4.233.26**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Southern Software (integrated with CAD)**
- Dispatch Mapping Software Version: **MDS Map Viewer v2.102.3.0**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Voice Print International (VPI)**
- Logging Recorder Model:
- Logging Recorder Software Version: **1.3.0.8**
- Audio Origination Point: **Both trunk-based and position-based**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **CodeRed** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has no open grant. Their CHE replacement grant for FY18 has been executed.

GIS Data Preparation

GIS Data Sources

Currently, **Clarke County GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **Clarke County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **99.6%**
- Address Point – **97.9%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.7%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **99.7%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **40**
- Road centerline has right or left side overlapping address range - **5**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **78**
- Address point Is duplicate, has no street name, or no address number - **5,066**
- Address point street name and road centerline street name mismatch - **13**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Clarke County GIS** will need to resolve these issues through internal resources, at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **23 ESNs** for their area of responsibility. **Clarke County GIS** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

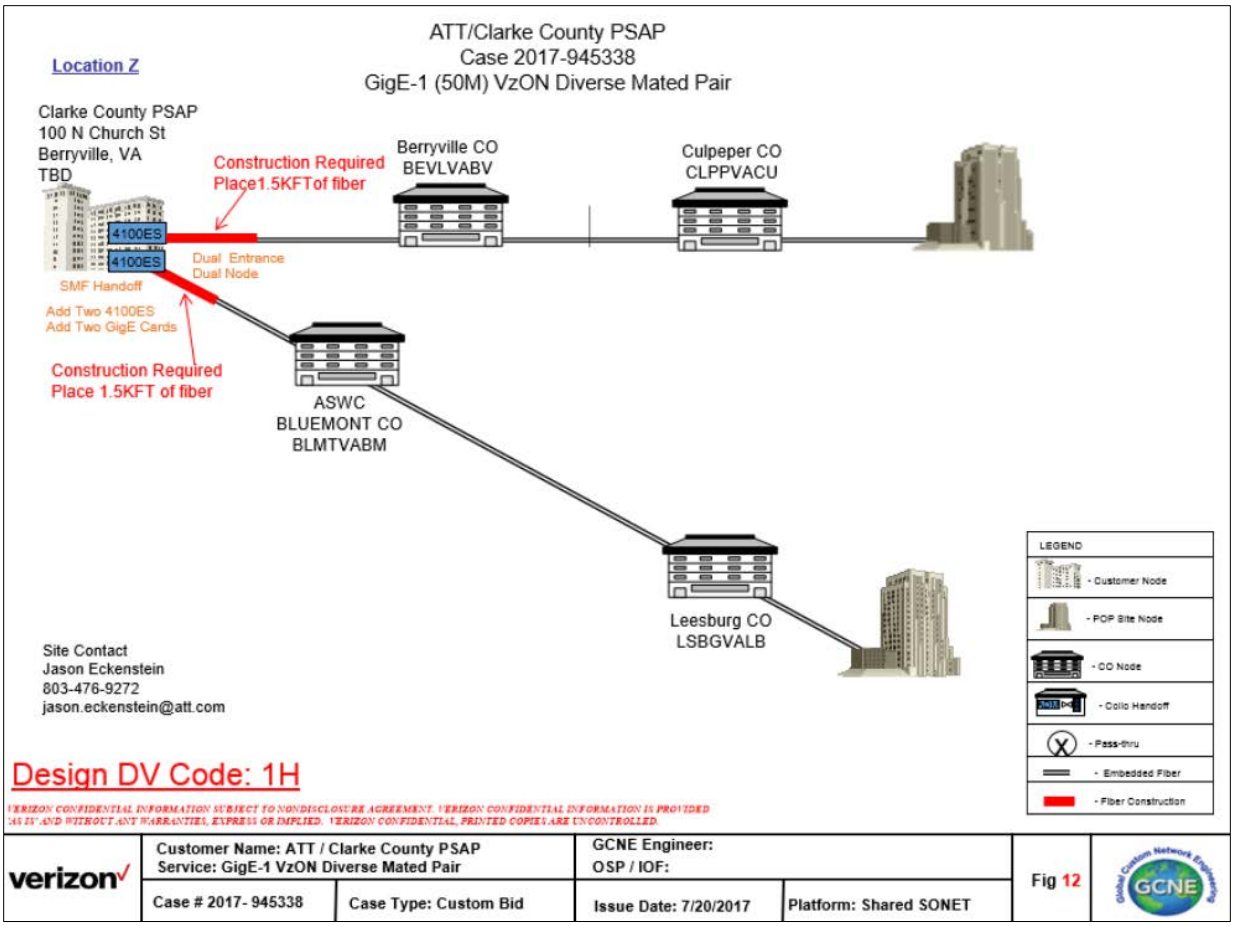
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Fredericksburg/Winchester**
- Trunk counts (all): **19**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **11**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Clarke County** PSAP are as follows:



The total cost for this diverse connectivity is **$62,298.85**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason, or should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to the **City of Winchester PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this

migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DDoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.

- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	**Verizon**	**343,031**	**July 2020 – December 2020**
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Clarke County PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 licenses and professional services
CHE replacement	$0	CHE replacement in FY2023
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$62,298.85	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$5,820.00	Verizon costs
Project management assistance	$0	None requested
Total	$133,118.85	

The monthly recurring cost for the AT&T solution is **$4,193.46** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$1,013.29**. The estimated monthly increase to the PSAP after deployment is approximately **$3,180.17**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines

approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$133,118.85
Recurring (over 24 months)	$76,324.08
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

City of Colonial Heights
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **City of Colonial Heights PSAP** based on the Fairfax County contract with **AT&T**. **Eric Albert** shall be the primary contacts.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Colonial Heights PSAP** will need to have i3-capable call handling equipment in place that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta**
- CHE version number (clients): **4.2 Build 433**
- CHE version number (server): **4.2 Build 433**
- CHE maintenance provider (channel): **Radio Communications of Virginia**
- CHE Geodiversity: **No**
- Number of positions: **6**
- SIP capable: **Yes**

This CHE will need to be upgraded to Vesta 7.2 to implement the full i3 interface. This may require the purchase of firewall(s) to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **2019 or 2020**. This is during or after the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. Prior to this requirement, the PSAP has implemented the web-based solution for text to 9-1-1. While this meets the legislative requirement, the PSAP will be upgraded to the direct IP solution with the implementation of NG9-1-1. Their CHE version will need to be capable of the text to 9-1-1 direct IP solution.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Shield Technology Corp.**
- CAD software version: **ShieldWare 6.4.3**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Shield Technology Corp. (integrated with CAD)**
- Dispatch Mapping Software Version: **ShieldWare 6.4.3**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Carolina Recording Systems**
- Logging Recorder Model: **Higher Ground**
- Logging Recorder Software Version:
- Audio Origination Point: **Both trunk based and position based**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **Aurora and ECaTS are used equally**
- Data Analytics Vendor: **Motorola and ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP. The Aurora data analytics system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Outcall Notification Systems

The PSAP currently uses **CivicReady** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has two open grants:

1. **FY18 – Mapping – $150,000**
2. **FY19 – NG9-1-1 GIS – $100,697**

To ensure the grant funds support the migration to NG9-1-1, the PSAP should, to the extent practical, use funding from the FY19 GIS grant to correct geospatial issues identified in the following section.

GIS Data Preparation

GIS Data Sources

Currently, the **City of Colonial Heights Emergency Communications** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **City of Colonial Heights Emergency Communications** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used

by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **60.7%**
- Address Point – **59.1%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **71.9%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **88.9%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While

many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **151**
- Road centerline has right or left side overlapping address range - **3**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **21**
- Address point Is duplicate, has no street name, or no address number - **17**
- Address point street name and road centerline street name mismatch - **4,193**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, the **City of Colonial Heights** will need to resolve these issues through internal resources, assistance from VITA-ISP and/or a contractor at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP

has **one ESN** for their area of responsibility. The **City of Colonial Heights** does not maintain an ESN boundary layer depicting this area. Since this layer, and the PSAP boundary layer, are the same as the city boundary they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and

ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals and the CHE is upgraded at least three months before deployment, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

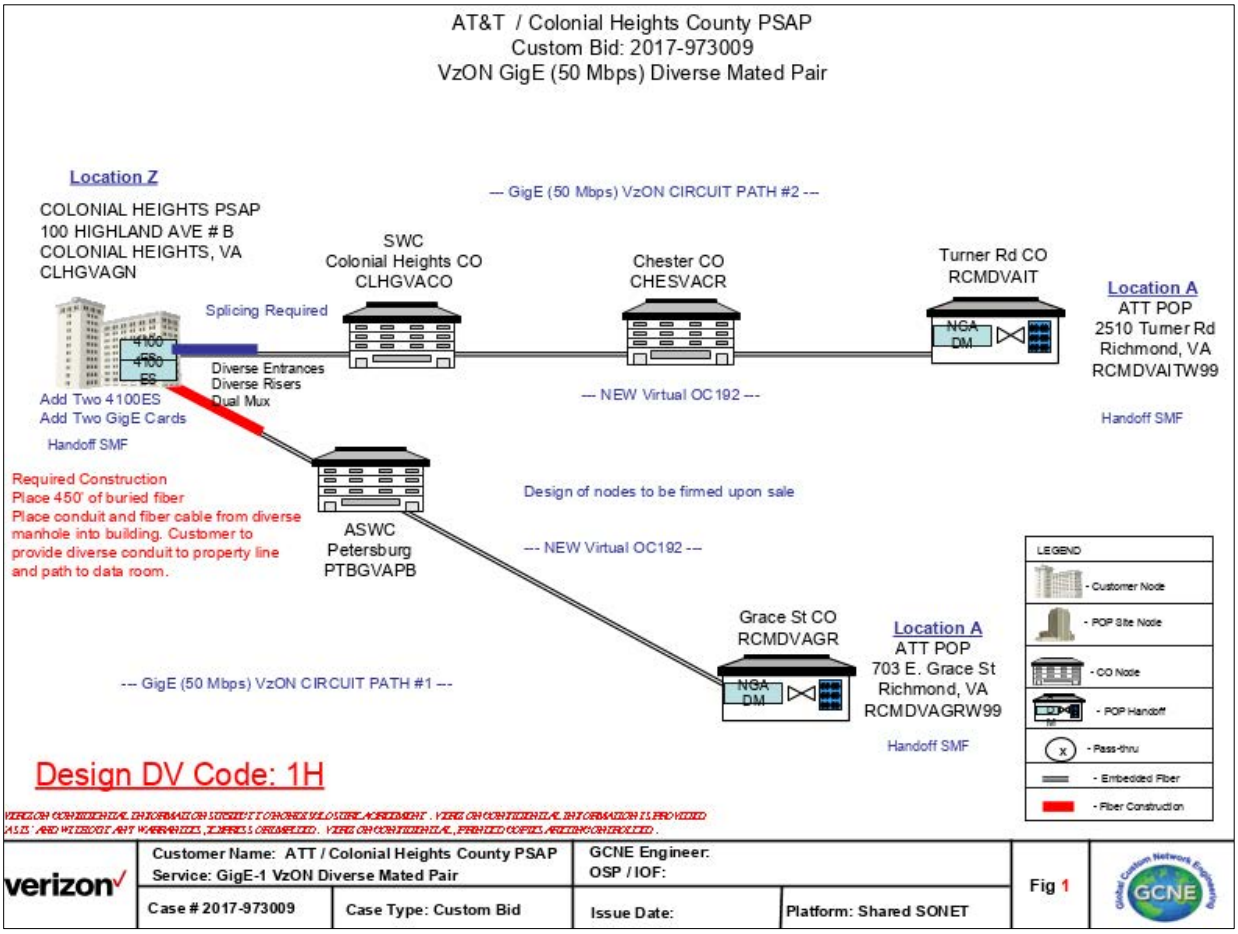
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Chester/Richmond Stuart**
- Trunk counts (all): **18**
    - Wireline: **4**
    - Wireless: **6**
    - SIP: **0**
    - Administrative: **8**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **City of Colonial Heights** PSAP are as follows:



The total cost for this diverse connectivity is $**45,330.00** which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are

two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan. If the PSAP must be evacuated for any reason, or if the 9-1-1 network is unavailable calls will be routed to the **Chesterfield County PSAP**.

Based on the current disaster recovery plan, no additional steps need to be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	**Verizon**	**1,660,182**	**January 2020 – June 2020**
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021

Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **City of Colonial Heights** PSAP's deployment window will be **January 2020 – June 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE replacement	$150,000	Planning replacement in 2019 or 2020
CHE upgrade	$30,000	i3 deployment services
Text-to-911	$30,000	Deployed web-based. May need firewalls for direct IP
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	
Diverse connectivity costs	$45,330.00	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Currently utilizing grant funds
Legacy 9-1-1 transition costs	$1,513.20	Verizon costs
Project management assistance	$0	None requested
Total	$261,843.20	

The monthly recurring cost for the AT&T solution is **$4,190.57** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$1,016.67**. The estimated monthly increase to the PSAP after deployment is approximately **$3,173.90**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current

monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$261,843.20
Recurring (over 24 months)	$76,173.60
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Craig County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Craig County PSAP** based on the Fairfax County contract with **AT&T**. **Robert Wrzosek** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Craig County PSAP** will need to upgrade their current Viper software or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **West**
- CHE model: **Viper**
- CHE version number (clients): **Power911 v5.5 SP4**
- CHE version number (server): **Viper v5.0**
- CHE maintenance provider (channel): **West**
- CHE Geodiversity: **No**
- Number of positions: **2**
- SIP capable: **Yes**

This CHE will require an upgrade to Viper 5.1 and Power911 6.4 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **July 2022**. This is after their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled just after the new deadline for text to 9-1-1 deployment, they will need to consider how to deploy before the deadline. The web-based service may be an option until the direct IP service integrated with their CHE can be deployed with NG9-1-1. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Southern Software**
- CAD software version: **17.4.233.28**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Southern Software (integrated with CAD)**
- Dispatch Mapping Software Version: **17.4.233.28**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **RedBox Recorders**
- Logging Recorder Model:
- Logging Recorder Software
- Audio Origination Point:

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently does not have an outcall notification system. When on is in place, AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP does not currently have any open grants.

GIS Data Preparation

GIS Data Sources

Currently, **MSAG Data Consultants** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Craig County PSAP** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **99.3%**
- Address Point – **96.5%**

Craig County already meets the goal for RCL. If they desire a higher match rate, there are differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.4%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **97.8%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no

duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **2**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **1**
- Address point street name and road centerline street name mismatch - **0**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Craig County** will need to resolve these issues through external resources or through assistance of their VITA IPS GIS data analysts, at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **7 ESNs** for their area of responsibility. **Craig County** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to

as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **TDS Telecom**
- ALI database provider: **West**
- Selective router pair(s): **New Castle (TDS Telecom)**
- Trunk counts (all): **13**
    - Wireline: **5**
    - Wireless: **5**
    - SIP: **0**
    - Administrative: **3**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999%

availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP. Unfortunately, the results for the current location of the **Craig County PSAP** are that diversity is not available. Redundant connectivity will instead be provided. If a diversity option becomes available in the future, the funding for such a solution could be provided by the Board as part of the PSAP's funding submission.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP does not have a disaster recovery plan for if the PSAP must be evacuated for any reason. Should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to a **ten-digit number**.

Since they currently do not have a disaster recovery plan, the PSAP may want to concern implementing one with the migration to NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	**TDS Telecom**	**5,158**	**January 2021 – June 2021**
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Craig County PSAP's** deployment window will be **January 2021 – June 2021**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$15,000	i3 licenses and services
Text-to-911	$15,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$0	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required

Legacy 9-1-1 transition costs	$552.90	
Project management assistance	$0	None requested
Total	$35,552.90	

The monthly recurring cost for the AT&T solution is **$3,263.21** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$929.30**. The estimated monthly increase to the PSAP after deployment is approximately **$2,333.91**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$35,552.90
Recurring (over 24 months)	$56,013.84
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Culpeper County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Culpeper County PSAP** based on the Fairfax County contract with **AT&T**. **William Martin** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Culpeper County PSAP** will need to upgrade their current Vesta 911 software or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **VESTA 911**
- CHE version number (clients): **6.1 Build 1222**
- CHE version number (server): **6.1 Build 1222**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **9**
- SIP capable: **Yes**

This CHE will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **July 2020**. This is after their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The **Culpeper County PSAP** is working to implement the direct IP solution for text to 9-1-1. No additional upgrade or change is required with the deployment of NG9-1-1.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system.

However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Sungard OSSI**
- CAD software version: **OneSolution CAD Version 18.0.0.2010**
- CAD interfaces: **Yes**
- Method of data transfer: **Through Digi port**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Sungard OSSI (integrated with CAD)**
- Dispatch Mapping Software Version: **OneSolution CAD Version 18.0.0.2010**
- Method of data transfer: **Through Digi port**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Synergon Solutions**
- Logging Recorder Model: **Vault Logger**
- Logging Recorder Software Version: **3.0.6500.2791**
- Audio Origination Point: **Both positions and trunks**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board

will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Rave Alert** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP does not currently have any open grants.

GIS Data Preparation

GIS Data Sources

Currently, the **Culpeper County GIS and Town of Culpeper GIS** maintain all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **Culpeper County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be

resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **98.9%**
- Address Point – **96.4%**

Culpeper County already meets the goal for RCL. If they desire a higher match rate, there are differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.5%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.5%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **5**

- Road centerline has right or left side overlapping address range - **91**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **37**
- Address point street name and road centerline street name mismatch - **25**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Culpeper County GIS** will need to resolve these issues through internal resources, at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **76 ESNs** for their area of responsibility. **Culpeper County GIS** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

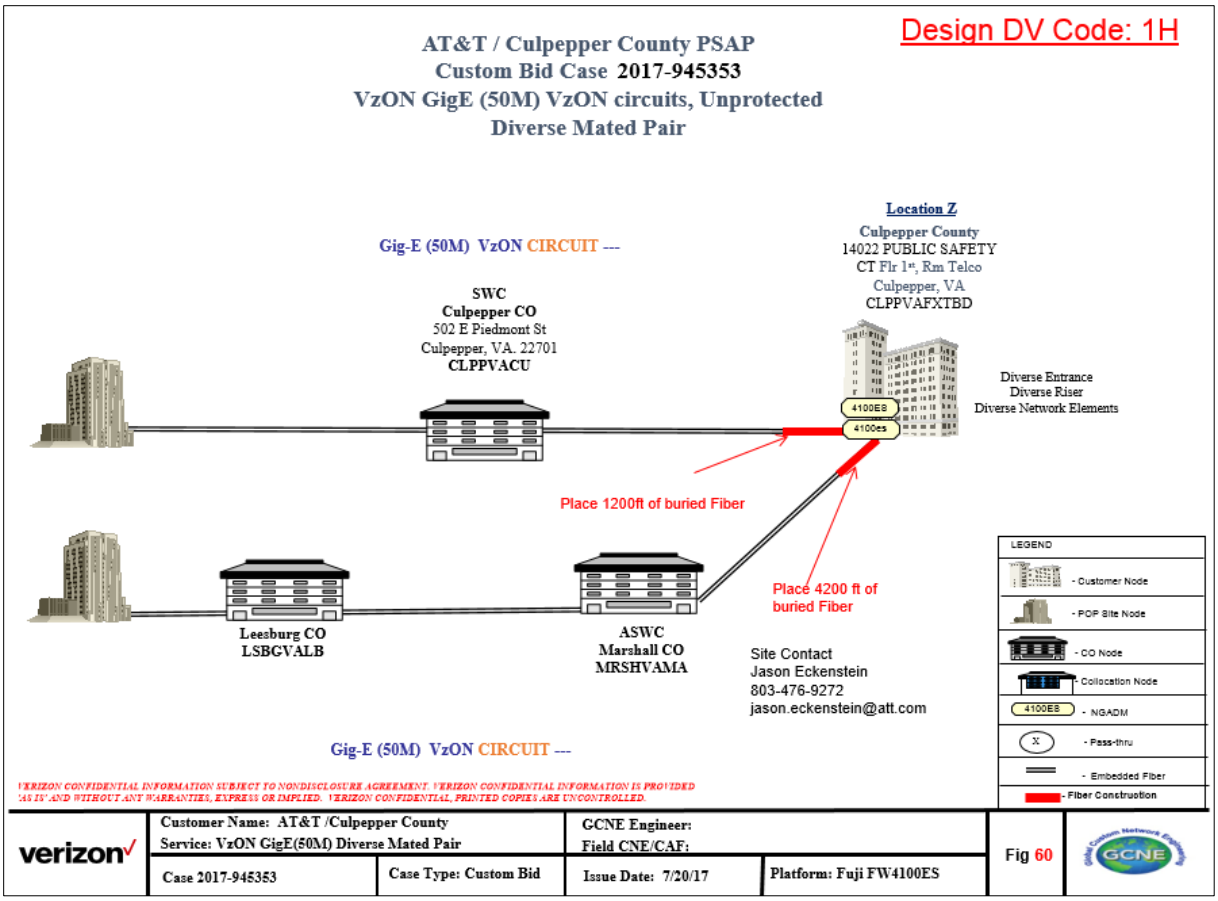
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Fredericksburg/Winchester**
- Trunk counts (all): **27**
    - Wireline: **5**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **18**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Culpeper County** PSAP are as follows:



The total cost for this diverse connectivity is **$156,946.00**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan that states if the PSAP must be evacuated for any reason or should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to the **Fauquier County PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a

neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.

- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	**Verizon**	**343,031**	**July 2020 – December 2020**
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Culpeper County PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 licenses and services
CHE replacement	$150,000	CHE replacement in FY2020
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$156,946.00	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$5,005.20	Verizon costs
Project management assistance	$0	None requested
Total	$376,951.20	

The monthly recurring cost for the AT&T solution is **$8,117.00** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$2,451.71**. The estimated monthly increase to the PSAP after deployment is approximately **$5,665.29**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines

approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$376,951.20
Recurring (over 24 months)	$135,966.96
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Cumberland County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Cumberland County PSAP** based on the Fairfax County contract with **AT&T**. **Shawn Howard** shall be the primary contacts.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Cumberland County PSAP** will need to have i3-capable call handling equipment in place that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta**
- CHE version number (clients): **4.2**
- CHE version number (server): **4.2**
- CHE maintenance provider (channel): **Century Link**
- CHE Geodiversity: **No**
- Number of positions: **2**
- SIP capable: **No**

This CHE will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **November 2019**. This is during the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **ID Networks**
- CAD software version: **3.4.193**
- CAD interfaces: **Yes**
- Method of data transfer: **IP converter**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Digital Data Technologies Inc. (embedded in CAD)**
- Dispatch Mapping Software Version: **3.0.3009.0**
- Method of data transfer: **Software provided API**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model: **Inform**
- Logging Recorder Software Version: **7.1.0.175**
- Audio Origination Point: **Trunks**

While the voice logging recorder system does not require any upgrade or modification with the deployment of NG9-1-1, if the PSAP wishes to maintain trunk-based recording, a span port will be provided by AT&T. The recording system may require an upgrade to receive and interpret the IP data. If desired, the cost of this upgrade would be covered by the Board. It is important to note that while this will allow audio to be pulled from the IP talk paths, it will not mirror current functionality. Currently, with analog trunks, trunk-based recording allows the audio to be captured before the call is answered by the call taker and the call is still in queue. With an IP connection, the audio is not present on the circuit

until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). The PSAP can choose to convert to position-based recording and the Board will cover the cost of reconfiguration.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Regroup** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY19 – NG9-1-1 GIS - $101,358**

To ensure the grant funds support the migration to NG9-1-1, the PSAP should, to the extent practical, use funding from the FY19 regional GIS grant to correct geospatial issues identified in the following section.

GIS Data Preparation

GIS Data Sources

Currently, the **Cumberland County GIS,** in conjunction with external GIS and CAD vendors, maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is **Cumberland County's** responsibility to aggregate the GIS data required for the PSAP and NG9-1-1, even if performed by a third party vendor.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these

data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **71.5%**
- Address Point – **5.3%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **72.8%** and address point to **69.6%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **92.8%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.

4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **425**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **8**
- Address point Is duplicate, has no street name, or no address number - **24**
- Address point street name and road centerline street name mismatch - **4,797**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Cumberland County** will need to resolve these issues through internal resources, at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing

MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **an unknown number** ESNs for their area of responsibility. **Cumberland County** does not maintain an ESN boundary layer depicting this area. If there is only one ESN, then the ESN boundary would be coincident with the PSAP boundary and both can be created at the same time. If more than one ESN is needed, then an ESN boundary layer will need to be created. Once it is, they can utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

Legacy PSAP Gateway - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

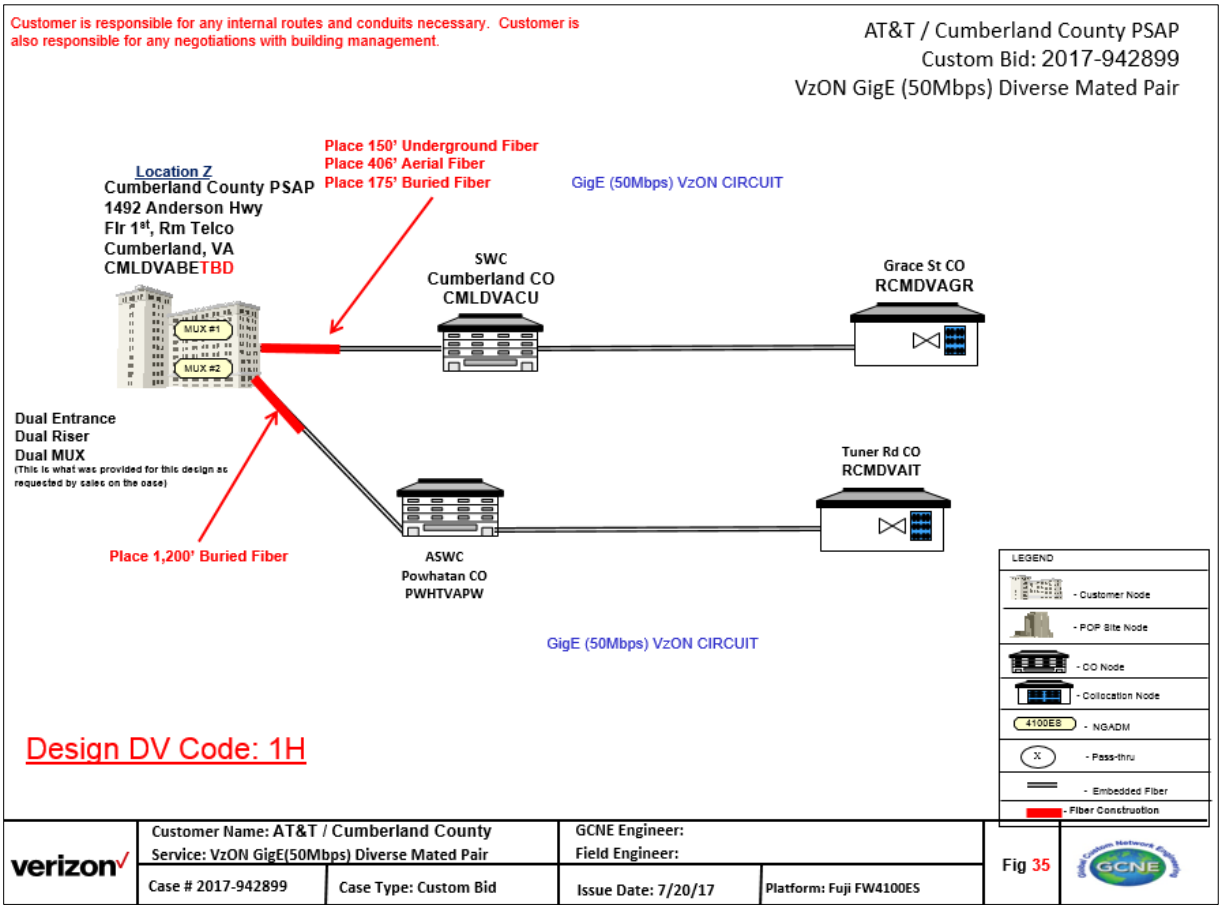
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Chester/Richmond Stuart**
- Trunk counts (all): **9**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **1**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Cumberland County** PSAP are as follows:



The total cost for this diverse connectivity is $**39,339.01**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a

neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, or if the 9-1-1 network is unavailable and the PSAP can still be occupied, calls are routed to **administrative lines**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	**Verizon**	**1,660,182**	**January 2020 – June 2020**
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021

Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Cumberland County PSAP's** deployment window will be **January 2020 – June 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE replacement	$150,000	Estimated replacement FY20
CHE upgrade	$30,000	i3 deployment services
Text-to-911	$30,000	Not currently deployed
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	
Diverse connectivity costs	$39,339.01	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Currently using grant funds
Legacy 9-1-1 transition costs	$1,455.00	
Project management assistance	$0	None requested
Total	$255,794.01	

The monthly recurring cost for the AT&T solution is **$3,762.50** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$1,200**. The estimated monthly increase to the PSAP after deployment is approximately **$2,562.50**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$255,794.01
Recurring (over 24 months)	$61,500.00
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

City of Danville
PSAP/GIS Specific
Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **City of Danville** based on the Fairfax County contract with **AT&T**. **Michael Gobble** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Danville PSAP** will be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at:

https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta**
- CHE version number (clients): **6.1 Build 394**
- CHE version number (server): **6.1 Build 340**
- CHE maintenance provider (channel): **Mobile Communications of America**
- CHE Geodiversity: **No**
- Number of positions: **6**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to version 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the plan replacement of their CHE in **August 2021**. This is after the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The City of Danville has deployed a TTY text to 9-1-1 solution, and therefore meets this legislative requirement. With the migration to NG9-1-1, Danville will need to convert their text to 9-1-1 solution to direct IP. The costs to implement this must be determined, but will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Superion**
- CAD software version: **One Solution CAD v18.0**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Superion**
- Dispatch Mapping Software Version: **One Solution CAD v18.0**
- Method of data transfer: **Serial through CAD**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Eventide**
- Logging Recorder Model: **NexLog**
- Logging Recorder Software Version: **2.7.0**
- Audio Origination Point: **Both**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS, currently also has Airbus Aurora v3.2**

Any necessary upgrades to Aurora will be the responsibility of the PSAP. To reduce their costs, the PSAP may want to consider fully utilizing ECaTS. All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Vesta Alert** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has no open grants.

GIS Data Preparation

GIS Data Sources

Currently, at the **City of Danville**, GIS data is maintained by individual departments, who are responsible for their respective GIS data layers. **Danville GIS** is then responsible for compiling the data from all the individual departments and providing it to the PSAP. Therefore, it will be the responsibility of the **Danville GIS** department to provide the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be

available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline – **98.9%**
- Address Point – **98.4**

The **City of Danville** currently meets both goals. If they desire a greater match rate, there are some differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.4%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.9%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when

routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **18**
- Road centerline has right or left side overlapping address range - **119**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **5**
- Address point Is duplicate, has no street name, or no address number - **20**
- Address point street name and road centerline street name mismatch - **23**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Though the **City of Danville** currently meets the goal, this must be maintained using internal resources to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has one ESN for their area of responsibility. **City of Danville GIS** maintains an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a

separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

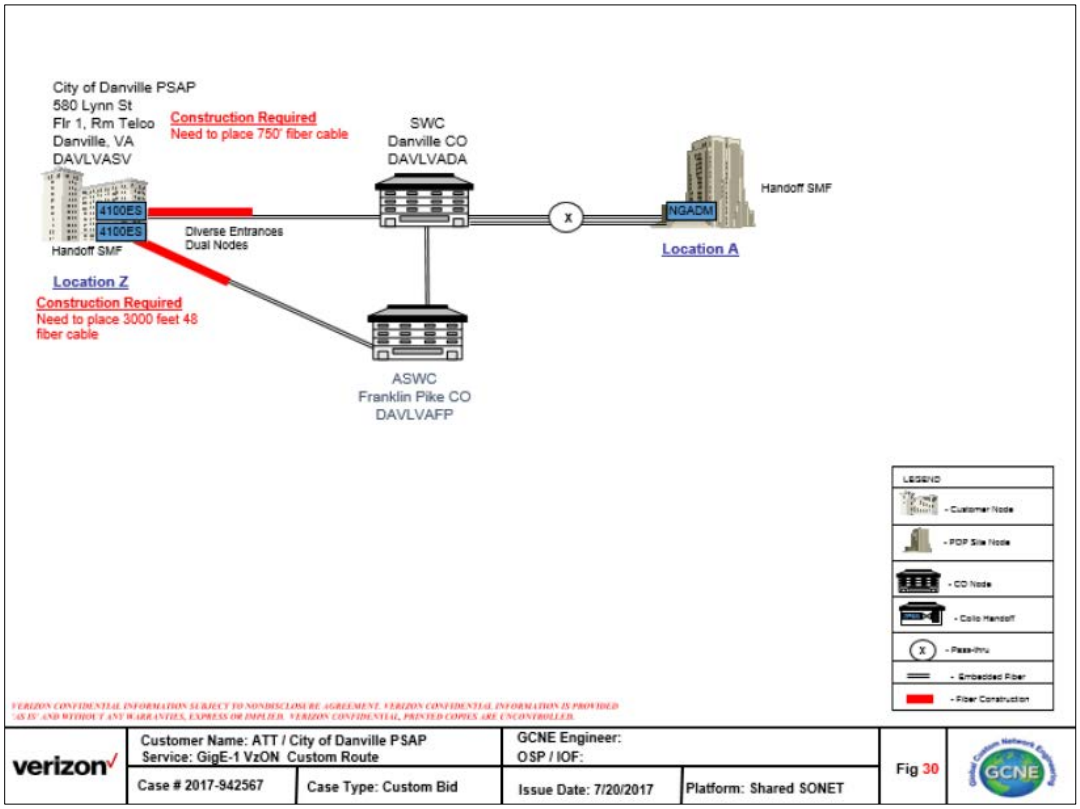
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Danville/Lynchburg**
- Trunk counts (all): **20**
    - Wireline: **6**
    - Wireless: **6**
    - VOIP Trunks**: 0**
    - SIP: **0**
    - Administrative: **8**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal, or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant

connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **City of Danville** PSAP are as follows:



The total cost for this diverse connectivity is **$38,734.52**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, the calls all transferred to the Pittsylvania County PSAP. Should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to a 10-digit number within the PSAP.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.

- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	**Verizon**	**320,247**	**July 2020 – December 2020**
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **City of Danville PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE replacement	$150,000	Replacement in August 2021
CHE upgrade	$30,000	i3 licenses and services
Text to 9-1-1	$30,000	Conversion to direct IP
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Not required
Diverse connectivity costs	$38,734.52	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	None
Legacy 9-1-1 transition costs	$4,277.70	Verizon costs
Project management assistance	$0	None requested
Total	$258,012.22	

The monthly recurring cost for the AT&T solution is **$6,888.64**, which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$2,106.48**. The estimated monthly increase to the PSAP after deployment is approximately **$4,782.16**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines

approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$258,012.22
Recurring (over 24 months)	$114,771.84
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Dickenson County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Dickenson County PSAP** based on the Fairfax County contract with **AT&T**. **Matt Slemp** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Dickenson County PSAP** will be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **West**
- CHE model: **Viper**
- CHE version number (clients): **Power911 6.1**
- CHE version number (server): **Viper 5.1**
- CHE maintenance provider (channel): **West (VA KY Communications)**
- CHE Geodiversity: **Hosted CHE – Viper cores in Longmont, CO and Miami, FL**
- Number of positions: **3**
- SIP capable: **Yes**

The current version of the CHE is i3 capable. Since it is a hosted solution, any upgrades will be made by West and prior to NG9-1-1 migration. No additional upgrades will need to be made at the **Dickenson County PSAP**. Currently, both the A9-1-1 and hosted CHE services utilize the same network provided by West. Migrating to the AT&T ESInet will replace the A9-1-1 services. The AT&T ESInet cannot be used for the hosted CHE services from West. The PSAP can stay with their current hosted solution (requires two networks), utilize a different hosted/shared solution or revert to a typical CHE installed at the PSAP.

The PSAP indicates the planned replacement of their CHE in **January 2023**. This is before their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The **Dickenson County PSAP** has deployed the direct IP solution for text to 9-1-1. No additional upgrade or change is required with the deployment of NG9-1-1.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Spillman Technologies**
- CAD software version: **2018.1.14.942**
- CAD interfaces: **Non operational**
- Method of data transfer: **Non operational**

This CAD system does not currently have a working ALI interface, but the vendor is working on implementing one. Even with this implemented, deployment of NG9-1-1 will not require any upgrade or modification to the CAD system.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **GeoComm**
- Dispatch Mapping Software Version: **GeoLynx v8.1**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Eventide**
- Logging Recorder Model: **NexLog**
- Logging Recorder Software Version: **2.7.3**
- Audio Origination Point: **Both positions and trunks**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **CodeRed** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY18 – NG9-1-1 GIS – Shared services participating – $182,000**

GIS Data Preparation

GIS Data Sources

Currently, **Dickenson County 9-1-1/GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **Dickenson County** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be

available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **98.8%**
- Address Point – **98.0%**

Dickenson County already meets both goals. If they desire a higher match rate, there are differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.0%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **99.5%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when

routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - 2
- Road centerline has right or left side overlapping address range - **2**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **1**
- Address point Is duplicate, has no street name, or no address number - **59**
- Address point street name and road centerline street name mismatch - **50**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Dickenson County** will need to resolve these issues through internal resources or existing grant funding, at least three months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **28 ESNs** for their area of responsibility. **Dickenson County** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not

part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still

use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **West**
- ALI database provider: **West**
- Selective router pair(s): **Blacksburg/Norton**
- Trunk counts (all): **12**
    - Wireline:
    - Wireless:
    - SIP: **8**
    - Administrative: **4**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant

connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP. The results for the **Dickenson County PSAP** are not yet finalized. It is likely that connectivity will be provided directly to the West-hosted Viper cores. If this occurs, it will be shared among all hosted PSAPs in Virginia and will not incur an additional cost.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan that states if the PSAP must be evacuated for any reason call will be routed to the **Wise County PSAP**. The PSAP does not have a plan for if the 9-1-1 network is unavailable and the PSAP can still be occupied.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	**Verizon**	**340,101**	**July 2021 – December 2021**
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Dickenson County PSAP's** deployment window will be **July 2021 – December 2021**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$15,000	i3 licenses and services
CHE Replacement	$0	CHE replacement post deployment
Text-to-911	$0	Already deployed
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$0	

Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Currently using grant funds
Legacy 9-1-1 transition costs	$1,164.00	Verizon costs
Project management assistance	$0	None requested
Total	$21,164.00	

The monthly recurring cost for the AT&T solution is **$4,249.75** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$830.83**. The estimated monthly increase to the PSAP after deployment is approximately **$3,418.92**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$21,164.00
Recurring (over 24 months)	$82,054.08
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Dinwiddie County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Dinwiddie County PSAP** based on the Fairfax County contract with **AT&T**. **Denise Crowder** shall be the primary contacts.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Dinwiddie County PSAP** will need to have i3-capable call handling equipment in place that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **West**
- CHE model: **Viper**
- CHE version number (clients): **Power911 v5.3.144**
- CHE version number (server): **4.1 SP3**
- CHE maintenance provider (channel): **West**
- CHE Geodiversity: **No**
- Number of positions: **6**
- SIP capable: **Yes**

This CHE will require an upgrade to, at a minimum, Viper 5.1 and Power911 6.4 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **May 2023**. This is after the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. Prior to this requirement, **Dinwiddie County** has implemented the direct IP solution for text to 9-1-1. No additional upgrade or change is required with the deployment of NG9-1-1.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system.

However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Caliber**
- CAD software version: **CAD 10.5.3.133**
- CAD interfaces: **Yes**
- Method of data transfer: **Digiport (serial)**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Caliber (integrated with CAD)**
- Dispatch Mapping Software Version: **10.5.3.133**
- Method of data transfer:

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **HigherGround**
- Logging Recorder Model:
- Logging Recorder Software Version: **2.5.2014.909**
- Audio Origination Point: **Both position and trunk based**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board

will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Active911** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY18 – CHE - $150,000**

GIS Data Preparation

GIS Data Sources

Currently, **WorldView Solutions, Inc**. maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Dinwiddie County via Worldview Solutions, Inc.** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **65.0%**
- Address Point – **61.1%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **87.8%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **83.1%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **22**
- Road centerline has right or left side overlapping address range - **45**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **28**
- Address point street name and road centerline street name mismatch - **39**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Dinwiddie County** will need to resolve these issues through use of a contractor, at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **one** ESN for their area of responsibility. **Dinwiddie County via Worldview Solutions, Inc.** maintains an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

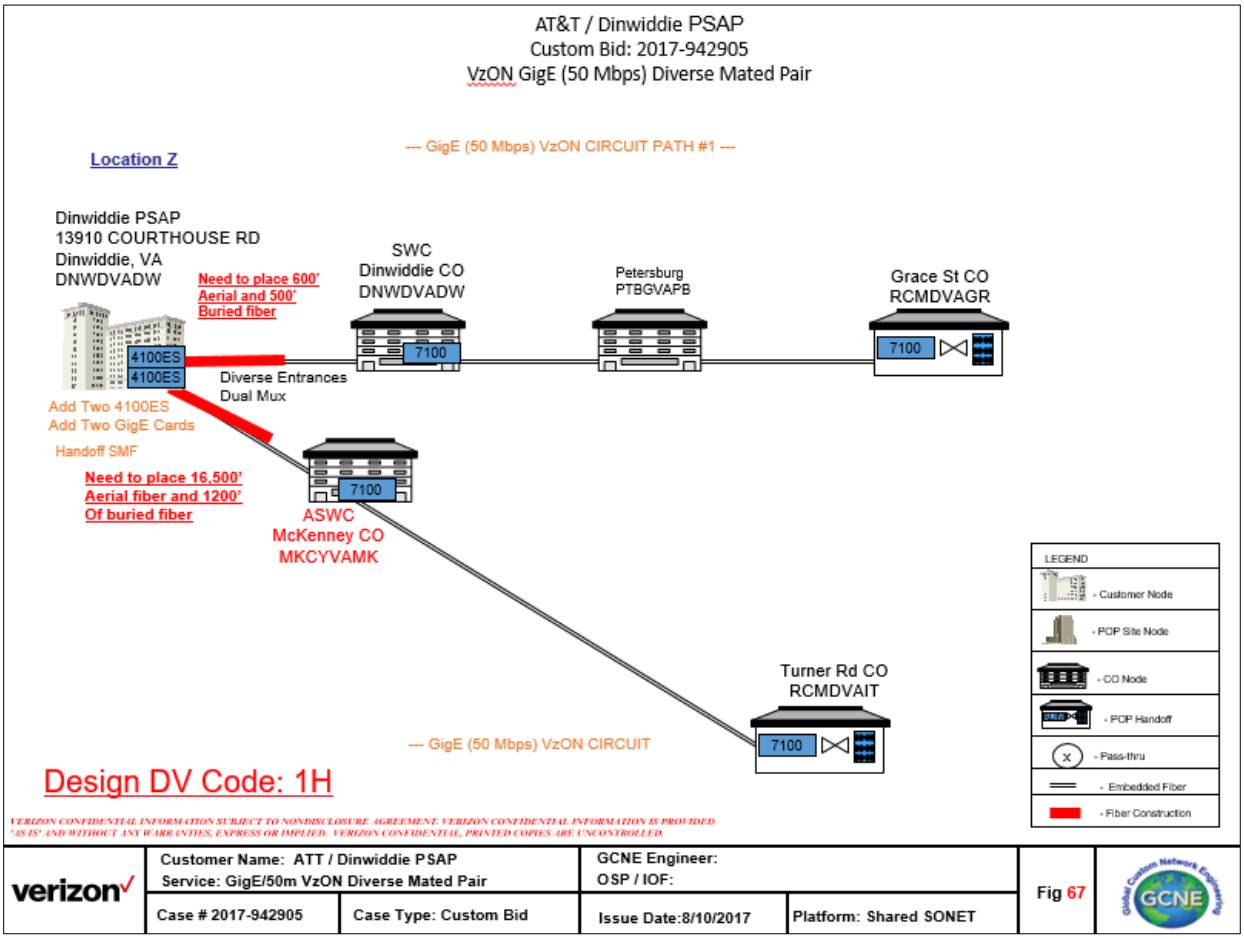
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Chester/Richmond Stuart**
- Trunk counts (all): **12**
    - Wireline: **4**
    - Wireless: **4**
    - SIP:
    - Administrative: **4**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999%

availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Dinwiddie County** PSAP are as follows:



The total cost for this diverse connectivity is $**571,002.94** which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan. If the PSAP must be evacuated for any reason, or if the 9-1-1 network is unavailable calls will be forwarded to the **Prince George County PSAP**.

Based on the current disaster recovery plan, no additional steps need to be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.

- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	**Verizon**	**1,660,182**	**January 2020 – June 2020**
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Dinwiddie County** PSAP's deployment window will be **January 2020 – June 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$15,000	i3 deployment services
CHE replacement	$0	New system in May 2018
Text-to-911	$0	Currently has direct IP text to 911
CAD upgrade	$0	
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	
Diverse connectivity costs	$571,002.94	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$30,000	No internal GIS data maintenance
Legacy 9-1-1 transition costs	$1,746.00	Verizon costs
Project management assistance	$0	None requested
Total	$622,748.94	

The monthly recurring cost for the AT&T solution is **$5,614.67** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$2,266.00**. The estimated monthly increase to the PSAP after deployment is approximately **$3,348.67**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines

approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$622,748.94
Recurring (over 24 months)	$80,368.08
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Eastern Shore
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Eastern Shore PSAP** based on the Fairfax County contract with **AT&T**. **Jeff Flournoy** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Eastern Shore PSAP** will be able to implement the full NENA i3 standard without the need for any interim or transitional steps unless their current call handling equipment cannot be made i3 capable. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at:

https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola CallWorks**
- CHE model: **CallStation WM**
- CHE version number (clients): **4.2.5.4.70248**
- CHE version number (server): **4.2.5.4.70248**
- CHE maintenance provider (channel): **Motorola**
- CHE Geodiversity: **N/A – CHE is hosted**
- Number of positions: **4**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but is in testing on the AT&T network to determine if i3 capable. A legacy PSAP gateway (LPG) may be required if testing is not complete at time of deployment. Once testing is complete and the CHE certified as i3 capable in the AT&T network, then the CHE can be migrated to i3 call routing. There will be no functionality loss during the time of LPG use. The voice call will still be delivered as IP (SIP), but the location data will still be pulled with an ALI dip. It will still use IP to deliver the data, but it follows a different path than the voice.

The PSAP reports plans to replace their CHE in **September 2021**. If their current equipment is not certified by that time, the new CHE must be i3 capable and should be tested to be connected to the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. Prior to this requirement, the PSAP has implemented the TTY solution for text to 9-1-1. While this meets the legislative requirement, the PSAP will be

upgraded to the direct IP solution with the implementation of NG9-1-1. The new CHE version will need to be capable of the text to 9-1-1 direct IP solution.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Superion**
- CAD software version: **OneSolution - OSSI CAD**
- CAD interfaces: **ALI data interface**
- Method of data transfer: **IP**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Superion**
- Dispatch Mapping Software Version: **OneSolution - OSSI CAD**
- Method of data transfer: **IP**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Applied Digital Solutions/Dictaphone/NICE**
- Logging Recorder Model: **NICE Inform**
- Logging Recorder Software Version: **6.0.2.103**
- Audio Origination Point: **Both trunk-based or position-based.**

This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1. It is important to note that while trunk-based recording is possible with NG9-1-1, it will not mirror current functionality. Currently, with analog trunks, trunk-based recording allows the audio to be captured before the call is answered by the call taker and the call is still

in queue. With an IP connection, the audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message).

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS/ECW 911 Decision Station**
- Data Analytics Vendor: **West/ECaTS & Motorola**
- Data Analytics Version: **4.2.7.4.77316**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP and no required upgrades to the Motorola system had been identified.

Outcall Notification Systems

The PSAP currently uses does not have an outcall notification system. If one is put in place, AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has open grants, as of April 1, 2018, as follows with the noted status:

1. **FY18 – 069 - NG9-1-1 GIS**

To ensure the grant funds support the migration to NG9-1-1, the PSAP should, to the extent practical, use funding from the FY18 GIS grant to correct geospatial issues identified in the following section.

GIS Data Preparation

GIS Data Sources

Currently, the **Worldview Solutions, Inc.** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Eastern Shore PSAP** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these

data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

PSAP	Road Centerline (RCL)	Address Point
Accomack County	**82.3%**	**80.1%**
Northampton County	**97.9%**	**96.2%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **95.5%** for Accomack County and **98.6%** for Northampton County. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **96.4%** for Accomack County and **97.4%** for Northampton County. During July 2018, VITA will send each PSAP and GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type

between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.

4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **11**
- Road centerline has right or left side overlapping address range - **146**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **130**
- Address point street name and road centerline street name mismatch - **55**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, the **Eastern Shore PSAP** will need to resolve these issues through internal resources or their GIS consultant at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has 36 ESNs for their area of responsibility. The PSAP maintains an ESN boundary layer depicting these areas so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows. Additionally, the existing FY18 share services GIS grant will be evaluating these processes and will recommend improvements.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate

on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary as long as the current CHE can be upgraded to a version that it i3 capable. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

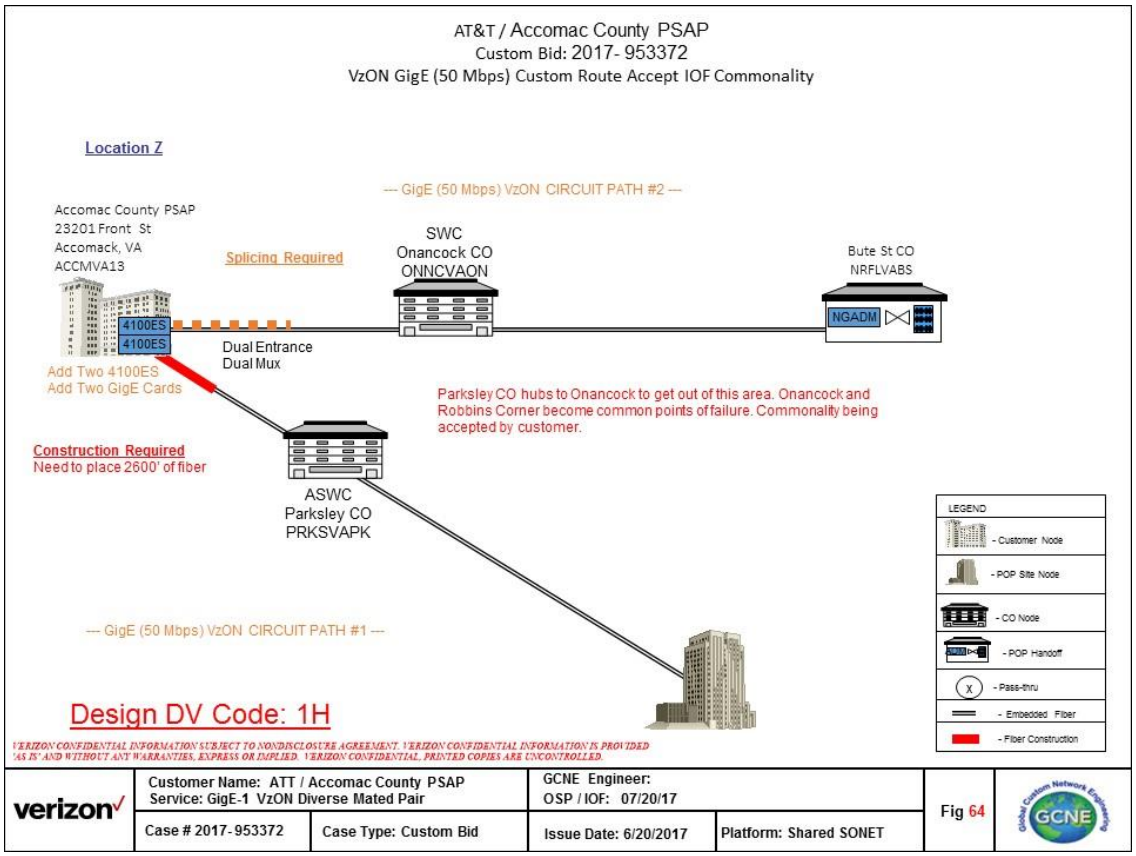
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **High Street/Jefferson Avenue**

- Trunk counts (all): **18**
    - Wireline: **6**
    - Wireless: **4**
    - Administrative: **8**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results are as follows:



The total cost for this diverse connectivity is **$45,475.58**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, the calls all transferred to the **Onancock Volunteer Fire-EMS Station** on 10-digit number. Should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to a 10-digit number within the PSAP.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

The following secondary PSAP(s) have been identified within the service area of the primary PSAP:

- Accomack County Sheriff's Office
- Northampton County Sheriff's Office
- Chincoteague Police Department

Since these PSAP are not connected to the selective routers, they will not be included in the plans for migration to NG9-1-1. Calls transferred to these PSAP will occur in the same manner as they are transferred in the legacy network. The PSAPs may consider expanding the ESInet to these locations, but it would be at their expense. While funding is not available for these PSAPs to connect to the ESInet, cost information can be provided.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established

for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	**Verizon**	**1,662,247**	**July 2019 – December 2019**
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Eastern Shore PSAP's** deployment window will be **July 2019 – December 2019**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least three months before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE replacement	$150,000	CHE replacement in FY2021
CHE upgrade	$15,000	i3 licenses and services
Text to 9-1-1	$15,000	Deploy integrated solution
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Not required
Diverse connectivity costs	$45,475.58	

Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Included in FY18 shared services grant.
Legacy 9-1-1 transition costs	$6,605.70	Verizon costs
Project management assistance	$0	None requested
Total	$237,081.28	

The monthly recurring cost for the AT&T solution is **$7,288.34**, which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$5,833.33**. The estimated monthly increase to the PSAP after deployment is approximately **$1,455.01**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

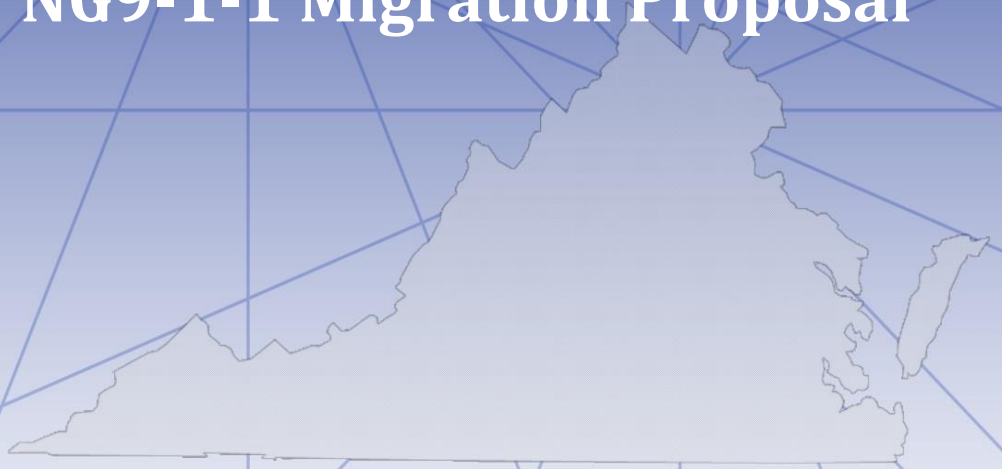
The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$237,081.28
Recurring (over 24 months)	$34,920.24
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

City of Emporia
PSAP/GIS Specific
NG9-1-1 Migration Proposal



February 1, 2019

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for **City of Emporia** based on the Fairfax County contract with **AT&T**. **Todd Anderson** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Emporia PSAP** will be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1

PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at:

https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 9-1-1**
- CHE version number (clients): **7.1**
- CHE version number (server): **7.1**
- CHE maintenance provider (channel): **Radio Communications of Virginia**
- CHE Geodiversity: **No**
- Number of positions: **3**
- SIP capable: **No**

This CHE has been determined to be SIP capable, but will require an upgrade to version 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

Since the CHE was just replaced in **December 2018**, it will not be replaced again until after the NG9-1-1 migration is complete.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is before the new deadline for text to 9-1-1 deployment, they will deploy

it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this on the new CHE will be determined, but will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Superion**
- CAD software version: **OneSolutionCAD**
- CAD interfaces: **ALI data**
- Method of data transfer: **Serial data**

This CAD system, as well as the future system, have been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Superion**
- Dispatch Mapping Software Version: **OneSolutionCAD**
- Method of data transfer: **Through CAD**

This mapping display system, as well as the future system, have been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Equature**
- Logging Recorder Model: **2013**
- Logging Recorder Software Version:
- Audio Origination Point: **Both position and trunk based**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call

to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **West/ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP. Since the PSAP is not currently connected to ECaTS, the new CHE must be connected.

Outcall Notification Systems

The PSAP currently uses **Code Red** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP will have that space after the PSAP expansion project, but additional rack space may be needed if NG9-1-1 migration occurs before the project is completed.

Coordination with Open Grants

The PSAP currently has open grants, as of April 1, 2018, as follows with the noted status:

1. **FY18 – Shared Services CAD grant with Greensville County - $350,000**
2. **FY19 – CHE grant - $150,000**

There are no required changes to the open grants though all new system must be i3 capable. All projects resulting from the grants should be completed well before the migration to NG9-1-1.

GIS Data Preparation

GIS Data Sources

Currently, the **Worldview Solutions** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **City of Emporia, through Worldview Solutions,** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **91.6%**
- Address Point – **91.9%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **97.9%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.3%**. During July 2018, VITA will send each PSAP and GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be

resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.

4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **4**
- Road centerline has right or left side overlapping address range - **6**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **22**
- Address point street name and road centerline street name mismatch - **15**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, the **City of Emporia** will need to resolve these issues through internal resources at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **two ESNs** for their area of responsibility. **City of Emporia** does not maintain an ESN boundary layer depicting this area. This layer will either need to be created or the number of ESNs can be reduced to one which will make the ESN boundary and PSAP boundary the same. They can then be created at the same time. Regardless of which option is selected, once created, they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

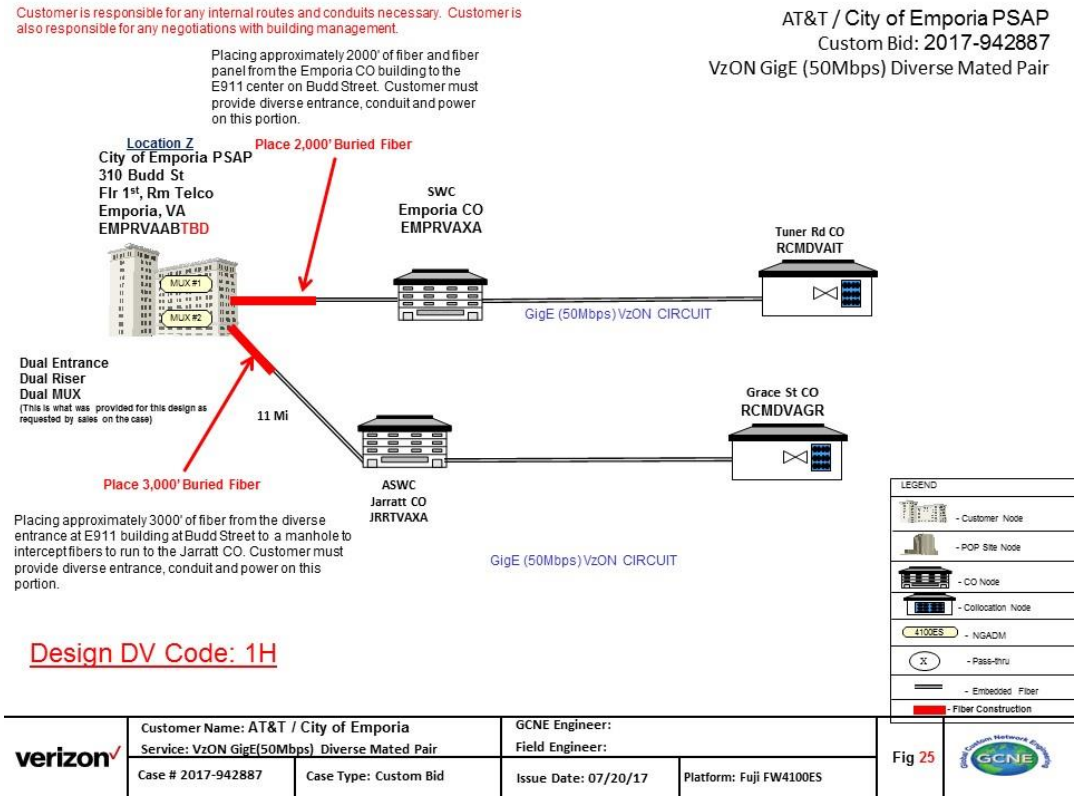
- Legacy E9-1-1 service provider: **Verizon**

- ALI database provider: **Verizon**
- Selective router pair(s): **Stuart/Chester**
- Trunk counts (all): **10**
    - Wireline: **2**
    - Wireless: **4**
    - Administrative: **4**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results are as follows:



The total cost for this diverse connectivity is **$578,252.47**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, the calls all transferred to the **Greensville County PSAP**. Should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to a 10-digit number within the PSAP.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.

- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	**Verizon**	**1,660,182**	**January 2020 – June 2020**

Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Emporia PSAP's** deployment window will be **January 2020 – June 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least three months before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3. The **Emporia PSAP** has expressed a desire to consolidate with the **Greensville County PSAP**. If this is to take place before the migration to NG9-1-1, this move must be completed at least six months prior to the migration date.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided above in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 deployment services
Text to 9-1-1	$30,000	
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Not required
Diverse connectivity costs	$578,252.47	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$30,000	
Legacy 9-1-1 transition costs	$1,251.30	Verizon costs

Project management assistance	$0	None requested
Total	$674,503.77	

The monthly recurring cost for the AT&T solution is **$3,357.88**, which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$1,187.42**. The estimated monthly increase to the PSAP after deployment is approximately **$2,170.46**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$674,503.77
Recurring (over 24 months)	$52,091.04
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Version Log

Version	Date	Change Summary
1.0	11/01/2018	Initial draft created
1.1	02/01/2019	Updated current CHE to reflect equipment upgrade

Commonwealth of Virginia
Next Generation 9-1-1

Essex County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Essex County PSAP** based on the Fairfax County contract with **AT&T**. **Susanne Joy** shall be the primary contacts.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Essex County PSAP** will need to have i3-capable call handling equipment in place that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **6.1**
- CHE version number (server): **6.1**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **2**
- SIP capable: **Yes**

This CHE will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **January 2022**. This is after the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **DaPro (replacing with ID Networks CAD)**
- CAD software version: **IBR Plus**
- CAD interfaces: **Yes**
- Method of data transfer: **Ethernet**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **TCS (will likely be integrated with ID Networks CAD)**
- Dispatch Mapping Software Version: **Unknown**
- Method of data transfer: **On server with CHE**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE (replacing with Eventide NexLog 470 by end of 2018)**
- Logging Recorder Model:
- Logging Recorder Software Version: **7.1.0.175**
- Audio Origination Point: **Trunks**

While the voice logging recorder system does not require any upgrade or modification with the deployment of NG9-1-1, if the PSAP wishes to maintain trunk-based recording, a span port will be provided by AT&T. The recording system may require an upgrade to receive and interpret the IP data. If desired, the cost of this upgrade would be covered by the Board. It is important to note that while this will allow audio to be pulled from the IP talk paths, it will not mirror current functionality. Currently, with analog trunks, trunk-based recording allows the audio to be captured before the call is answered by the call taker and the call is still in queue. With an IP connection, the audio is not present on the circuit

until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). The PSAP can choose to convert to position-based recording and the Board will cover the cost of reconfiguration.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **CodeRed** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has two open grants:

1. **FY18 – NG9-1-1 GIS –Address Validation - $139,920**
2. **FY18 – NG9-1-1 GIS –Shared Services grant participant - $515,728.86**

To ensure the grant funds support the migration to NG9-1-1, the PSAP should, to the extent practical, use funding from the FY18 regional GIS grant to correct geospatial issues identified in the following section.

GIS Data Preparation

GIS Data Sources

Currently, the **Essex County GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Essex County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **94.6%**
- Address Point – **95.0%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **96.2%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.0%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be

resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.

4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **49**
- Road centerline has right or left side overlapping address range - **687**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **3,013**
- Address point street name and road centerline street name mismatch - **37**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Essex County** will need to resolve these issues through internal resources or existing grants, at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **one** ESN for their area of responsibility. **Essex County GIS** maintains an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

Legacy PSAP Gateway - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

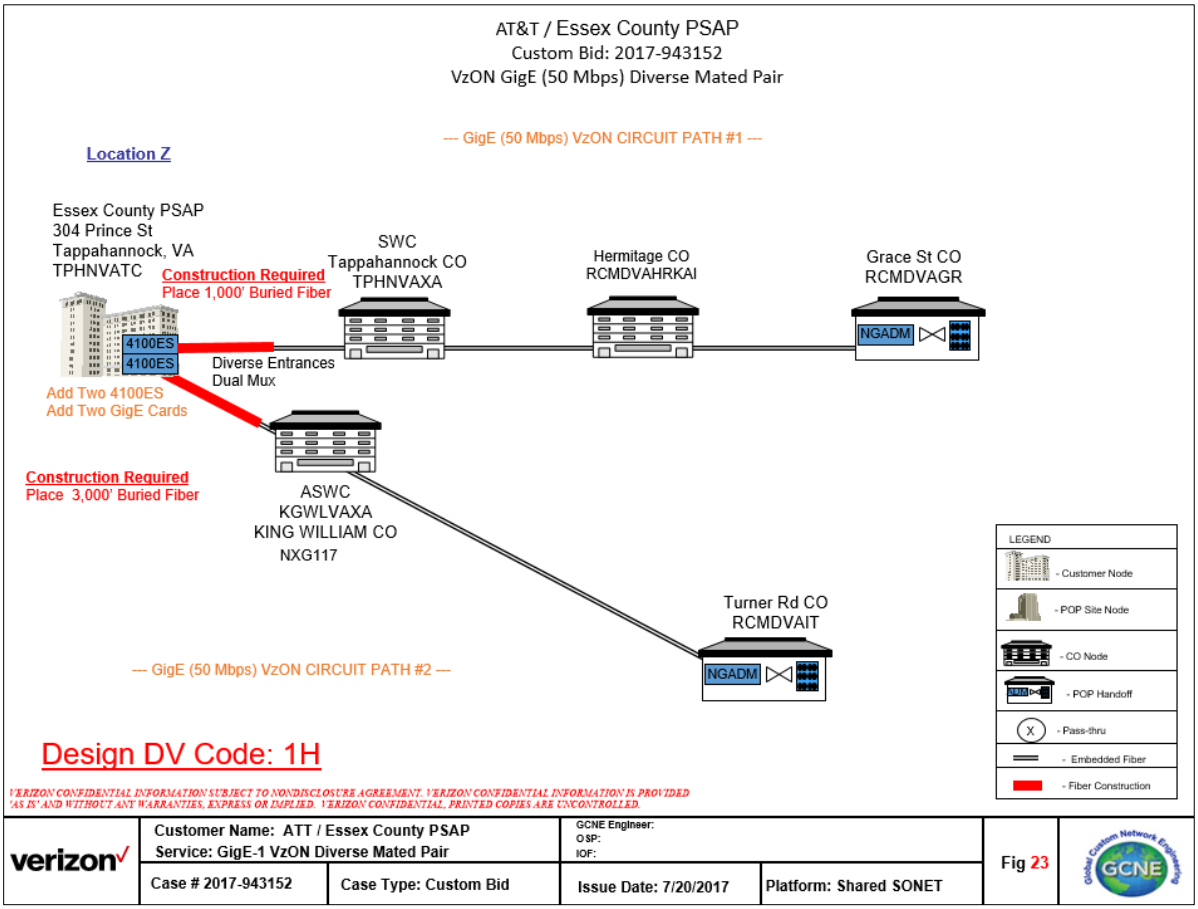
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Chester/Richmond Stuart**
- Trunk counts (all): **9**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **1**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Essex County** PSAP are as follows:



The total cost for this diverse connectivity is **$87,610.78**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a

neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, or if the 9-1-1 network is unavailable and the PSAP can still be occupied, calls are routed to the **Richmond County PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	**Verizon**	**1,660,182**	**January 2020 – June 2020**
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021

Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Essex County PSAP's** deployment window will be **January 2020 – June 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 licenses and services
CHE replacement	$150,000	Replacement planned for FY22
Text-to-911	$30,000	Not currently deployed
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	
Diverse connectivity costs	$87,610.78	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Using existing grants
Legacy 9-1-1 transition costs	$1,047.60	Verizon costs
Project management assistance	$0	To be provided by VITA ISP staff as required
Total	$303,658.38	

The monthly recurring cost for the AT&T solution is **$3,885.95** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$600**. The estimated monthly increase to the PSAP after deployment is approximately **$3,285.95**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$303,658.38
Recurring (over 24 months)	$78,862.80
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Fairfax County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Fairfax County PSAP** based on the Fairfax County contract with **AT&T**. **Steve McMurrer** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Fairfax County** PSAP will need to have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **7.1 SP1**
- CHE version number (server): **7.1 SP1**
- CHE maintenance provider (channel): **GDIT**
- CHE Geodiversity: **Yes (B side at 3911 Woodburn Rd., Annandale)**
- Number of positions: **81 (62 at primary, 19 at backup)**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to version 7.2 to implement the full i3 interface. Fairfax County is expecting to upgrade to version 7.2 in late 2018.

Additionally, the PSAP indicates the planned replacement of their CHE in **January 2022**. Since this is after their planned NG9-1-1 migration, any new CHE will need to be i3 capable and tested on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. **Fairfax County** has deployed direct-IP text to 9-1-1.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense.

Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Intergraph**
- CAD software version: **CAD v9.1.1**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **DDTI**
- Dispatch Mapping Software Version: **Response Assist 3.12.12.17638**
- Method of data transfer: **Serial through Digi-smart box**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **EXACOM**
- Logging Recorder Model:
- Logging Recorder Software Version: **3.0.1.2 Build 11261**
- Audio Origination Point: **Digital – position based IP recording (spanning port)**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **Both ECaTS and Vesta Analytics are used equally**

- Data Analytics Vendor: **ECaTS and Motorola**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP and no required upgrades to the Motorola system had been identified.

Outcall Notification Systems

The PSAP currently uses Everbridge as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP indicates that rack space is available.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY17 – CHE ESInet – shared services host PSAP – $1,225,000**

GIS Data Preparation

GIS Data Sources

Currently, **Fairfax County GIS** maintains all of the county's GIS data for the PSAP. The county GIS department will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments, or jurisdictions within the county may contribute data or manage various processes. It is the responsibility of **Fairfax County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS

data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **93.8%**
- Address Point – **91.0%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **94.0%.** The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **95.9%.** During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **47**
- Road centerline has right or left side overlapping address range - **243**

- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **27**
- Address point Is duplicate, has no street name, or no address number - **0**
- Address point street name and road centerline street name mismatch - **4**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Fairfax County** will need to resolve these issues through internal resources, at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has 36 ESNs for their area of responsibility. **Fairfax County** is in the process of validating their ESN boundary layer depicting this area, so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is

updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

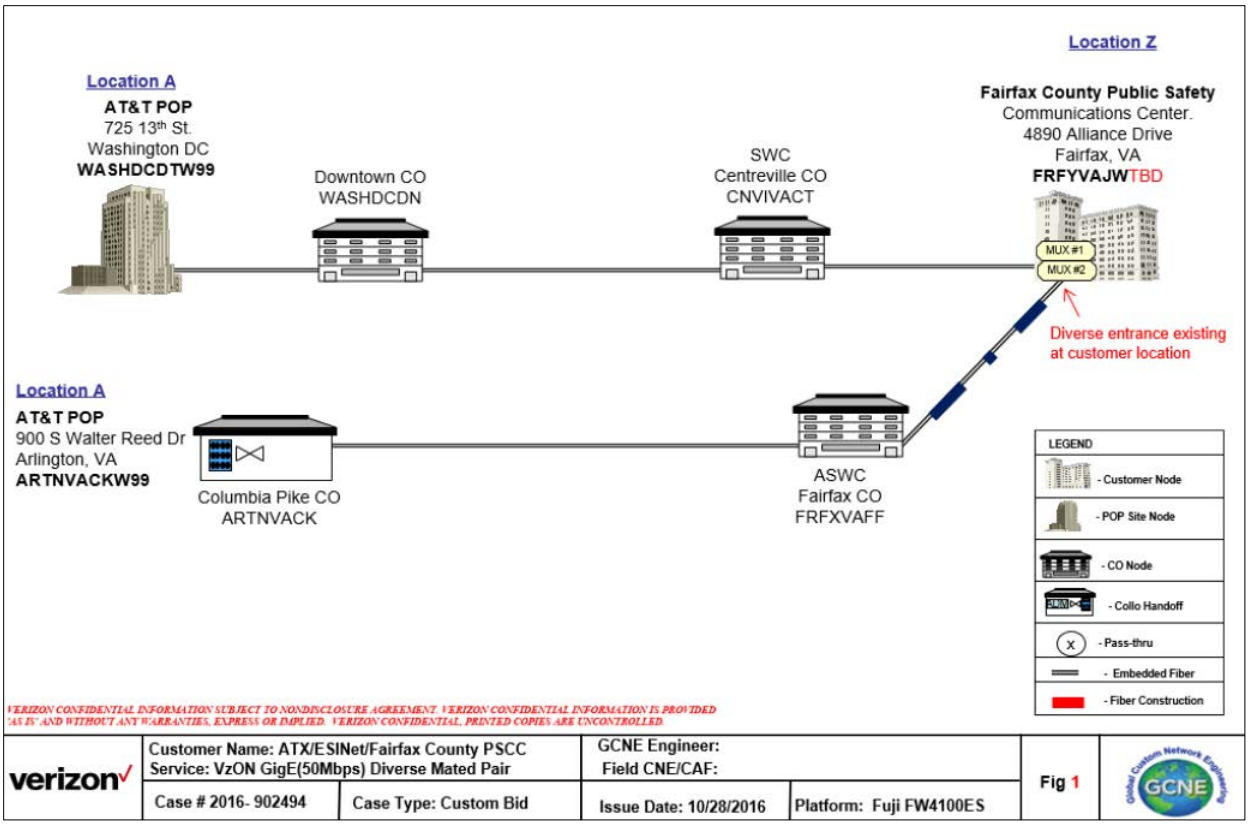
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Alexandria/Fairfax**
- Trunk counts (all): **58**
    - Wireline: **20**
    - Wireless: **28**
    - SIP: **8**
    - Administrative: **2**

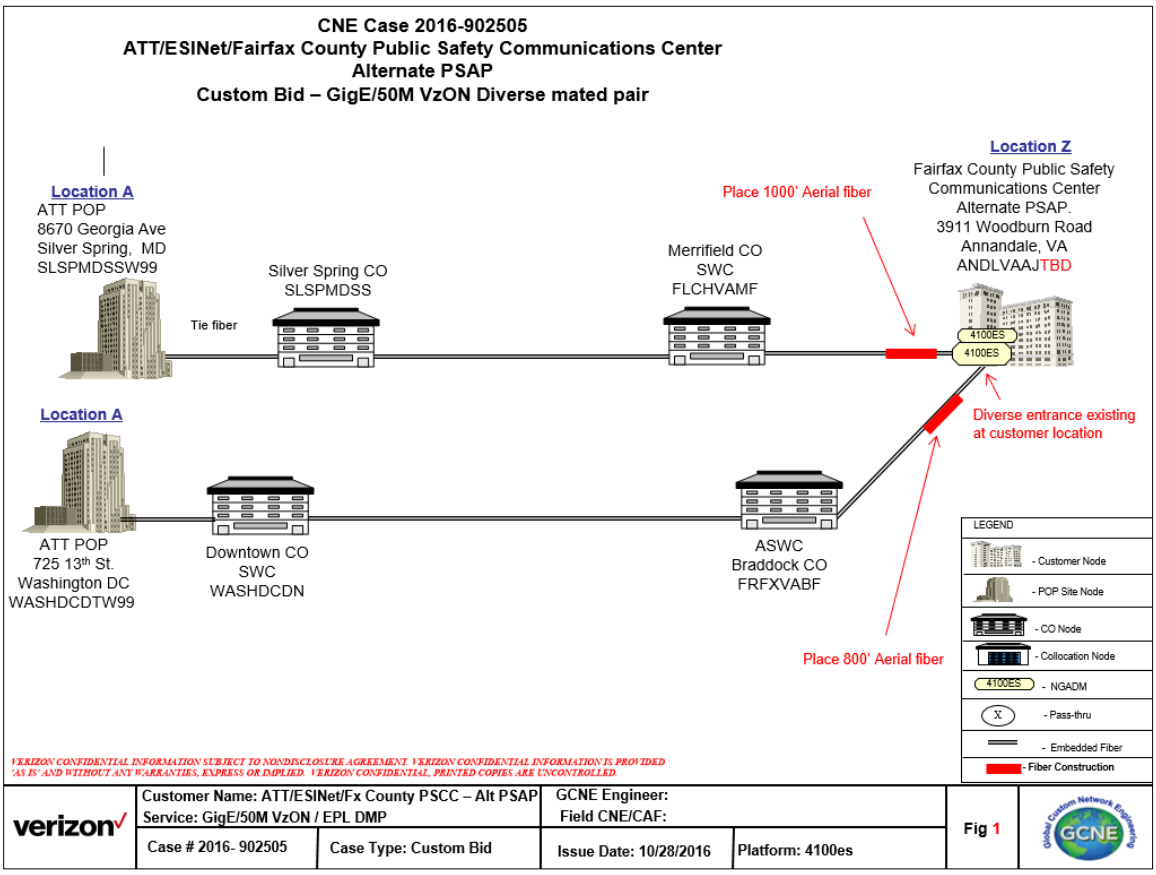
The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the primary location of the **Fairfax County** PSAP are as follows:



AT&T has conducted a diversity study for each PSAP and the results for the backup location of the **Fairfax County** PSAP are as follows:



The total cost for this diverse connectivity is **$27,080** (for both the Alliance Drive and Woodburn Road sites) which has been provided by the Board as part of the NoVA ESInet project grant funding. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason operations move to the **back-up center**. Should just the 9-1-1 network be unavailable and the PSAP can still be occupied calls receive a fast busy signal.

Based on the current disaster recovery plan, no additional steps to be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

The City of Fairfax and towns of Herdon and Vienna have secondary PSAPs and are within the boundary of the **Fairfax County PSAP**. The PSAPs receive transferred calls through **Fairfax County** through the PSAP's CHE as those PSAPs have answering positions on their CHE.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	**Verizon**	**2,494,184**	**January 2019 – June 2019**
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Fairfax County PSAP's** deployment window is **January 2019 – June 2019**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T; covered by grant
CHE upgrade	$30,000	i3 deployment services; covered by grant
CHE replacement	$150,000	Replacement planned for FY22
Text-to-911	$0	Implemented direct-IP solution
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$27,080	Covered by grant

Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$295,074.00	Verizon costs, covered by grant
Project management assistance	$0	None requested
Total	**$507,154.00**	

The monthly recurring cost for the AT&T solution is **$152,297.87** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$100,177.18**. The estimated monthly increase to the PSAP after deployment is approximately **$52,120.69**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	**$507,154.00**
Covered by grant	$356,154.00
Board funding	$151,000.00
Recurring (over 24 months)	**$1,250,896.56**
Data Analytics (monthly)	**$415.12**

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

City of Falls Church
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **City of Falls Church** based on the Fairfax County contract with **AT&T**. **Pilar Uelmen** shall be the primary contact. The Falls Church PSAP has been identified by the Virginia 9-1-1 Services Board as being a secondary PSAP directly connected to a selective router. As a result, they will need to be migrated off the selective routers to the ESInet.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **City of Falls Church PSAP** will be able to implement the full NENA i3 standard without the need for any

interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call

delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at:

https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **VESTA**
- CHE version number (clients): **4.3.1**
- CHE version number (server): **4.3.1**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **Yes (B side at 6950 Little Falls Road, Arlington VA 22213).** PSAP is occupying this location while renovation is ongoing at primary location. Renovation expected to conclude February 2019. May become a node on the shared Arlington and Alexandria CHE.
- Number of positions: **6**
- SIP capable: **No**

This CHE has been determined to be SIP capable, but will require an upgrade to version 7.2 to implement the full i3 interface. The purchase and placement of two firewalls will be necessary to connect to the ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. Text to 9-1-1 messages for **City of Falls Church** will be received by **Arlington County**. No additional changes need to be made.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Superion**
- CAD software version: **OneSolution 17.2.0.2168**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial over IP**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Superion OneSolution (integrated with CAD)**
- Dispatch Mapping Software Version: **17.2.0.2168**
- Method of data transfer: **Serial over IP**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model: **Inform Lite**
- Logging Recorder Software Version: **6.1.0.158**
- Audio Origination Point: **Both trunks and positions**

This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all primary PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. These local

data analytics application may also need to be upgraded to interface with the NG9-1-1 environment. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **Vesta Analytics**
- Data Analytics Vendor: **Motorola**

This system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Outcall Notification Systems

The PSAP currently uses **Everbridge** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is available.

Coordination with Open Grants

The PSAP currently does not have any grants or funding from the Virginia 9-1-1 Services Board.

GIS Data Preparation

GIS Data Sources

Currently, the **City of Falls Church GIS Department** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, this data is then provided to **Arlington County**, who aggregates it with their own data for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment, permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be

resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the Arlington PSAP, which includes GIS data for the City of Falls Church, determined the current match rate to be as follows:

- Road Centerline (RCL) – **95.8%**
- Address Point – **95.9%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **97.4%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.7%**. During July 2018, VITA will send each PSAP and GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed on the **Falls Church** data and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **2**
- Road centerline has right or left side overlapping address range - **4**

- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **69**
- Address point street name and road centerline street name mismatch - **27**

All of these errors will also be included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, the **City of Falls Church GIS Department** will need to resolve these issues through internal resources and working with **Arlington County** at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **one ESN** for their area of responsibility. **Arlington County** GIS maintains an ESN boundary layer depicting this area, which includes the City of Falls Church, so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, it should be possible to implement geospatial routing initially with NG9-1-1, and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

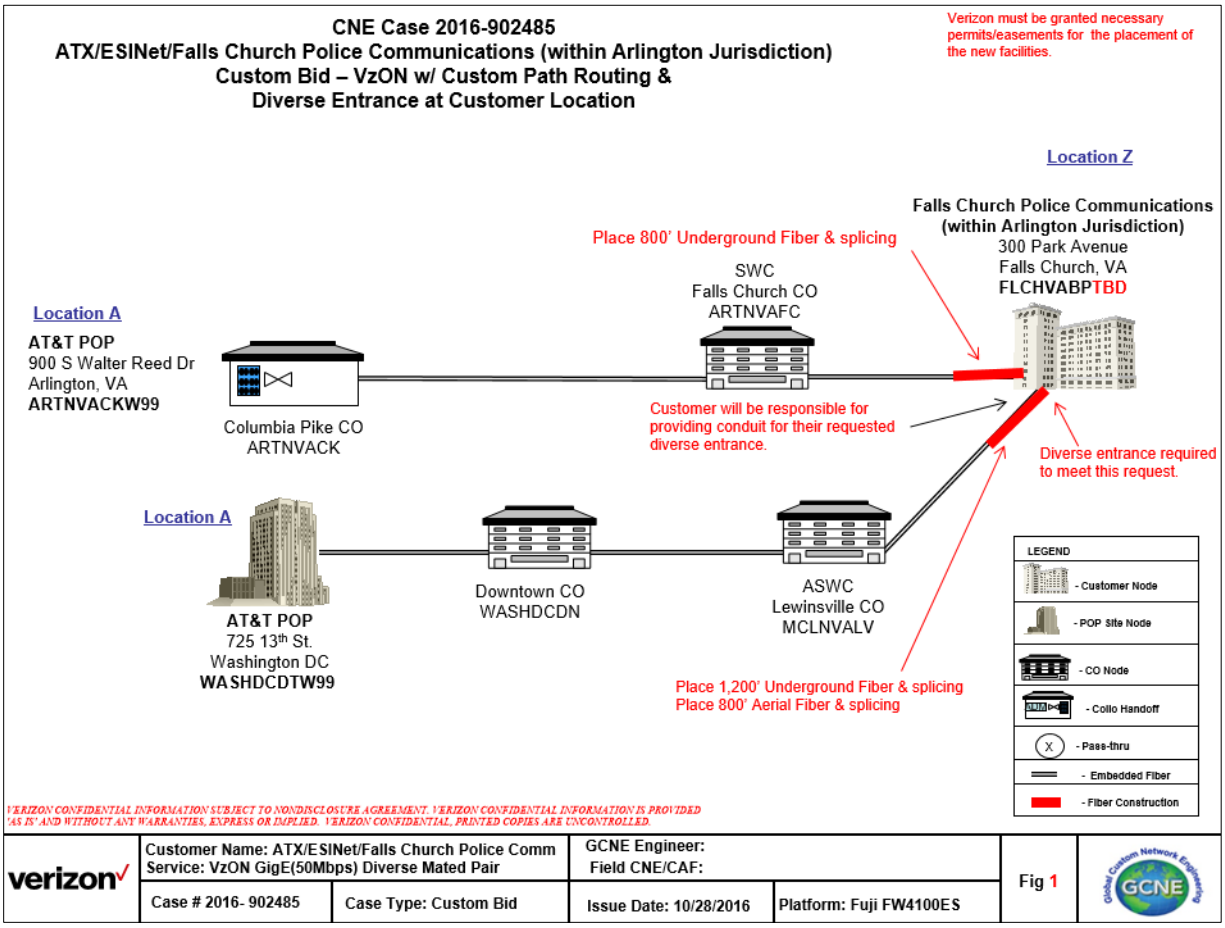
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Alexandria/Fairfax**
- Trunk counts (all): **4**
    - Wireline: **4**
    - Wireless: **0**
    - Administrative: **0**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not

available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Falls Church PSAP** are as follows:



The total cost for this diverse connectivity is **$35,282**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan, which states that if the PSAP must be evacuated for any reason, or should just the network be unavailable and the PSAP can still be occupied calls are rerouted to the **PSAP's side B location**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

The City of Falls Church is a secondary PSAP in the City of Arlington. The PSAP does not receive 9-1-1 calls directly but is connected to the selective router pair so automatic number information (ANI) and automatic location information (ALI) can be accessed by the PSAP when they receive transferred calls.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.

- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	**Verizon**	**2,494,184**	**January 2019 – June 2019**
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Falls Church PSAP's** deployment window is **January 2019 – June 2019**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$0	Not applicable
CHE upgrade	$30,000	Firewalls and professional services
Text to 9-1-1	$0	Not applicable
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$0	Not included for secondary PSAPs
Other system upgrades	$0	Not required
Rack space	$0	Not required
Diverse connectivity costs	$35,282	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$0	None
Project management assistance	$0	None requested
Total	**$65,282.00**	

The monthly recurring cost for the AT&T solution is **$3,313.69,** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$524.76**. The estimated monthly savings to the PSAP after deployment is approximately **$2,788.93**. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount

Non-recurring	**$65,282.00**
Recurring (over 24 months)	**$66,934.32**
Data Analytics (monthly)	**$0**

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

City of Farmville
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Farmville PSAP** based on the Fairfax County contract with **AT&T**. **Jackie Gilbert** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Farmville PSAP** will need to upgrade their current call handling equipment system or have in place an i3 capable CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Sentinel Patriot**
- CHE version number (clients): **Sentinel 3.3**
- CHE version number (server): **Patriot 3.3**
- CHE maintenance provider (channel): **Century Link**
- CHE Geodiversity: **No**
- Number of positions: **5**
- SIP capable: **Yes**

This CHE has been determined to not be SIP capable, and will require an upgrade to an i3 capable system to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **February 2019**. This is before their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **DaPro (replacing with Zuercher CAD by 12/2018)**
- CAD software version: **IBR Plus 5.3.1**
- CAD interfaces: **Not currently but will be with new CAD**
- Method of data transfer: **None**

The PSAP currently has a grant to replace this CAD system. It is the responsibility of the PSAP to determine any upgrade or modification the new system may need with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **GeoComm**
- Dispatch Mapping Software Version: **GeoLynx v8.18.2**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Versadial Solutions**
- Logging Recorder Model: **VS Logger**
- Logging Recorder Software Version: **4.7.0.1**
- Audio Origination Point: **Positions and trunks**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS and Aurora**
- Data Analytics Vendor: **ECaTS and Motorola**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **CodeRed** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP indicates that this space may be available.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY19 – CAD - $75,000**

GIS Data Preparation

GIS Data Sources

Currently, **Town of Farmville GIS, Timmons Group (for Prince Edward County), and Cumberland County** maintain all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Town of Farmville GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be

available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP (including Town of Farmville and Prince Edward County GIS data) determined the current match rate to be as follows:

- Road Centerline (RCL) – **95.6%**
- Address Point – **95.8%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **96.7%.** The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.3%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when

routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges – **0**
- Road centerline has right or left side overlapping address range – **1**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard – **0**
- Address point Is duplicate, has no street name, or no address number – **0**
- Address point street name and road centerline street name mismatch – **6**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Town of Farmville and Prince Edward County** will need to resolve these issues through internal resources, at least three months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **15 ESNs** for their area of responsibility. **Town of Farmville GIS** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a

separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

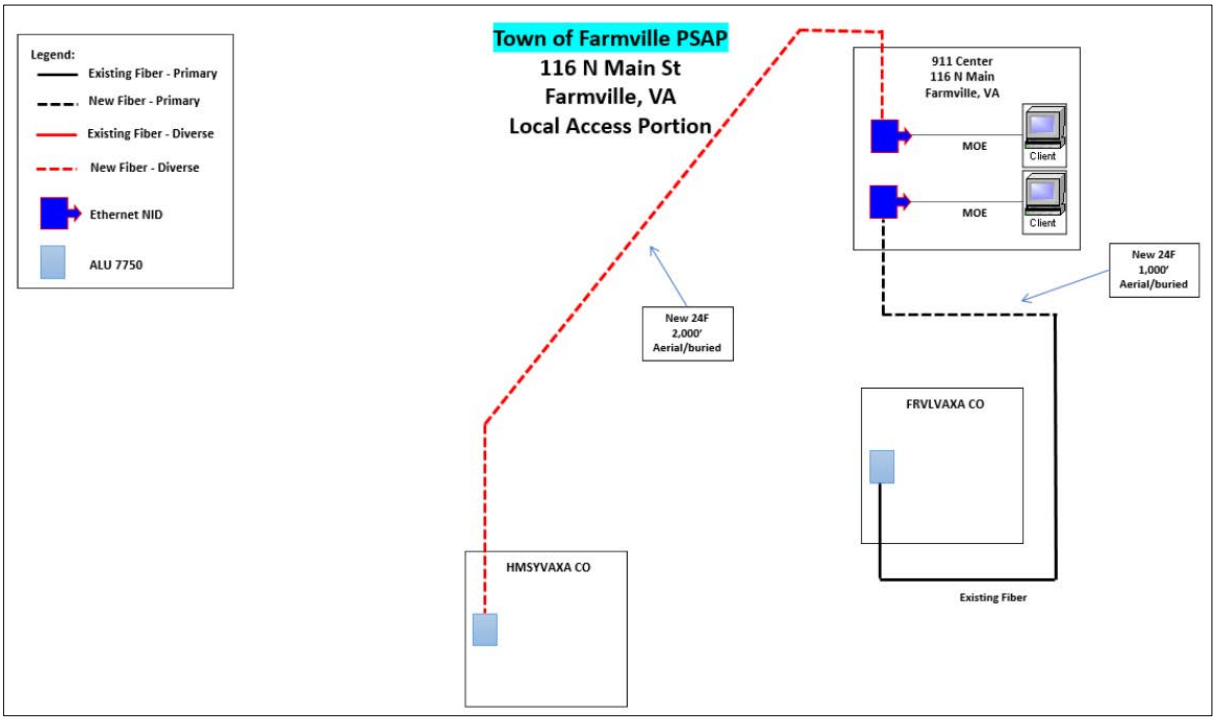
- Legacy E9-1-1 service provider: **CenturyLink**
- ALI database provider: **CenturyLink**
- Selective router pair(s): **Charlottesville/Farmville**
- Trunk counts (all): **13**
    - Wireline: **6**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **3**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999%

availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Town of Farmville** PSAP are as follows:



The total cost for this diverse connectivity is **$98,000**, which will be provided by the Board as part of the PSAP's funding submission. Also, there is a one-time $82,000 charge for all CenturyLink sites. That cost will be provided by the Board as part of the first PSAP's funding submission that choses the AT&T solution. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason or should just the network be unavailable and the PSAP can still be occupied, incoming calls are rerouted to either the **Buckingham or Nottoway County PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this

migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

The **Prince Edward County Sheriff's Office** is a secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.

- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	**CenturyLink**	**403,369**	**July 2020 – December 2020**
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Farmville PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE replacement	$150,000	Replacement in FY19
CHE upgrade	$30,000	i3 deployment services
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$98,000	+$82,000 if first CenturyLink PSAP
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$3,433.80	CenturyLink costs
Project management assistance	$0	None requested
Total	$316,433.80	

The monthly recurring cost for the AT&T solution is **$5,156.79** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$3,014.00**. The estimated monthly increase to the PSAP after deployment is approximately **$2,142.79**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines

approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$316,433.80
Recurring (over 24 months)	$51,426.96
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Fauquier County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Fauquier County PSAP** based on the Fairfax County contract with **AT&T**. **Joell Kight** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Fauquier County** PSAP will need to have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta**
- CHE version number (clients): **6.1.1**
- CHE version number (server): **6.1.1**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **7**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to version 7.2 to implement the full i3 interface. This upgrade from version 6.1 should be at no cost, but will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the integrated solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP reports plans to replace their CHE in **January 2019**. If their current equipment is not certified by that time, the new CHE must be i3 capable and should be tested to be connected to the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Sungard OSSI**
- CAD software version: **One Solution 17.4.0.1**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Sungard OSSI (integrated with CAD)**
- Dispatch Mapping Software Version: **17.4.0.1**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Voice Print International (VPI)**
- Logging Recorder Model:
- Logging Recorder Software Version: **6.0**
- Audio Origination Point: **Both trunks and positions**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **Both ECaTS and Vesta Analytics**
- Data Analytics Vendor: **ECaTS and Motorola**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP and no required upgrades to the Motorola system had been identified.

Outcall Notification Systems

The PSAP currently uses Everbridge as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP indicates that rack space is available.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY17 – CHE ESInet – shared services participating PSAP – $1,225,000**

GIS Data Preparation

GIS Data Sources

Currently, **Fauquier County GIS** maintains all of the GIS data for the PSAP. The county GIS department will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments, may contribute data or manage various processes. It is the responsibility of **Fauquier County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be

available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **99.3%**
- Address Point – **98.4%**

Fauquier County already meets both goals. If they desire a higher match rate, there are differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.6%.** The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.8%.** During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **26**
- Road centerline has right or left side overlapping address range - **32**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **25**
- Address point Is duplicate, has no street name, or no address number - **166**
- Address point street name and road centerline street name mismatch - **74**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Fauquier County** will need to resolve these issues through internal resources, at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has 1 ESN for their area of responsibility. Since **Fauquier County** maintains an ESN boundary layer, they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI

lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

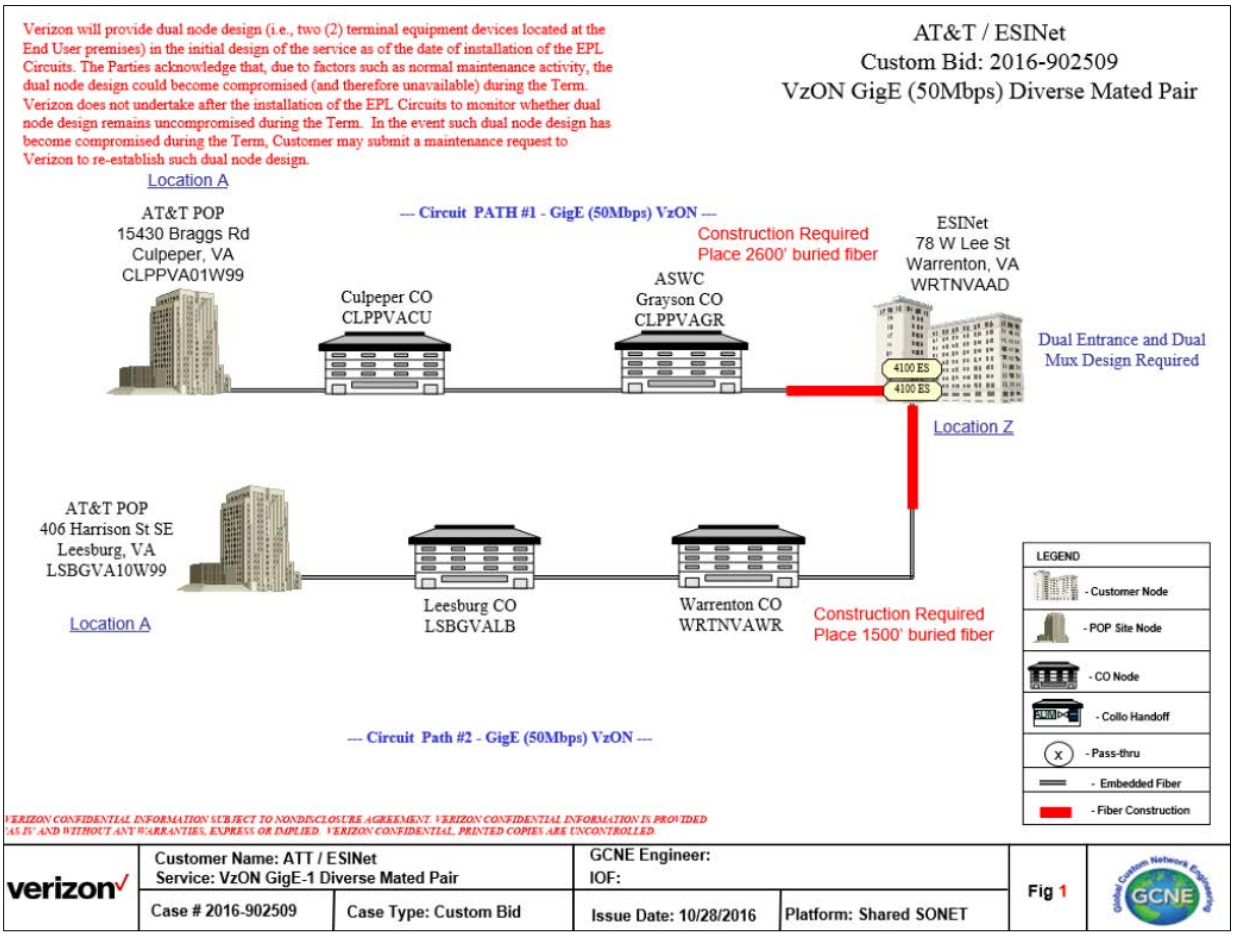
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Alexandria/Fairfax**
- Trunk counts (all): **22**
    - Wireline: **6**
    - Wireless: **6**
    - SIP: **0**
    - Administrative: **10**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast

busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the primary location of the **Fauquier County** PSAP are as follows:



The total cost for diverse connectivity is **$99,519** which has been provided by the Board as part of the NoVA ESInet project grant funding. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason or should just the 9-1-1 network be unavailable and the PSAP can still be occupied calls will roll over to a **ten-digit administrative line**.

Based on the current disaster recovery plan, no additional steps to be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than

supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	**Verizon**	**2,494,184**	**January 2019 – June 2019**
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021

Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Fauquier County PSAP's** deployment window is **January 2019 – June 2019**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T; covered by grant
CHE upgrade	$30,000	i3 deployment services; covered by grant
CHE replacement	$150,000	Replacement planned for FY2019
Text-to-911	$30,000	Implement direct-IP with migration
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$99,519	Covered by grant
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$8,526.30	Covered by grant
Project management assistance	$0	None requested
Total	$323,045.30	

The monthly recurring cost for the AT&T solution is **$9,107.93** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$3,313.92**. The estimated monthly increase to the PSAP after deployment is approximately **$5,857.01**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	**$323,045.30**
Covered by grant	$142,045.30
Board funding	$181,000.00
Recurring (over 24 months)	**$140,568.24**
Data Analytics (monthly)	**$415.12**

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Floyd County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Floyd County PSAP** based on the Fairfax County contract with **AT&T**. **Kevin Sowers** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Floyd County PSAP** will need to upgrade their current call handling equipment system or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola (upgrading to West VIPER in next 6 months)**
- CHE model: **Sentinel Patriot**
- CHE version number (clients): **Sentinel 3.3**
- CHE version number (server): **Patriot 3.3**
- CHE maintenance provider (channel): **Century Link**
- CHE Geodiversity: **No**
- Number of positions: **5**
- SIP capable: **Yes**

The PSAP has indicated that they will be replacing the current system with West's VIPER CHE within the next 6 months. This purchase should include all components necessary to interface, with i3 functionality, to the AT&T ESInet. The PSAP has an existing FY2019 PSAP grant for this upgrade.

The PSAP indicates the planned replacement of their CHE in **December 2018**. This is before their planned NG9-1-1 migration. Grant funding is being utilized to acquire a new system which will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Southern Software**
- CAD software version: **17.4233.17**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **GeoComm**
- Dispatch Mapping Software Version: **GeoLynx v8.2**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Eventide**
- Logging Recorder Model: **NexLog 740**
- Logging Recorder Software Version: **2.6.1**
- Audio Origination Point: **Positions and trunks**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Everbridge** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is available.

Coordination with Open Grants

The PSAP currently has two open grants:

1. **FY18 – CAD - $150,000**
2. **FY19 – CHE - $150,000**

GIS Data Preparation

GIS Data Sources

Currently, **Floyd County GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Floyd County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be

available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **94.3%**
- Address Point – **93.3%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.1%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **99.5%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in

two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **36**
- Road centerline has right or left side overlapping address range - **1**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **8**
- Address point Is duplicate, has no street name, or no address number - **30**
- Address point street name and road centerline street name mismatch - **151**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Floyd County GIS** will need to resolve these issues through internal resources at least three months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **13 ESNs** for their area of responsibility. **Floyd County** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to

as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to

the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Citizens**
- ALI database provider: **Citizens**
- Selective router pair(s): **None**
- Trunk counts (all): **15**
    - Wireline: **8**
    - Wireless: **2**
    - SIP: **0**
    - Administrative: **5**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999%

availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP. Unfortunately, the results for the **Floyd County PSAP** are that diversity is not currently available. Redundant connectivity will instead be provided. If a diversity option becomes available in the future, the funding for such a solution could be provided by the Board as part of the PSAP's funding submission.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason or should just the network be unavailable and the PSAP can still be occupied, incoming calls are routed to the **Montgomery County PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	**Citizens**	**15,651**	**January 2021 – June 2021**
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Floyd County PSAP's** deployment window will be **January 2021 – June 2021**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$15,000	i3 deployment services
Text-to-911	$15,000	Firewalls and professional services
CAD upgrade	$0	Currently utilizing grant funds
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$0	No diversity offered; need single path
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required

Legacy 9-1-1 transition costs	$2,240.70	Verizon costs
Project management assistance	$0	None requested
Total	$37,240.70	

The monthly recurring cost for the AT&T solution is **$4,279.32** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$437.67**. The estimated monthly increase to the PSAP after deployment is approximately **$3,841.65**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$37,240.70
Recurring (over 24 months)	$92,199.60
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Fluvanna County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Fluvanna County PSAP** based on the Fairfax County contract with **AT&T**. **Michael Grandstaff** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Fluvanna County PSAP** will need to upgrade their current Vesta 911 software or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **6.1**
- CHE version number (server): **6.1**
- CHE maintenance provider (channel): **Century Link**
- CHE Geodiversity: **No**
- Number of positions: **4**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **2018**; therefore, funding for this will be available to the PSAP in fiscal year 2019. This is before their planned NG9-1-1 migration so any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Spillman Flex (will be Motorola Flex after 1/2019)**
- CAD software version: **2018.1.14.972**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial to IP**

The PSAP has recently upgraded their CAD system. It is the responsibility of the PSAP to determine any upgrades or modifications the new system may need with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **GeoComm**
- Dispatch Mapping Software Version: **GeoLynx v8.10.0**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model: **Inform**
- Logging Recorder Software Version: **6.1**
- Audio Origination Point: **Trunks**

While the voice logging recorder system does not require any upgrade or modification with the deployment of NG9-1-1, if the PSAP wishes to maintain trunk-based recording, a span port will be provided by AT&T. The recording system may require an upgrade to receive and interpret the IP data. If desired, the cost of this upgrade would be covered by the Board. It is important to note that while this will allow audio to be pulled from the IP talk paths, it will not mirror current functionality. Currently, with analog trunks, trunk-based recording allows the audio to be captured before the call is answered by the call taker and the call is still in queue. With an IP connection, the audio is not present on the circuit

until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). The PSAP can choose to convert to position-based recording and the Board will cover the cost of reconfiguration.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Everbridge** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is available.

Coordination with Open Grants

The PSAP currently has no open grants.

GIS Data Preparation

GIS Data Sources

Currently, **GeoComm** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **Fluvanna County Planner** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against

the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **98.6%**
- Address Point – **96.9%**

Fluvanna County already meets the RCL goal. If they desire a greater match rate, there are some differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.1%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **97.6%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **2**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **14**
- Address point street name and road centerline street name mismatch - **5**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Fluvanna County** will need to resolve these issues through external resources, at least three months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has an unknown number of **ESNs** for their area of responsibility. **Fluvanna County** may not have an ESN boundary layer depicting this area. If they do it will be used to generate a GIS data based MSAG with the transition to

NG9-1-1. If they do not, and since this layer is the same as the PSAP boundary layer it will be created at the same time. Once it is, they can utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI

lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

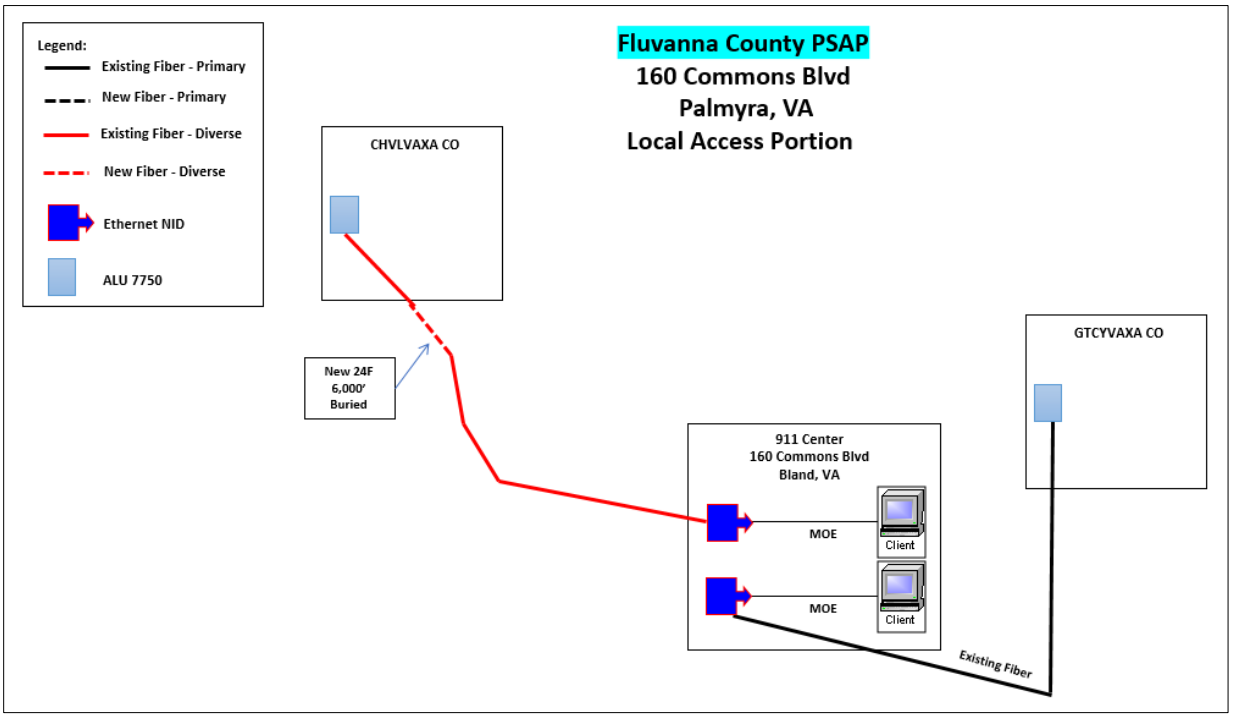
- Legacy E9-1-1 service provider: **CenturyLink**
- ALI database provider: **CenturyLink**
- Selective router pair(s): **Charlottesville/Farmville**
- Trunk counts (all): **14**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **6**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast

busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Fluvanna County** PSAP are as follows:



The total cost for this diverse connectivity is **$26,000**, which will be provided by the Board as part of the PSAP's funding submission. Also, there is a one-time $82,000 charge for all CenturyLink sites. That cost will be provided by the Board as part of the first PSAP's funding submission that choses the AT&T solution. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason, or should just the network be unavailable and the PSAP can still be occupied, incoming calls are rerouted to a **10-digit administrative line**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	**CenturyLink**	**403,369**	**July 2020 – December 2020**
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Fluvanna County PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not

completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE replacement	$150,000	Replacement in FY19
CHE upgrade	$30,000	i3 deployment services
Text-to-911	$30,000	Firewalls and professional services
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$26,000	+$82,000 if first CenturyLink PSAP
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$3,812.10	CenturyLink costs
Project management assistance	$0	None requested
Total	$244,812.10	

The monthly recurring cost for the AT&T solution is **$5,562.49** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$1,665.00**. The estimated monthly increase to the PSAP after deployment is approximately **$3,897.49**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$244,812.10
Recurring (over 24 months)	$93,539.76
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia

City of Franklin
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **City of Franklin PSAP** based on the Fairfax County contract with **AT&T**. **Bruce Edwards** shall be the primary contacts.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **City of Franklin PSAP** will need to have i3-capable call handling equipment in place that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **6.1**
- CHE version number (server): **6.1**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **3**
- SIP capable: **Yes**

This CHE will need to be upgraded to Vesta 7.2 to implement the full i3 interface. This may require the purchase of firewall(s) to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **July 2019**. This is during the planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP has not yet deployed text to 9-1-1. Since their deployment for NG9-1-1 is scheduled before the new deadline for text to 9-1-1 deployment, they will deploy it with NG9-1-1 as a direct IP service integrated with their CHE. The cost to implement this on the new CHE will be covered by the Board.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Southern Software**
- CAD software version: **16.1.1.226**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Southern Software (integrated with CAD)**
- Dispatch Mapping Software Version: **MDS Map Viewer v2.105.3**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Equature**
- Logging Recorder Model:
- Logging Recorder Software Version: **1.73.1**
- Audio Origination Point: **Both trunk based and position based**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

Outcall Notification Systems

The PSAP currently uses **CodeRed** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has one open grant:

1. **FY18 – NG9-1-1 GIS - $138,080**

GIS Data Preparation

GIS Data Sources

Currently, **Worldview Solutions** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of the **City of Franklin PSAP** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **98.1%**
- Address Point – **96%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **98.9%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.1%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no

duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **4**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **24**
- Address point street name and road centerline street name mismatch - **0**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, the **City of Franklin** will need to resolve these issues through internal resources or assistance from VITA-ISP and/or a contractor at least 3 months prior to the targeted deployment date.

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Edge-matching conformance addresses boundaries between GIS sources within a PSAP and between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. GIS features need to meet at the agreed upon boundary for geometric continuity and attribute consistency.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is the end-state goal for full i3 implementation since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **one** ESN for their area of responsibility. **City of Franklin** maintains an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to

as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing GIS data to the AT&T Spatial Interface. Localities wishing to use existing internal tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to review and resolve error and discrepancy reports within the timeframe required by AT&T and periodically provide updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important localities document GIS data maintenance workflows to ensure maintenance activities engage all responsible entities. It is equally important to ensure GIS maintenance workflows and procedures are updated to be compatible with discrepancy management required to support NG9-1-1. NG9-1-1 will introduce additional maintenance issues such as periodically reviewing conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or

firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

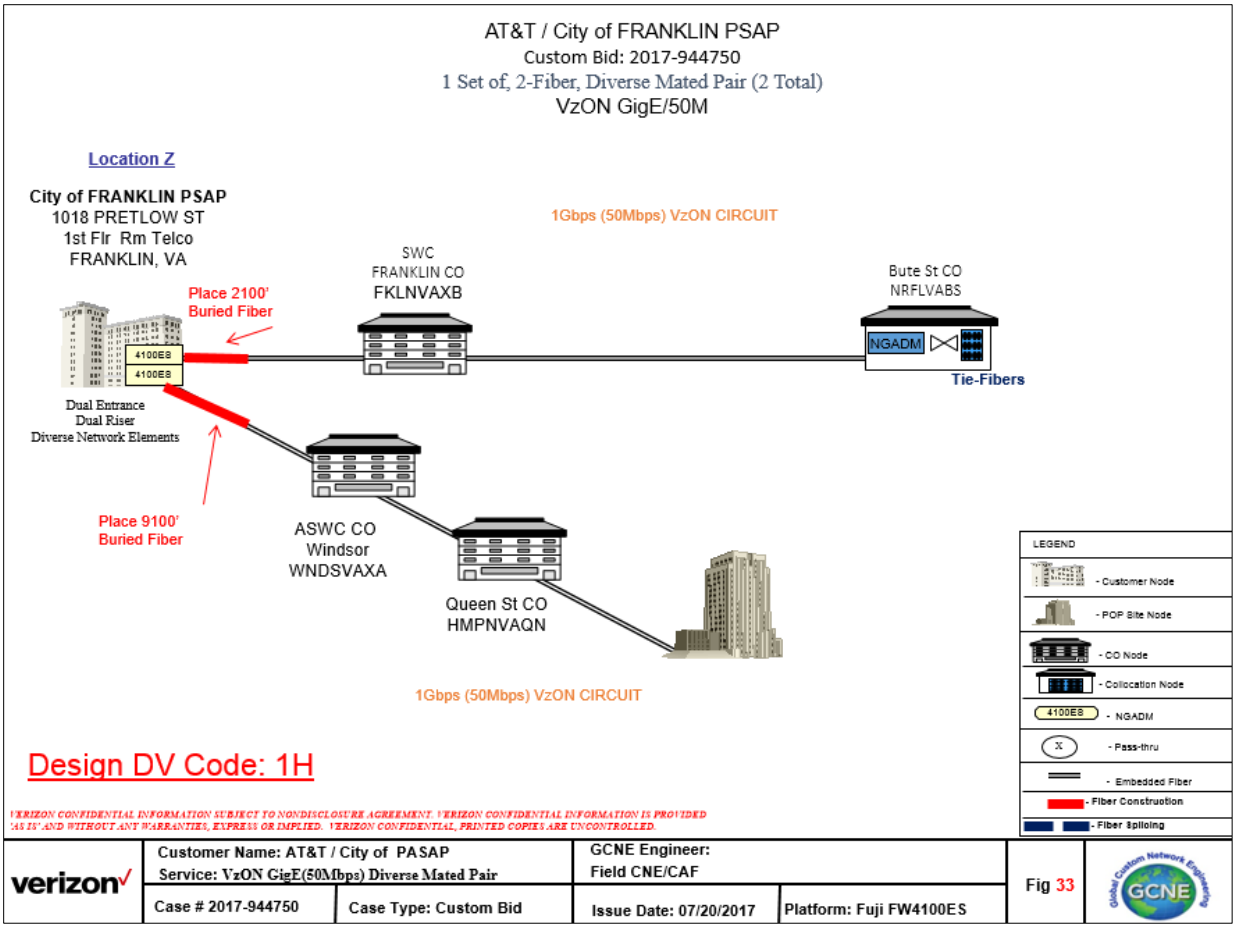
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Jefferson Avenue/High Street**
- Trunk counts (all): **15**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **7**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections,

but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **City of Franklin** PSAP are as follows:



The total cost for this diverse connectivity is $**183,679.08** which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan. If the PSAP must be evacuated for any reason, calls are rerouted the **Southampton County PSAP**. If the 9-1-1 network is unavailable, calls receive a fast busy signal.

Based on the current disaster recovery plan, no additional steps need to be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DDoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	**Verizon**	**1,662,247**	**July 2019 – December 2019**
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **City of Franklin** PSAP's deployment window will be **July 2019 – December 2019**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not

completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 licenses and services
CHE replacement	$150,000	Planned replacement in FY2019
Text-to-911	$30,000	Not deployed
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	
Diverse connectivity costs	$183,679.08	69K feet of fiber
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Currently utilizing grant funds
Legacy 9-1-1 transition costs	$1,542.30	Verizon costs
Project management assistance	$0	None requested
Total	$400,221.38	

The monthly recurring cost for the AT&T solution is **$3,629.16** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$791.39**. The estimated monthly increase to the PSAP after deployment is approximately **$2,837.77**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$400,221.38
Recurring (over 24 months)	$68,106.48
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Franklin County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Franklin County PSAP** based on the Fairfax County contract with **AT&T**. **Peggy Foley** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Franklin County PSAP** currently has in place an i3 functional CHE that has been approved on the AT&T ESInet™ and will be able to implement the full NENA i3 standard without the need for any interim or transitional steps. It is recommended that they upgrade their client software to Power 911 v6.4. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **West**
- CHE model: **Viper**
- CHE version number (clients): **Power911 v6.1**
- CHE version number (server): **Viper 5.1**
- CHE maintenance provider (channel): **Century Link**
- CHE Geodiversity: **No**
- Number of positions: **6**
- SIP capable: **Yes**

This CHE should be able to utilize the full i3 interface of the AT&T ESInet; however, it is recommended that they upgrade their software to the most current release. Since the PSAP has deployed text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, the necessary firewalls are already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **January 2021** and to have a shared system with the Patrick County and Martinsville-Henry PSAPs. This is after their planned NG9-1-1 migration. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The **Franklin County PSAP** has deployed direct-IP text to 9-1-1 and therefore meets this legislative requirement.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system.

However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Southern Software**
- CAD software version: **14.2.2.218**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Southern Software**
- Dispatch Mapping Software Version: **MDS Map Viewer v2.102.5.0**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model:
- Logging Recorder Software Version: **6.1.0.158**
- Audio Origination Point: **Positions**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board

will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **CodeRed** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently available.

Coordination with Open Grants

The PSAP currently does not have open grants.

GIS Data Preparation

GIS Data Sources

Currently, **Franklin County GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **Franklin County** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be

resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **99.7%**
- Address Point – **90.0%**

Franklin County already meets the goal for RCL. If they desire a greater match rate, there are some differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **99.8%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **98.3%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **164**

- Road centerline has right or left side overlapping address range - **54**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **4**
- Address point Is duplicate, has no street name, or no address number - **80**
- Address point street name and road centerline street name mismatch - **113**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Franklin County** will need to resolve these issues through internal resources, at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **80 ESNs** for their area of responsibility. **Franklin County** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

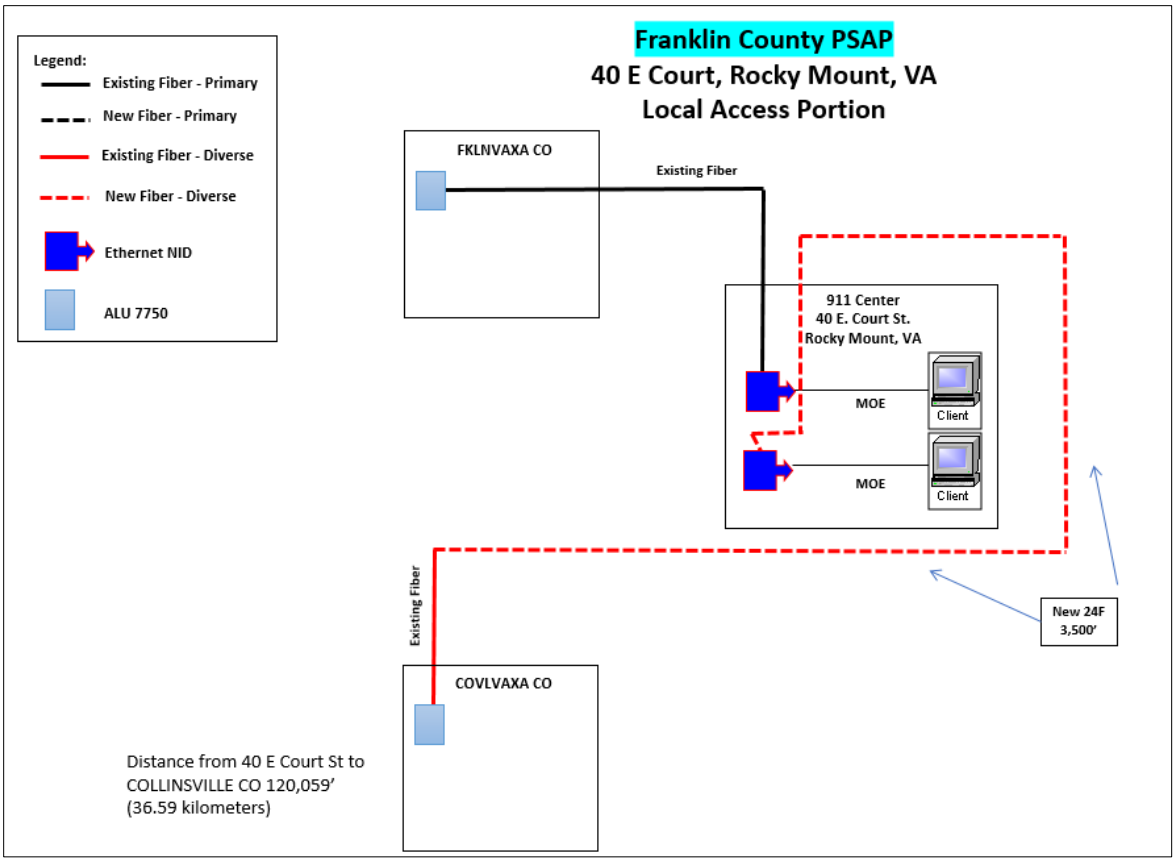
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **West**
- ALI database provider: **West**
- Selective router pair(s): **Johnson City/Wytheville**
- Trunk counts (all): **18**
    - Wireline: **7**
    - Wireless: **7**
    - SIP:
    - Administrative: **4**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP. The results for the **Franklin County PSAP** are as follows:



The total cost for this diverse connectivity is **$8,000;** plus, there is a one-time **$82,000** charge for all CenturyLink sites**.** That cost will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan that states if the PSAP must be evacuated for any reason calls will receive a fast busy signal. The PSAP does not have a plan for if the center can still be occupied but the 9-1-1 network is unavailable.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a

neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.

- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	Verizon	343,031	July 2020 – December 2020
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	**CenturyLink**	**338,311**	**July 2021 – December 2021**

The **Franklin County PSAP's** deployment window will be **July 2021 – December 2021**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$15,000	i3 licenses and services
CHE replacement	$200,000	Replacement planned for FY22
Text-to-911	$0	Deployed
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$8,000	+ $82,000 if first CenturyLink locality
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Currently using grant funds
Legacy 9-1-1 transition costs	$8,206.20	CenturyLink costs
Project management assistance	$0	None requested
Total	$236,206.20	

The monthly recurring cost for the AT&T solution is **$8,832.64** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$8,760.00**. The estimated monthly increase to the PSAP after deployment is approximately **$72.64**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$236,206.20
Recurring (over 24 months)	$1,743.36
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

Frederick County
PSAP/GIS Specific
NG9-1-1 Migration Proposal

November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **Frederick County PSAP** based on the Fairfax County contract with **AT&T**. **LeeAnna Pyles** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **Frederick County PSAP** will need to upgrade their current Vesta 911 software or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **6.1**
- CHE version number (server): **6.1**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **6**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **October 2019**. This is before their planned NG9-1-1 migration, therefore funding is included in the budget in FY2020. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The PSAP is currently working toward the deployment of the direct IP service integrated with their CHE. This will meet the legislative requirement. The PSAP can migrate over to the AT&T text to 9-1-1 solution with the migration to NG9-1-1.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Sungard OSSI**
- CAD software version: **One Solution**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Sungard OSSI (integrated with CAD)**
- Dispatch Mapping Software Version: **One Solution**
- Method of data transfer: **Serial**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **Carolina Recording Systems**
- Logging Recorder Model:
- Logging Recorder Software Version: **2.7.3**
- Audio Origination Point: **Both trunk-based and position-based**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **ECaTS**
- Data Analytics Vendor: **ECaTS**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Hyper-reach** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has no open grant.

GIS Data Preparation

GIS Data Sources

Currently, **Frederick County GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **Frederick County GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met, the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **96.9%**
- Address Point – **81.4%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **98.5%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **97.4%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data. These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **175**
- Road centerline has right or left side overlapping address range - **87**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **55**
- Address point Is duplicate, has no street name, or no address number - **6**
- Address point street name and road centerline street name mismatch - **57**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **Frederick County GIS** will need to resolve these issues through internal resources, at least three months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **one ESN** for their area of responsibility. **Frederick County GIS** has an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.
>
> **Transitional SIP** - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

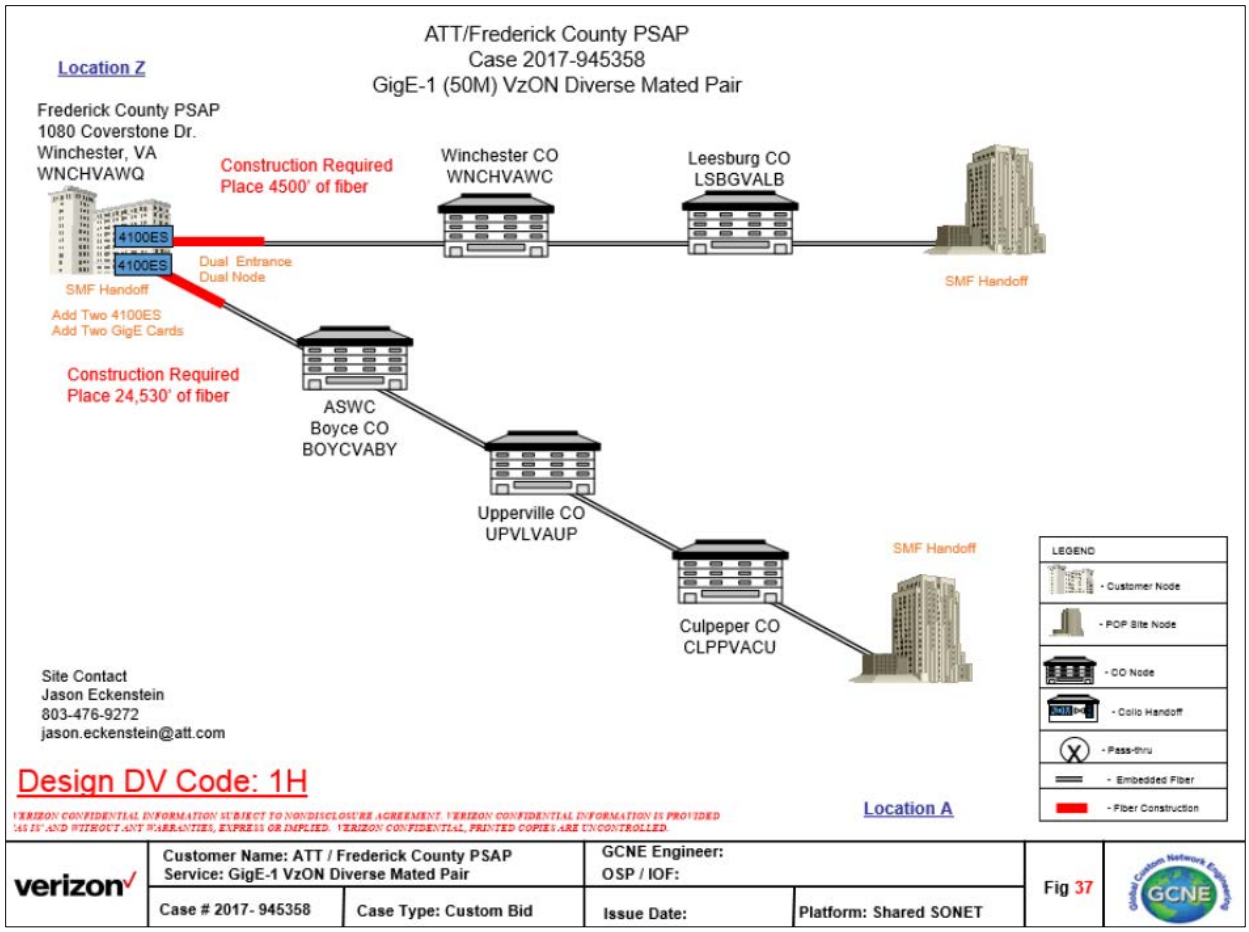
The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Fredericksburg/Winchester**
- Trunk counts (all): **29**
    - Wireline: **4**
    - Wireless: **4**
    - SIP: **0**
    - Administrative: **21**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **Frederick County** PSAP are as follows:



The total cost for this diverse connectivity is **$650,649.09**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason, or should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to the **City of Winchester PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this

migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.

- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	**Verizon**	**343,031**	**July 2020 – December 2020**
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021
Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **Frederick County PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 deployment services
CHE replacement	$150,000	Replacement in FY20
Text-to-911	$0	Already deploying
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$650,649.09	29K+ feet of new fiber necessary
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Not required
Legacy 9-1-1 transition costs	$7,827.90	Verizon costs
Project management assistance	$0	None requested
Total	$843,476.99	

The monthly recurring cost for the AT&T solution is **$12,237.61** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$3,356.84**. The estimated monthly increase to the PSAP after deployment is approximately **$8,880.77**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines

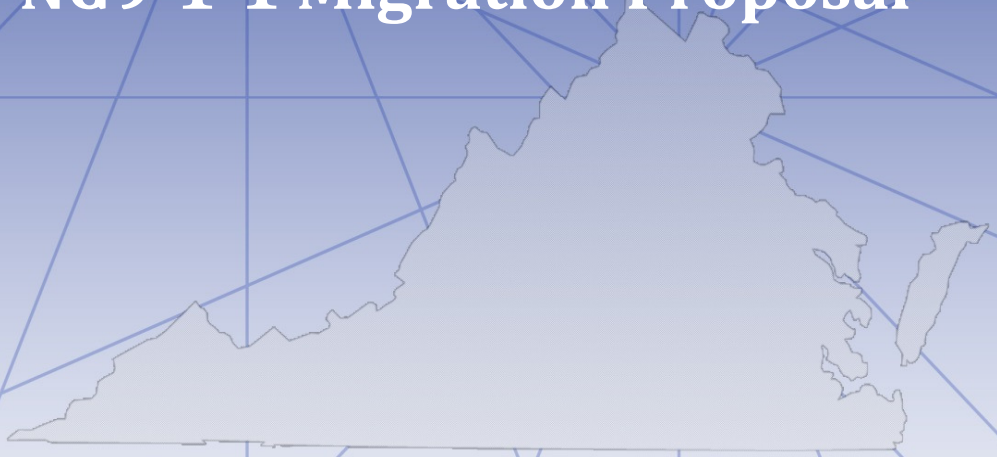
approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$843,476.99
Recurring (over 24 months)	$213,138.48
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.

Commonwealth of Virginia
Next Generation 9-1-1

City of Fredericksburg
PSAP/GIS Specific
NG9-1-1 Migration Proposal



November 1, 2018

www.vita.virginia.gov

Executive Summary

This migration proposal is being prepared for the **City of Fredericksburg PSAP** based on the Fairfax County contract with **AT&T**. **Greg Baugher** shall be the primary contact.

The Commonwealth has been discussing and planning for next generation 9-1-1 (NG9-1-1) for nearly a decade. With significant advances of the technology, capabilities and functionality of an NG network, now is the time to move from planning to implementation. The question is not if the Commonwealth should deploy NG9-1-1, but rather, how should the Commonwealth deploy NG9-1-1. There is no option for not deploying it. Since 9-1-1 is a local service, it is up to each locality to determine how they will move forward with NG9-1-1 deployment. To aid that decision, the 9-1-1 Services Board (the Board) adopted the Virginia NG9-1-1 Deployment Plan in January 2018. That plan proposed the methodology and process to guide the 9-1-1 Services Board and Commonwealth as a whole, through this deployment. Fortunately, localities in the Commonwealth are able to leverage a project in Northern Virginia for both lessons learned and a procurement vehicle that will make the process significantly easier. Though the Board is recommending the Fairfax County contract with AT&T for NG9-1-1 services since it was awarded through a competitive process, each locality will need to determine the most appropriate path. The Board and VITA are positioned to provide assistance, and to assure a seamless, unified network.

Regardless of the locality's decision, all stakeholders in the 9-1-1 ecosystem must work together on deployment. A primary goal of NG9-1-1 is to ensure calls and information received in one locality can be transferred to any surrounding locality even if it is to another state. Accomplishing that will require continual coordination, communications and cooperation among the stakeholders throughout the deployment process. The cost of failure is too high. Each stakeholder in the 9-1-1 ecosystem must work together and ensure a smooth transition to NG9-1-1.

A Migration Proposal is being developed for each locality (or groups of localities if served by a consolidated public safety answering point or PSAP) to provide information about the AT&T solution, prerequisite work needed within the PSAP and the expected costs and funding provided by the Board. The goal of this document is to provide each PSAP/locality with all of the information needed to evaluate the AT&T solution and determine whether it will meet the local needs. No locality should feel obligated to accept this proposal as they may use an appropriate procurement process for these services. This is simply to provide more information about services that are already available through an existing contract.

The Commonwealth's goal is to have all PSAPs fully deployed with the National Emergency Number Association (NENA) i3 standard. This standard states that all 9-1-1 calls are delivered to the PSAP on IP circuits with associated caller location data. If the equipment or GIS data in the PSAP is not capable of supporting the NENA i3 standard, interim solutions are available. These solutions allow calls to be delivered to the PSAP as IP, but then be converted back to analog for interface with the PSAP's systems. This interim solution established the PSAP's connection to the ESInet and will serve as the initial migration to NG9-1-1. After system and/or GIS data upgrades are complete the PSAP will be able to reach a full i3, NG9-1-1 environment. While AT&T will conduct a more exhaustive assessment after the PSAP executes a participation agreement, the review ISP performed for this proposal indicates that the **City of Fredericksburg PSAP** will need to upgrade their current Vesta 911 software or have in place an i3 functional CHE that has been approved on the AT&T ESInet™ to be able to implement the full NENA i3 standard without the need for any interim or transitional steps. Some work on their GIS data will be required, but it should not impact the deployment schedule.

Solution Overview

AT&T is offering their Next Generation ESInet solution throughout Virginia as a solution that will facilitate a transition from legacy 9-1-1 networks to networks capable of supporting the growing demands of a mobile society. AT&T's solution supports key NENA i3 capabilities today, while forming the basis of a true NG9-1-1 platform that will support multimedia emergency services as standards are solidified in the industry.

The AT&T ESInet™ solution is a combination of a world class IP network and the NG9-1-1 components. Their ESInet solution (delivered as a service) comes complete with a full suite of advanced features, management services and tools to help ensure they provide the best possible service to each PSAP and ultimately the citizens they serve.

The AT&T ESInet™ solution provides the public safety community with an i3 architecture built from the ground up. AT&T's commitment to the NENA i3 standard is based on years of contributions to NENA standards committees and understanding the evolving needs and requirements of the Public Safety community. The AT&T solution is not just "i3 like," or "i3 aligned." As elements of the i3 standard continue to be ratified, updated and enhanced—AT&T will continue its commitment to i3. The AT&T ESInet™ services will provide Virginia everything needed to deliver the critical foundational components of an industry standard i3 solution delivered over the worlds most advanced IP network.

AT&T ESInet™ Included Features

- Initial build-out with expandable capacity
- Nationally distributed, geographically diverse and redundant service architecture
- Pre-deployed ESInet Call Processing Centers in AT&T datacenters across US
- Aggregation Centers (AGC) in AT&T Central Offices across the US to easily augment growth capacity
- Initial call processing capacity more than twice current US E9-1-1 call volumes
- NENA i3 compliant
- High availability design (99.999% availability)
- 6 core redundant architecture
- Redundant ALI database
- Interoperable with neighboring PSAPs
- Defense in depth security
- Text to 911 – National TCC Provider
- IPV6 capable
- Reporting Suite
- Full lifecycle management
- End to end management and monitoring
- Fully resourced team to install and support
- Full Business Continuity/Disaster Recovery organization
- Dedicated Program / Service Manager

The proposed solution provides a secure IP-based network with no single point of failure. With no single point of failure, the solution includes six ESInet data centers located at AT&T facilities throughout the country. The ESInet will provide the core for a robust emergency services IP network that assures call delivery. The AT&T solution enables call delivery into a legacy PSAP environment, an IP-enabled 9-1-1 PSAP, or to peer ESInets. AT&T and West Corporation have deep security and support provisions in

place. AT&T has demonstrated experience in cybersecurity. All of this is backed by AT&T's 24/7/365 Resolution Center, AT&T Labs, AT&T's world class project management and service delivery organizations.

Additional information about the AT&T solutions and the contract with Fairfax County can be found at: https://www.fairfaxcounty.gov/cregister/ContractDetails.aspx?contractNumber=4400007825

PSAP Call Handling Systems and Applications

Each PSAP system and application that interfaces with the 9-1-1 call must be assessed to determine if it will be compatible with NG9-1-1. This section of the migration proposal identifies each major system, assesses its readiness and outlines any upgrades that must or could be implemented with NG9-1-1.

Call Handling Equipment

Obviously, the PSAP's call handling equipment (CHE) is the primary system that interfaces with the 9-1-1 network. As such, it is likely the one that will require the deepest assessment and potential upgrades to operate with the NG9-1-1 network. CHE that is non-vendor supported (NVS) (or will become NVS during the transition period) or cannot be upgraded to be NG9-1-1 capable will be identified for replacement, but will be subject to the funding limits currently in place for the PSAP grant program ($150,000 individual or $200,000 shared services). This may also apply to technology refreshes of hardware due to becoming NVS or operating systems becoming end-of-support. The current CHE in the PSAP has been identified as:

- CHE manufacturer: **Motorola**
- CHE model: **Vesta 911**
- CHE version number (clients): **6.1 build 1222**
- CHE version number (server): **6.1 build 1222**
- CHE maintenance provider (channel): **Carousel Industries**
- CHE Geodiversity: **No**
- Number of positions: **6**
- SIP capable: **Yes**

This CHE has been determined to be SIP capable, but will require an upgrade to Vesta 7.2 to implement the full i3 interface. This upgrade will require the purchase of two firewalls to connect to the ESInet. However, if the PSAP deploys text to 9-1-1 with the direct IP solution prior to NG9-1-1 migration, these firewalls will already have been purchased and can be used for both purposes.

The PSAP indicates the planned replacement of their CHE in **October 2021**. This is after their planned NG9-1-1 migration, but during the overall funding period so funding is included in the budget in FY2021. Any new CHE will need to be tested and i3 functional on the AT&T ESInet.

Text to 9-1-1

Text to 9-1-1 can be deployed web-based on a separate computer or integrated with the CHE. While the former is typically at no cost, the latter tends to have a cost associated with it. Though text to 9-1-1 will be a base feature of NG9-1-1, the passage of Senate Bill 418 in the 2018 General Assembly requires all PSAPs to implement text to 9-1-1 by July 1, 2020. The **City of Fredericksburg PSAP** is working to implement the direct IP solution for text to 9-1-1. No additional upgrade or change is required with the deployment of NG9-1-1.

Computer-Aided Dispatch

A computer-aided dispatch (CAD) system usually receives 9-1-1 location information (ALI) through an interface with the CHE. As a result, the change to NG9-1-1 should not have an impact on a CAD system. However, an assessment is made to determine if that is the case and if any options are available from the CAD vendor that could improve operations after NG9-1-1 is deployed. Any required upgrades would be funded through the Board, but any options to improve operations would be at the PSAP's expense. Additionally, as a reminder, CAD system replacement is no longer funded through the PSAP grant program so PSAPs need to plan for its replacement locally. The current CAD system has been identified as follows:

- CAD vendor: **Superion**
- CAD software version: **OneSolution CAD 17.4.0.2128**
- CAD interfaces: **Yes**
- Method of data transfer: **Serial**

This CAD system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Mapping Display System

Similar to a CAD system, a mapping display system usually receives 9-1-1 location information (ALI) through an interface with the CHE or is part of the CHE or CAD. As a result, the change to NG9-1-1 should not have an impact on a mapping display system. However, an assessment is made to determine if that is the case and if any options are available from the mapping vendor that could improve operations after NG9-1-1 is deployed. The current mapping display system has been identified as follows:

- Dispatch Mapping Vendor: **Superion (integrated with CAD)**
- Dispatch Mapping Software Version: **OneSolution 17.4.0.2128**
- Method of data transfer: **None**

This mapping display system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Voice Logging and Recording

Typically, the audio recorded by a voice logging recorder is generated by the CHE. Though not a best practice, it is possible to record audio directly from the incoming 9-1-1 trunks so an assessment must be performed to ensure that audio from 9-1-1 calls will still be recorded after the deployment of NG9-1-1. The current logging system has been identified as follows:

- Logging Recorder Vendor: **NICE**
- Logging Recorder Model: **Inform**
- Logging Recorder Software Version: **7.0.3.66**
- Audio Origination Point: **Both trunk-based and position-based**

It is important to note that with an IP connection, audio is not present on the circuit until the CHE responds with an answer code. This is usually not until it is answered by a call taker, though it could be earlier if an audio message is played for the caller (which technically requires the CHE to answer the call to play the message). This voice logging recorder system has been determined to not require any upgrade or modification with the deployment of NG9-1-1.

Data Analytics

Though the ECaTS data analytics application is provided to all PSAPs by the 9-1-1 Services Board, some PSAPs still use a second application, native to the CHE, for data analytics in the PSAP. While the Board will directly fund the upgrade to ECaTS to handle NG9-1-1, the local data analytics application may also need to be upgraded. The current data analytics application has been identified as follows:

- Primary Data Analytics System: **Vesta Analytics**
- Data Analytics Vendor: **Motorola**

All required upgrades to ECaTS will be handled through the statewide contract at no cost to the PSAP.

Outcall Notification Systems

The PSAP currently uses **Everbridge** as their outcall notification system. AT&T will provide quarterly subscriber data for use in this system at no cost. It is important to note that this data's use is limited to the outcall notification system and cannot be used for other purposes.

Other Systems or Applications

No other systems, that interface with the 9-1-1 call flow have been identified that will impact the PSAP's readiness for NG9-1-1.

Rack Space

The AT&T solution requires four units (4U) of rack space in the PSAP equipment/computer room for networking equipment. The rack must also have available electrical connections and be properly grounded. The PSAP has confirmed that this space is currently or will be available.

Coordination with Open Grants

The PSAP currently has two open grants:

1. **FY18 – NG9-1-1 GIS - $51,854**
2. **FY19 – CHE Text to 9-1-1 – $75,300**

To ensure the grant funds support the migration to NG9-1-1, the PSAP should, to the extent practical, use funding from the FY18 regional GIS grant to correct geospatial issues identified in the following section.

GIS Data Preparation

GIS Data Sources

Currently, **City of Fredericksburg GIS** maintains all of the GIS data for the PSAP and will be the source for all GIS data required for NG9-1-1 geospatial routing; however, other departments within the locality may contribute data or manage various processes. It is the responsibility of **City of Fredericksburg GIS** to aggregate the GIS data required for the PSAP and NG9-1-1.

Locality GIS Data Readiness

Geospatial data drives the routing of NG9-1-1 calls. It is imperative that road centerline and address point data layers are highly accurate and well maintained. In 2016, VITA conducted an analysis of these data against the existing automatic location identification (ALI) database and master street address guide (MSAG) to help determine readiness and provided a report to each PSAP of the results. This analysis has been repeated making adjustment to the logic to ensure it matches the methodology used by AT&T in their analysis. The goal is to have 98% of all addresses in the current ALI database geocode against the locality's road centerline data layer. Once the 98% threshold recommended by NENA is met,

the PSAP is ready to deploy NG9-1-1. Since matching to the address point is more accurate, VITA is recommending the additional goal of matching 98% of ALI database addresses when geocoded against the address point data layer. If either of these goals in not achieved, then GIS data work must be completed to meet or exceed these goals. While financial support from the PSAP grant program may be available to fund this work, localities with GIS programs will be encouraged to make the necessary corrections in house if resources and time before deployment permits.

These are preliminary results based on expected data criteria of AT&T, and will be retested directly by AT&T after the execution of the participation agreement. This analysis provides the PSAP and their GIS support with an estimate of the extent of potential errors and helps identify the issues that need to be resolved. ISP staff including a GIS analyst and/or regional coordinator will begin working with the GIS data maintenance provider (internal or external) to identify and correct the GIS data or ALI data and achieve a higher match rate and thus more accurate geospatial routing.

Though there are other types of errors that may exist in the GIS data used by the PSAP (such as parity or cartography errors), these do not usually impact the routing of a 9-1-1 call. As a result, as part of this effort, only corrections that impact routing the 9-1-1 call will be required. PSAPs, in coordination with their GIS support, are encouraged to look more broadly at their data and work to improve its overall quality as well.

The 2018 MSAG/ALI/GIS analysis for the PSAP determined the current match rate to be as follows:

- Road Centerline (RCL) – **96.7%**
- Address Point – **93.8%**

The primary issue with the RCL data is differences in street names between the ALI and GIS data. Correcting the street names so they match would increase the match rate for RCL to **98.3%**. The analysis also determined that no more than ten addresses were responsible for many of the address point discrepancies. Resolving no more than ten addresses will increase the result to **96.8%**. During July 2018, VITA will send each PSAP and/or GIS manager a report detailing this analysis, and identifying the specific ALI records that could not be matched to the RCL or address point data. To resolve these ALI address discrepancies, there are potentially four actions that will need to take place:

1. **Add a record to the GIS** – When the ALI database has correct addresses that have not been added to the GIS data, the addition of data needs to occur. This may entail adding a road segment to the RCL or a point to the address points.
2. **Change attribution in the GIS** – When an ALI record has a correct address but the RCL or address point attribution is incorrect the discrepancy in the GIS data must be resolved. A common issue is a difference with the street name or street type between the ALI and the GIS data. Often, this issue can be corrected using a batch script process. VITA staff can assist.
3. **Change attribution in the ALI database** – When the RCL or address point has the correct address but the ALI record is incorrect, the discrepancy in the ALI database may need to be resolved. Again, this is often caused by differences in the street name or street type between the records. If necessary, AT&T can make batch changes as they load the ALI database into the ESInet.
4. **Determine that the discrepancy is not an error** – There are often ALI records associated with telephone numbers that can never actually dial 9-1-1. They could be pilot numbers for a multi-line telephone system, foreign exchanges or shell records for wireless calls. While many of those records were filtered out of the analysis, some may still be within the data.

These ALI records need to be identified and removed from the match rate calculation. VITA staff will assist with this process.

In addition to the requirement for ALI address matches, there are five GIS data reviews that AT&T conducts on the GIS data to ensure there are no errors that would cause issues or uncertainty when routing a 9-1-1 call. As an example, duplicate GIS data could cause a search for an address to result in two or more matches. Since certainty of a location is important, checks are performed to ensure no duplicate data exist. The following is a list of the additional analyses performed and the number of records that were found to be in error that will need to be corrected:

- Road centerline has duplicate address ranges - **0**
- Road centerline has right or left side overlapping address range - **22**
- Road centerline has street name attributes not meeting Virginia, USPS, & NENA standard - **0**
- Address point Is duplicate, has no street name, or no address number - **97**
- Address point street name and road centerline street name mismatch - **19**

All of these errors will be also included in the analysis delivered to the PSAP and GIS Manager in July 2018. This includes geospatial data identifying each specific error that can be viewed in ArcMap. Utilizing this information will assist in error identification and correction.

Regardless of how they are resolved, **City of Fredericksburg GIS** will need to resolve these issues through internal resources, at least 3 months prior to the targeted deployment date

PSAP Boundary

This is a GIS polygon data layer that defines the area of responsibility for each PSAP. The PSAP boundary must be agreed to by all adjoining PSAPs, thus its development must be a regional effort. VITA ISP will support the regional development and maintenance of a statewide PSAP boundary. This PSAP boundary layer is essential to routing 9-1-1 calls based on caller location by either civic address or coordinate location. This layer must not have gaps or overlaps to ensure correct call routing. VITA will develop a best practice to guide each PSAP through this process, which can also be facilitated by the VITA ISP regional coordinator.

Authoritative GIS Data Source Boundary

This polygon layer defines the area of authoritative GIS data sources, with no unintentional gaps or overlaps. The boundary must be agreed to by all adjoining data provisioning providers. Edge-matching conformance is ensuring that one and only one entity is responsible for maintaining each piece of GIS data within a PSAP. Within a PSAP boundary, there may be multiple sources for authoritative GIS data as a combination of cities and counties. The GIS sources within the PSAP need a common and agreed-upon understanding for the maintenance of each feature and the provisioning boundary of responsibility. Making sure there is agreement of that point and ensuring each locality is only providing data where they are the authoritative GIS data source are the purpose of this assessment. External edge-matching conformance addresses boundaries between neighboring PSAPs to ensure that there are no overlaps or gaps in the maintenance of GIS data. Geometric features need to meet at the agreed upon boundary.

MSAG transition/confirmation

In order to accommodate originating service providers (OSP) that are not fully i3 capable, AT&T will maintain a master street address guide (MSAG) as part of the NG9-1-1 solution. While the existing MSAG can be used and maintained, generating a new MSAG from local GIS data is a better solution since existing GIS data is generally of superior quality than the MSAG. To use GIS data to generate the MSAG, an emergency service number (ESN) data layer must exist or be created. The PSAP has **two ESNs** for

their area of responsibility. **City of Fredericksburg GIS** is currently developing an ESN boundary layer depicting this area so they will utilize a GIS generated MSAG with the migration to NG9-1-1.

Ultimately, ESN and community name need to be attribute fields in the address points and road centerlines layers to support call routing until the OSP can transition to i3. If these attributes are not part of a locality's existing maintenance workflow or GIS database, they can be created by building a separate polygon layer and transferring these values to the centerline segments (commonly referred to as a spatial join). The spatial join method can be implemented as part of the workflow for preparing to transfer GIS data to AT&T to ensure these fields are accurately populated.

GIS Ingest Readiness

Localities may choose to implement AT&T's tools and workflows for ongoing maintenance of GIS data, or may choose to continue using internal workflows or third-party support services. As GIS data is updated, regardless of the tool set or service provider, the GIS datasets must be provided to the spatial interface (SI). The SI provisions the updated GIS data to drive location validation and call routing functions in the ESInet.

Localities choosing to adopt or transition to the AT&T toolset will have a defined workflow for providing updated GIS data. Localities wishing to use existing tools, acquire third-party tools, or rely on a service provider will need to ensure the workflows are in place to accept and resolve discrepancy calls (formalized requests to update GIS datasets), and periodically transfer updated GIS datasets to the AT&T spatial interface. This section will establish the path and milestones for completing this work.

Data maintenance Workflow/Procedures

The quality of GIS data diminishes over time unless it is properly maintained. It is important that localities document GIS data maintenance workflows and validations to ensure synchronization across GIS layers. This can include periodically ensuring conformance of edge matching of GIS data at shared boundaries. VITA has confirmed that the GIS organizations supporting the PSAP have appropriate internal data maintenance procedures/discrepancy management workflows.

Call Routing

The ultimate goal for all PSAPs is to use geospatial (i3) routing for all 9-1-1 calls. This solution uses all the NENA i3 standards for delivering voice and data directly into the PSAP's CHE. 9-1-1 call routing is based on the PSAP-provided GIS data. The ESInet router hands off the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be able to receive the voice call via SIP. Location data delivered via SIP using PIDF-LO, and would perform all the i3 protocols such as LoST and HELD.

If the PSAP's CHE is not NG9-1-1 capable or the geospatial data is not ready for deployment, a PSAP can still connect to the ESInet with an interim solution for call delivery. This will allow the PSAP to migrate on schedule, and they can implement geospatial (i3) routing when the GIS data is suitable for this use and the CHE is i3 capable.

The two interim solutions are as follows:

> **Legacy PSAP Gateway** - This solution allows the PSAP to be connected to the ESInet through a network gateway. In this call delivery configuration, the call is routed with the legacy MSAG and ALI data, however this is done over the IP network. Once the call reaches the gateway, the voice data is converted to analog and processed over an analog voice circuit to the PSAP's CHE. This does not require any upgrade to the CHE and as mentioned uses a legacy ALI lookup. The ALI

lookup would use a standard serial connection (in this case to the legacy PSAP gateway placed in the PSAP) to retrieve location information.

Transitional SIP - This solution uses an IP (SIP) connection to get the voice call directly into the PSAP's CHE. The ESInet router passes the call to the PSAP networking equipment (router or firewall). The PSAP's CHE must be capable of receiving the voice call via SIP. The CHE would still use a legacy ALI lookup. The ALI lookup would use the standard serial connection (in this case to the ESInet routers) to retrieve location information. MSAG and ALI are still used to conduct the routing.

Again, the ultimate goal for all PSAPs is to geospatially route all 9-1-1 calls. If the geospatial data meets the accuracy goals, a PSAP should be able to deploy NG9-1-1 with geospatial routing. If for some reason, this cannot be accomplished, interim solutions are available to allow the PSAP to deploy on schedule, and they can convert to geospatial routing later.

Based on an assessment of the CHE and GIS data, geospatial routing can be implemented initially with NG9-1-1 and no interim solution will be necessary. While some GIS data correction must take place, the PSAP is committed to correcting those issues well in advance of the required milestone and to maintain that data through the transition period.

Call Transfers

During the transition to NG9-1-1, the AT&T ESInet will be interconnected with all selective routers from Verizon and CenturyLink to ensure that calls received by PSAPs that have deployed NG9-1-1 can be transferred to PSAPs on the legacy E9-1-1 network and vice versa. No ability to transfer calls will be lost during the transition when neighboring PSAPs may be on different networks.

Post deployment, all Virginia PSAPs should be on an ESInet and should be able to transfer calls among PSAPs with accompanying location data. Even if more than one ESInet is deployed from different solution providers, the goal is that they are interconnected and calls can be transferred between them.

Network

The NG9-1-1 solution offered by AT&T is a service; therefore, the network is provided as part of that service. However, there are several issues impacting the network that may be outside of this service that must be considered. The configuration of the PSAP's connection to the network will be based on the legacy E9-1-1 network information as follows:

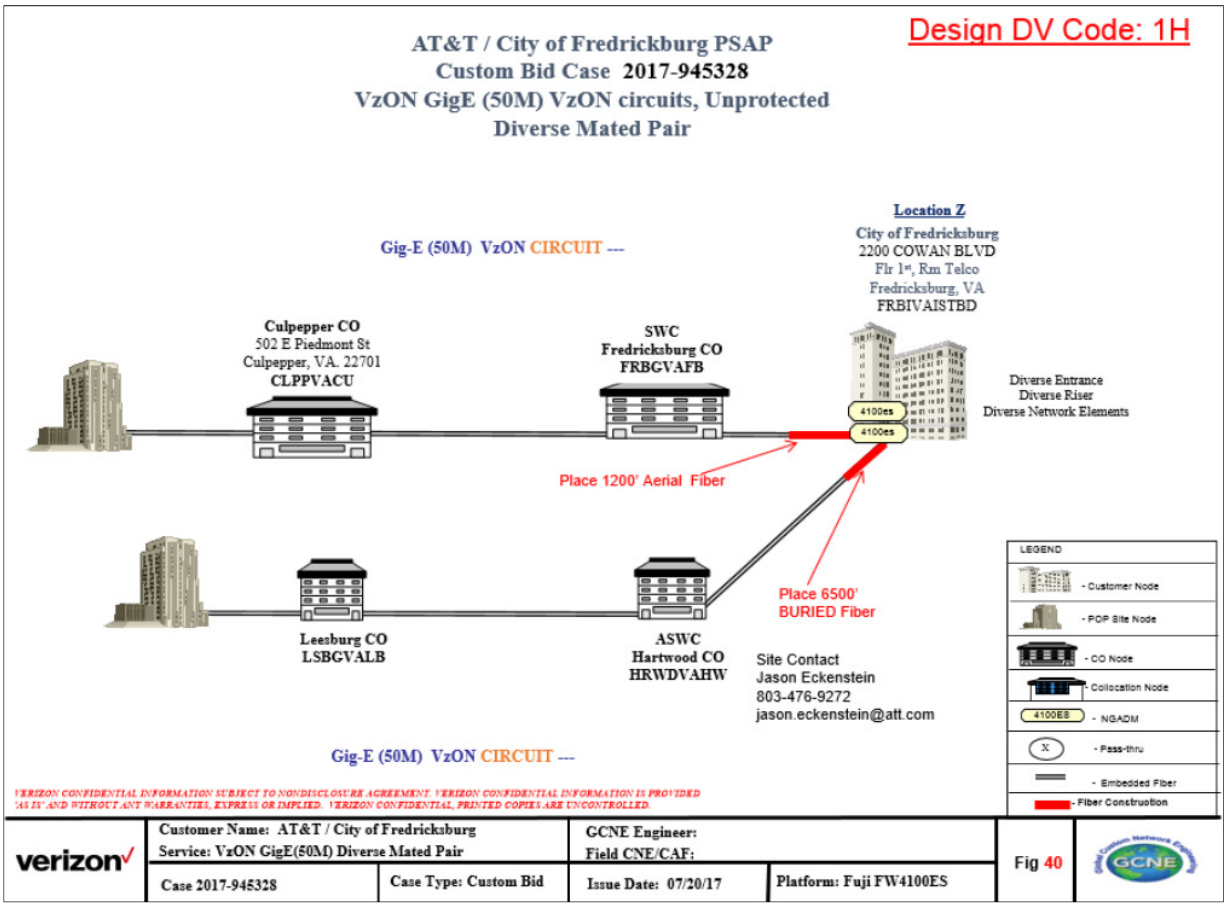
- Legacy E9-1-1 service provider: **Verizon**
- ALI database provider: **Verizon**
- Selective router pair(s): **Fredericksburg/Winchester**
- Trunk counts (all): **26**
    - Wireline: **6**
    - Wireless: **6**
    - SIP: **0**
    - Administrative: **14**

The NG9-1-1 network will be designed to support the same number of concurrent 9-1-1 calls as can be supported on the legacy network (wireline and wireless trunks). The PSAP can designate what happens to calls that exceed this number. This setting is determined in the PSAP CHE, but the options will be discussed with AT&T during system configuration. The options include providing the caller with a fast

busy signal, routing the call to another PSAP, or overflowing the call to another line. As a best practice, VITA ISP recommends routing the call to a fast busy signal or rerouting calls to another PSAP.

Redundancy and Diversity

In order to provide 99.999% availability of the NG9-1-1 service, each PSAP must have diverse and redundant IP connections to the ESInet. Having redundant connectivity means having two connections, but they could be co-located or follow the same path. Having diversity means that those redundant connections follow different paths that never touch from origin to destination. To achieve the 99.999% availability, diverse connectivity is planned for all PSAPs. There is a chance the diversity is simply not available to all PSAPs. AT&T has conducted a diversity study for each PSAP and the results for the current location of the **City of Fredericksburg** PSAP are as follows:



The total cost for this diverse connectivity is **$994,117.00**, which will be provided by the Board as part of the PSAP's funding submission. The timing of the implementation of the diverse connectivity may not be completed until after initial NG9-1-1 deployment.

Disaster Recovery

Though the NG9-1-1 solution is designed to provide 99.999% availability, disaster recovery plans still need to be in place for instances when the network becomes unavailable or the PSAP is otherwise inoperable (evacuation, structural damage, etc.). Broadly, when the PSAP must be abandoned, there are two approaches to disaster recovery, a) having a backup PSAP within the locality or b) partnering with a neighboring PSAP to take the calls. Additionally, if only the network is impacted and the PSAP is still operable, 9-1-1 calls can be forwarded to a 10-digit telephone number in the same PSAP. Location data is lost, but that call can still be answered and processed.

Currently, the PSAP has a disaster recovery plan which states that if the PSAP must be evacuated for any reason, or should just the network be unavailable and the PSAP can still be occupied, calls are rerouted to the **Spotsylvania County PSAP**.

Based on the current disaster recovery plan, no additional steps must be taken in order for this plan to continue to be viable with NG9-1-1. The PSAP need only inform AT&T of their disaster recovery plan during the detailed planning after the participation agreement is signed. AT&T will then build those routes in the configuration files both for during the transition and post-migration to NG9-1-1.

While support will be available to maintain the current disaster recovery capability for the PSAP, it is important to note that there are aspects of disaster recovery that are beyond the scope of this migration proposal. As an example, while the NG9-1-1 network can be configured to route calls to a neighboring PSAP in the event of a PSAP evacuation, getting the 9-1-1 call to another PSAP to be answered is only part of the dispatching process. The call for service then needs to be sent to first responders through a radio channel or mobile data. Assuming that capability already exists, nothing about the deployment of NG9-1-1 should impact that. In cases were disaster recovery does not exist currently, this migration proposal only deals with getting the 9-1-1 call routed to another PSAP (backup or neighboring) and does not address radio or CAD interoperability needed to effect the dispatch of first responders. VITA ISP can assist with that process, but outside of NG9-1-1 deployment. Additionally, VITA ISP can assist with the exercising of disaster recovery plans, which should be done at least once a year to make sure they are fully functional when needed.

Secondary PSAP

There are no secondary PSAP(s) identified within the service area of the primary PSAP.

Network Security

AT&T employs a defense-in-depth security strategy to protect sensitive information. Security mechanisms are deployed throughout the service in addition to the multi-layered security provided by the network itself, in order to provide seamless and effective security. AT&T's world-class experience in both IP and Telephony Security provides the following key security elements.

- Availability of the VoIP Service: Stop denial or deterioration of service functionality
- Integrity of the VoIP environment: Prevent system functions or data from being corrupted
- Confidentiality and Data Privacy in VoIP: Keep information secure and private

The AT&T IP/MPLS Converged Network deploys the same attention to state-of-the-art security measures as have been provided on traditional PSTN networks:

- AT&T Security Policy and Requirements (ASPR) and AT&T OneProcess provide the security foundation.
- AT&T Internet Protect helps protect against worm/virus attacks and offers DoS (denial of service) protection.
- A 24x7 Security Network Operations Center (SNOC).
- AT&T MPLS Voice Aware Network provides security and QoS.
- AT&T Global Fraud Management System protects AT&T VoIP against fraud.
- AT&T hub-and-spoke MPLS VoIP VPN for customer access helps to provide security and QoS for AT&T.

In the AT&T MPLS network, customer services are provisioned on specific interfaces of an MPLS VPN by using known IP addresses. This approach enables AT&T to authenticate users and traffic. Rather than

supporting signaling or voice encryption, AT&T relies on the MPLS security and secured IP tunnels to provide confidentiality for signaling and voice.

The data privacy and data integrity of an MPLS VPN is not dependent on encryption or address space-based access controls. AT&T protects the core network against compromise by:

- Hardening the routers and turning off unnecessary services.
- Implementing TACACS+ authentication, authorization and accounting for router access/commands.
- Automated provisioning of router configuration driven from ordering systems, to minimize human error, complimented by daily discord reports and investigation.
- 24/7 monitoring and DoS mitigation tools.
- Route dampening and/or limiting total number of routers learned to protect routing stability.
- Firewalls, IDS, token based authentication, encrypted remote access for network and service management systems/work centers.

The AT&T security culture assures that these architectural protections are enforced by audits, employee awareness training, penetration testing and enforcement of architectural principles and policy.

In addition, AT&T MPLS VPN service is a transport only service, with the data integrity and data privacy protection as described above. AT&T monitors the core network for traffic anomalies and shared resource consumption thresholds to protect the core network and assure that traffic storms do not impact the performance of other customers. AT&T network management and service management systems are hardened, require authentication and authorization control, and are instrumented with intrusion detection to assure that they are not compromised, and cannot serve as a vector to attack the network or customers.

Schedule for Deployment

A clear and accurate schedule is essential to ensure cost effective and coordinated deployment throughout the Commonwealth. For that reason, this section identifies all milestones that must be met in order to successfully deploy. To manage costs, a six-month deployment window has been established for each selective router pair regardless of whether the PSAPs choose the AT&T or another NG9-1-1 solution. The following chart identifies the deployment periods for each selective router pair:

Selective Routers	9-1-1 Service Provider	Population	Time Period
Fairfax/Alexandria	Verizon	2,494,184	January 2019 – June 2019
High St Portsmouth/Jefferson	Verizon	1,662,247	July 2019 – December 2019
Stuart/Chester	Verizon	1,660,182	January 2020 – June 2020
Charlottesville/Farmville	CenturyLink	403,369	July 2020 – December 2020
Fredericksburg/Winchester	**Verizon**	**343,031**	**July 2020 – December 2020**
Danville/Lynchburg Church St	Verizon	320,247	July 2020 – December 2020
Staunton/Salem	Verizon	453,065	January 2021 – June 2021
Shenandoah County ECC	Shentel	43,175	January 2021 – June 2021
Covington	Ntelos	21,556	January 2021 – June 2021
New Castle	TDS Telecom	5,158	January 2021 – June 2021
Floyd County	Citizens	15,651	January 2021 – June 2021
Monterey-Highland Telephone	Highland Telephone	2,216	January 2021 – June 2021
Blacksburg/Norton	Verizon	340,101	July 2021 – December 2021

Johnson City/Wytheville	CenturyLink	338,311	July 2021 – December 2021

The **City of Fredericksburg PSAP's** deployment window will be **July 2020 – December 2020**. A specific date will be determined after all PSAPs have made the NG9-1-1 decision and AT&T develops the master schedule. Regardless of the specific date, any CHE upgrades, diverse connectivity enhancements and GIS data corrections must be completed at least **three months** before the deployment date. If they are not completed by this date, migration can still occur on schedule, but it will require the deployment of an interim solution instead of full i3.

Cost Estimates for NG9-1-1 Funding

The 9-1-1 Services Board has committed to funding the transitional costs for NG9-1-1 deployment so it is important that all such costs are identified and made part of the overall budget. It is also important that the funding be provided on a fair basis across all PSAPs in Virginia. While most costs will be fully funded, others like replacement of non-vendor supported CHE will continue to be funded at the same levels as has been provided through the PSAP grant program in prior years. Based on all of the information provided in this migration proposal, the following budget is for your deployment of NG9-1-1:

Category	Amount	Notes
NG9-1-1 non-recurring cost	$4,000	Flat rate from AT&T
CHE upgrade	$30,000	i3 firewalls and services
CHE replacement	$150,000	Replacement in FY2022
Text-to-911	$0	Currently using grant funds
CAD upgrade	$0	Not required
Mapping upgrade	$0	Not required
Voice logging upgrade	$0	Not required
ECaTS Data analytics expansion	$1,000	i3 logging and text to 9-1-1
Other system upgrades	$0	Not required
Rack space	$0	Rack space is available
Diverse connectivity costs	$994,117.00	
Disaster recovery upgrade	$0	Not required
Secondary PSAPs	$0	None
GIS data preparation	$0	Currently using grant funds
Legacy 9-1-1 transition costs	$7,129.50	Verizon costs
Project management assistance	$0	None requested
Total	$1,186,246.50	

The monthly recurring cost for the AT&T solution is **$5,436.27** which is set for the ten-year term of the Fairfax County contract. The current monthly recurring cost for the legacy E9-1-1 solution is approximately **$2,478.66**. The estimated monthly increase to the PSAP after deployment is approximately **$2,957.61**. This increase will be covered by the Board for a period of 24 months after deployment is complete. At the end of this period, the entire cost will be the responsibility of the PSAP. Copies of invoices from the current 9-1-1 service provider must be provided to substantiate the current monthly cost. This will be the basis for determining whether monthly funding is provided and in what amount.

The monthly recurring cost is impacted by the bandwidth into the PSAP. Bandwidth is primarily impacted by the number of concurrent calls each PSAP wants to be able to process. As the PSAP grows and adds bandwidth to handle more concurrent calls, the increased monthly cost will be the obligation of the PSAP even if during the 24 months following transition. Additionally, the recurring maintenance costs for PSAP equipment and GIS data will remain the responsibility of the PSAP.

Projected Board Funding

The Board will begin awarding funding for NG9-1-1 in late 2018. Until the Board approves the funding request from the PSAP, all funding levels shown are just projected. Based on the funding guidelines approved by the Board (or will be approved by the Board), the following funding would be awarded to the PSAP:

Type of Funding	Amount
Non-recurring	$1,186,246.50
Recurring (over 24 months)	$70,982.64
Data Analytics (monthly)	$415.12

The funding amount shown is based on estimates at this point. As binding quotes are received, the budget will be adjusted. The approval from the Board will be for the specific equipment or services and contingency funding will be available should the final cost be slightly higher so long as the original scope of the effort does not change. Similarly, if the final cost is lower, the budget will be adjusted lower. That additional funding cannot be shifted to another part of the project.