Northern Virginia Electric Cooperative (NOVEC)

Cost Recapture for 3rd Party Pole Attachments

SYST699 Masters Program Final Project
Fall 2013

Prepared for Dr. Hoffman

Prepared by:
Matt Blanck
John O'Neill
Doug Smith

Table of Contents

1. Contents

2. Overview 5
3. Customer Overview 5
4. Background 5
   4.1 Stakeholders 6
5. Problem Definition 7
6. Gap Analysis 7
   6.1 Gap Analysis Overview 7
   6.2 Gap Analysis Methodology 8
   6.3 Gap Analysis Meetings 8
   6.4 Current Processes 9
   6.5 Decennial Census 14
      6.5.1 Census Data Analysis 14
      6.5.2 GIS and Census data analysis 16
   6.6 NOVEC's Current IT Infrastructure 21
   6.7 Work Management System 23
   6.8 GIS System 23
   6.9 Vegetation Management System 24
   6.10 Cost Recapture Opportunities and Trend Analysis 24
   6.11 Summary of Findings 25
7. Solution Space 26
8. Reference Design 26
   8.1 3PA Permit Application 27
   8.2 3rd Party Attachment Discovery 30
   8.3 3rd Party Attachment Compliance 31
   8.4 Requirements Model 32
   8.5 Architectural Model 33
   8.6 Technology Survey 34
   8.7 Rough Order Magnitude (ROM) Estimate 36
9. Conclusions & Recommendations 36
   9.1 System Capabilities Document 37
   9.2 Findings & Recommendations 37

Appendix A – Project Problem Definition Approach 38
1. Overview 38
2. Problem Situation Evaluation 38
2.1 NOVEC 38
2.2 Companies Requesting 3rd Party Pole Attachments 38
2.3 Government Regulators Managing Pole Attachment 39
3. Potential Problem Formulations 39
3.1 Streamline Permit Process 39
3.2 Provide Continual Audit Mechanism 39
3.3 Seek Government Support for Penalizing Permit Violations 40
4. Analysis Conclusions 40
Appendix B – System Capabilities Document 41
1. System Overview 41
1.1 System Description 41
1.2 Enabling Capabilities 41
1.2.1 Web Portal Services 41
1.2.2 Pole Auditing Services 41
1.2.3 GIS Tracking of Joint Use 42
2. Scope 42
3. Requirements 42
3.1 System Requirements 42
3.2 Web Portal Services 42
3.3 Pole Auditing Services 43
3.4 GIS Tracking of Joint Use 43
3.5 Interfaces 43
Appendix C – Reference Design Sequence Diagrams 44
1. Overview 44
1.1 Users 44
1.2 Sequence Diagrams 44
Appendix D - Artifacts from the Gap Analysis 55

List of Figures

Figure 1: System Level Gap Analysis 8
Figure 3: Make Ready Use Case Process 10
Figure 5: Pole Replacement Use Case Process Flow 12

Figure 8: Distribution of 3rd Parties on NOVEC Poles 15
Figure 9: Distribution of Pole Usage 15
Figure 10: Permits vs. Actual Attachments for 3rd Parties on NOVEC Poles 16
Figure 11: NOVEC Total Utility Pole Distribution 17
Figure 12: NOVEC use only poles 18
Figure 13: Verizon Poles 19
Figure 14: Comcast Poles 20
Figure 15: Cox Poles 21
Figure 16: Wire Diagram of NOVEC's Current IT Infrastructure 22
Figure 17: Ten Year JUP Trends 24
Figure 18: NOVEC System Use Case recommendations 26
Figure 19: 3PA Permit Application Prototype 28
Figure 20: 3PA Permit Application attachment (before) 29
Figure 21: 3PA Permit Application attachment (after) 29
Figure 22 Tree-Trimming Map with JUP attributes 30
Figure 23: 3PA Tree-Trimming Circuit Map 31
Figure 24: 3rd Party Attachment Compliance Prototype 32
Figure 25: Proposed NOVEC IT Architecture 34
Figure 26: ikeGPS Audit Device 35
Figure 27: ikeGPS Imagery 35
Figure 28: COCOMO II Cost Model 36

List of Tables

Table 1: Proposed NOVEC System Requirements 33

2. Overview

The George Mason University (GMU) Systems Engineering (SE) department continually partners with local commercial and government entities to sponsor Masters Program Final Projects for students as part of the curriculum structure. The following document is a Masters Project report provided to GMU Systems Engineering faculty and the sponsoring entity, Northern Virginia Electric Cooperative (NOVEC), detailing engineering related analysis conducted against a given problem set in conjunction with the degree program.

The document will walk through NOVECs background, detail a specific request by NOVEC for deeper SE insight into a particular problem, initial project definition, analysis and findings, project redirection based on findings, results, project deliverables and project conclusions. Included in the Appendices are several of the mentioned deliverables that will be referenced throughout the document.

3. Customer Overview

NOVEC is a locally based and locally owned electric distribution cooperative headquartered in Manassas, Virginia. NOVEC's long-term energy strategy is to deliver to its customers a locally controlled energy supply that is reliable, environmentally responsible, and competitively priced.

NOVEC's service territory encompasses 651 square miles with more than 6,790 miles of power lines. NOVEC provides reliable electric service to more than 150,000 homes and businesses located in Clarke, Fairfax, Fauquier, Loudoun, Prince William and Stafford counties, the City of Manassas Park and the Town of Clifton, all in the state of Virginia. Distribution to customers is provided through a system of over 60,000 utility poles.

NOVEC is a not-for-profit corporation. As a cooperative it is owned and controlled by its member-owners — the customers who purchase energy from NOVEC.

The majority of NOVEC's customers are residential and small commercial, however NOVEC provides electric service to numerous large commercial retailers such as AOL, Potomac Mills Outlet Mall, NOAA's Mount Weather Facility, Vulcan Materials Company, Verizon, AT&T, Doane Food Products, Treasure Chest Advertising and several Luck Stone Corporation quarry locations.

4. Background

Government regulations stemming from the 1996 Telecommunication Act aimed…

> *"…to provide for a pro-competitive, de-regulatory national policy framework designed to accelerate rapidly private sector deployment of advanced information technologies and services to all Americans by opening all telecommunications markets to competition…"*

…as a way to allow the U.S. to foster continued development in technology and infrastructure.

This monumental act of the federal government opened the floodgates of change throughout the communications sector and includes 'Title VII, Section 703' specifically addressing the use of 'Pole Attachments' as one of the primary physical enablers for competition. The regulations would later make their way down to the state level and

require utility providers, such as NOVEC, to allow dual-use of the existing infrastructure for authorized 3rd party vendors.

> *Per VA Code § 56-466.1 a public utility shall permit, upon reasonable terms and conditions and the payment of reasonable annual charges ... the attachment of any wire, cable, facility or apparatus to its poles or pedestals, or the placement of any wire, cable, facility or apparatus in conduit or duct space owned or controlled by it, by such telecommunications service provider or cable television system that is authorized by law, to construct and maintain the attachment, provided that the attachment does not interfere, obstruct or delay the service and operation of the public utility or create a safety hazard.*

Since the introduction of the 1996 Telecommunications Act, new challenges arose as 3rd party vendors continue to utilize utility infrastructure to deliver telephone, internet and television services to customers. While utility poles provide the most convenient mechanism for enabling competition in the communication services sector, regulations are continually revised at the state level to ensure cooperation between utility providers and the communications sectors.

One specific area to note is the sharing of maintenance costs between utility and communications providers. Currently cost burdens fall first on the utility providers as they incur additional overhead including tree trimming, pole maintenance and storm repair. Furthermore, regulations state utility providers are responsible for estimating and seeking approval for the appropriate level before charging fees to 3rd parties covering the additional costs incurred in hosting attachments. This is a time consuming process that takes years to gather sufficient data and necessary evidence before seeking changes to existing fee levels.

This new arrangement hasn't come without its challenges. At the time of this report, the state government has provided no penalty to communication companies who avoid applying for permits and attach additional communication lines to utility poles without permission or notification to the utility provider. Implications for failures in cooperation can lead to significant risks to public safety and also place significant cost burdens on local utility providers when not properly orchestrated.

4.1 Stakeholders

It is worth noting the situation described above can be observed from several stakeholder perspectives. The following is a list of all the active participants involved in enabling local communications providers to leverage utility poles to further distribute infrastructure.

- NOVEC
- Northern VA Government
    - City, County, & State
- Consumers of NOVEC
- Companies requesting 3rd party attachments

It is helpful to understand the breadth of the problem as it is being formulated. Each of the stakeholders has lower level actors that shape the interactions based on their observed utility of the problem and typically have several measures to evaluate potential interactions. This analysis helped the team gain a larger systems view of the problem and see if there were other avenues NOVEC would like to consider within the context of the problem. Options ranged from working to influence the local regulatory policy; local, state, and federal laws regarding the government's role in regulating utility pole management; providing a detailed design solution for process improvement at NOVEC.

It was decided to focus the team efforts on NOVEC's perspective to the problem, specifically on internal process improvement. It was found, through the dialog, that potential ways of effecting lower level outcomes were already being handled in other areas of NOVEC. For instance, NOVEC continues to work with Virginia state government to provide enforcement of the 3rd party attachment permit process. A more detailed decomposition of the stakeholders actors, objects of their system involved and potential resources committed to the problem can be found in Appendix A – Project Problem Definition Approach.

5. Problem Definition

The following are original problem definition statements provided by NOVEC to GMU:

- NOVEC is seeking improvement in its current tracking system for communications attachments to its electric distribution poles
- NOVEC would like to analyze how it might improve both the tracking of the installation of communications attachments and their associated maintenance costs
- Analyze current tracking methods for the installation of communications attachments to their distribution lines
- Determine if it is cost effective to improve the tracking of the installation of communications attachments and their associated maintenance costs

The team followed up with NOVEC to better understand the provided statements and helped the team make several refinements that further clarified the problem definition.

- NOVEC incurs costs associated with handling 3rd party attachments when performing maintenance or servicing infrastructure during outages
- NOVEC is typically not notified when items are added to their infrastructure by 3rd parties
- NOVEC is seeking help identifying where improvements can be made to their current system to improve both estimation & tracking of costs for improving overall cost recapture

After discussion with NOVEC we revised the problem statement; the GMU team will focus on understanding internal process improvements within the NOVEC division, described above, to capture details providing the basis for a gap analysis. This will enable the GMU team to provide recommendations for improvements in the current NOVEC system.

The revised problem definition statements provided significant focus for the team to respond back to NOVEC with a project proposal. The proposal included a Gap analysis, reference design focused on improving tracking of 3rd party installation and overall costs, and a set of requirements based on the design to provide an initial package NOVEC could use to solicit proposals from potential developers. The next section details the analysis, steps taken and results in the form of findings.

6. Gap Analysis

After narrowing down the scope of the project, the most critical areas to focus on process improvement and opportunities to streamline components of the NOVEC system were realized. To best understand the current methods used at NOVEC for the 3rd party permit process, handling of the data in GIS, and how tree trimming is conducted the team requested help from NOVEC to document and experience the process first hand.

6.1 Gap Analysis Overview

In order for the team to adequately understand and then propose solutions for the problems facing NOVEC, the team decided that they should conduct a gap analysis. This gap analysis would serve to educate the team members of current processes, procedures and architectures that NOVEC currently has in place as well as highlight any areas where NOVEC could improve their processes and procedures to solve their current problem. This gap analysis was conducted over the span of the first eight weeks of the project. The gap analysis included phone conversations, email correspondence and in-person site visits and meetings with the various components of NOVEC and their contractors. This gap analysis will lay out methodology by which the team approached the problem statement, examine the data collected through the interviews, correspondence and meetings, provide findings from which to build the new architecture, and to define a solution space for NOVEC to understand in order to solve their current problem (Figure 1).

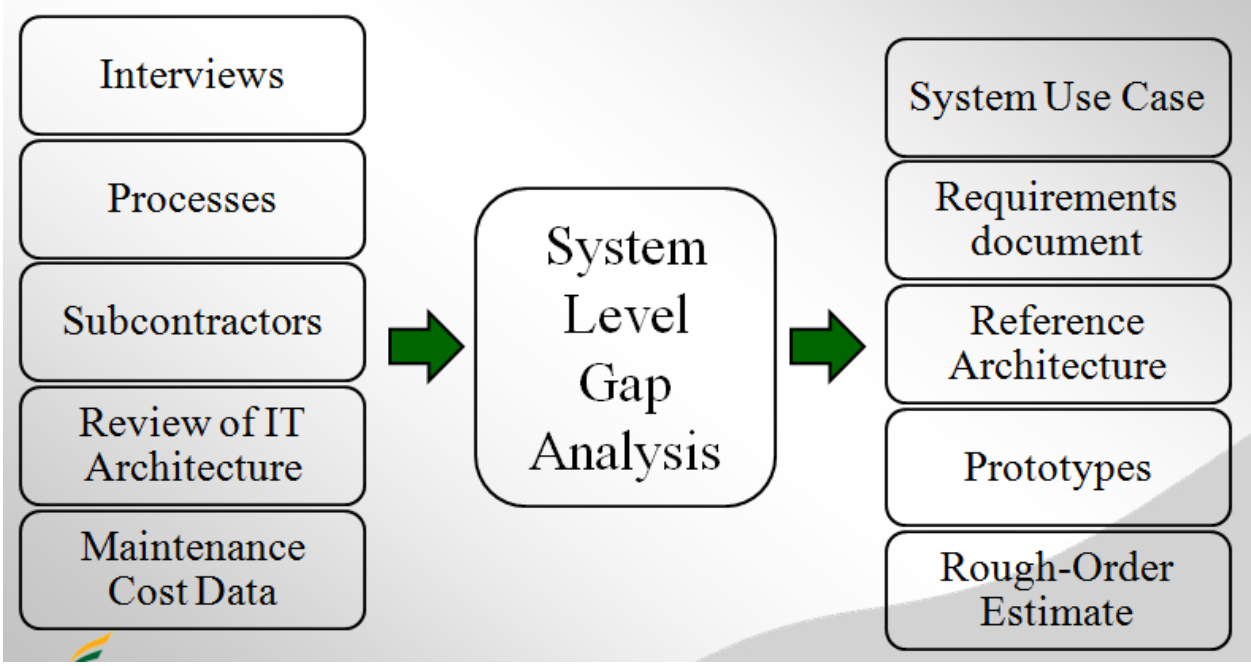


Figure 1: System Level Gap Analysis

6.2 Gap Analysis Methodology

The team took a very active approach to collecting the data to develop the Gap Analysis. The team worked with Mr. Bryan Barfield of NOVEC's Business Applications Group. Mr. Barfield was the team's point of contact within NOVEC who facilitated finding answers to all of our questions and setting up all of our meetings with NOVEC personnel. The approach that the team took included; phone conferences, in person interviews, work site interviews with contractors and an active email thread with Mr. Barfield. Before and after each meeting the team conferenced to determine what they had learned and what new questions arose from the new information. Based upon these meetings, the team was able to develop artifacts and identify current gaps in NOVEC's process. The report below summarizes the findings from the meetings, shows the artifacts developed from the findings and documents the current gaps found by the team.

6.3 Gap Analysis Meetings

On four occasions the team met with NOVEC personnel or contractors in person to conduct interviews on the various subjects. The team also conducted an introductory teleconference with NOVEC before it had any meetings. The first three on-site meetings occurred at NOVEC's home office and were coordinated by Mr. Barfield. The fourth meeting was an in the field meeting with Lewis Tree Service, NOVEC's vegetation management contractor. Through these visits the team was able to come to a better understanding of NOVEC's processes.

Before the team conducted its first on-site interview at NOVEC's Gainesville office, the team was able to have a teleconference with Mr. Barfield to learn about the current issues that NOVEC faces in regard to third party attachments. In attendance in that meeting was Mr. Bob Bission the Vice President for Electric System Development. Mr. Bission gave an overview of NOVEC's current issues with 3rd party attachments. From this overview the team learned the significant use cases concerning 3rd party attachments for NOVEC from their perspective. The three use cases are:

- Right of way maintenance – NOVEC maintains a fifteen foot (15') buffer between its lines and vegetation. When 3rd party attachments are placed on poles it increases the time required for NOVEC's maintenance contractors to do their maintenance. This would then add cost to NOVEC's operational budget.

- Pole replacement – NOVEC performs change orders on its poles whereby they physically replace one pole for another if it is determined that they need to add more capacity or a customer has new demands for service that increase the line size requirement. When there is an unauthorized 3rd party attachment present on a NOVEC pole it causes NOVEC to have to remove its own equipment from the existing pole, move it to the new pole and leave the 3rd party's equipment on the old pole. NOVEC is not authorized to move the 3rd party's equipment or lines from the existing pole to the new pole. NOVEC then has to have the 3rd party come out and move their equipment from the old to the new pole. To finish this process, NOVEC has to go back out to that site and remove the old pole. This causes NOVEC to have to make two trips to the pole to finish the work.
- Storm work – NOVEC is responsible for clearing any downed trees from their right of way and lines downed by the trees. In storms NOVEC is responsible for this clearing on both the 3rd party and their own lines. Currently there is little data that indicates how much of the time the repair takes longer due to 3rd party attachments. Due to the priority of the work crews to restore power to customers, this data is very hard to track.

Based off the use cases that Mr. Bission presented to the team, they asked us to focus on the first two cases (right of way maintenance and pole replacement) for our project. From this the team was able to focus on learning about the pole replacement and the right of way maintenance use cases in order to understand what NOVEC's current processes are and where the gaps exist.

6.4 Current Processes

In the first meeting with Mr. Barfield, the team worked to elicit the current work processes with regard to 3rd party attachments. The team was able to elicit and define four work processes, two of which Mr. Bission described in our original meeting and the third and fourth of which was found by the team during elicitation. These four work processes were termed (and will use for the remainder of the paper), the make ready use case, the tree trimming use case, the pole replacement process and the permitting process. NOVEC's current process flows for the four process use cases are seen on the three pages below.

Make Ready

1. Request for 3rd Party Attachment
   - Includes a route
2. Design Engineering
   - Evaluates the route using GIS & building Codes
   - Conducts a field assessment
3. Design Solutions
   - Approves / Rejects Request
   - Note: NOVEC absorbs costs for rejections
   - Generates work order for installation
   - Generates list of materials
4. Construction Scheduler
   - Generates Job Package
     - Work time estimates
     - Maps & Materials
     - Staking Sheet
       - Inventory & As-built form
   - Note: this doesn't include 3rd party attachment handling requirements
5. Work completed 'In-house' or 'Contracted'
   - Supervisor reviews & signs off
     - As-built list
     - Green Sheet
6. Construction Admins
   - Input units / quantity into WMS
   - Capture deltas from Job Package
   - Note: Time deltas could be attributed to 3rd Party Attachment handling
7. Work Management System
   - Contains final details for Cost Estimate
   - Provides as-built data to Design Engineering
     - Updates GIS
8. Total Cost Estimate
   - Provides bill to 3rd Party Requestor

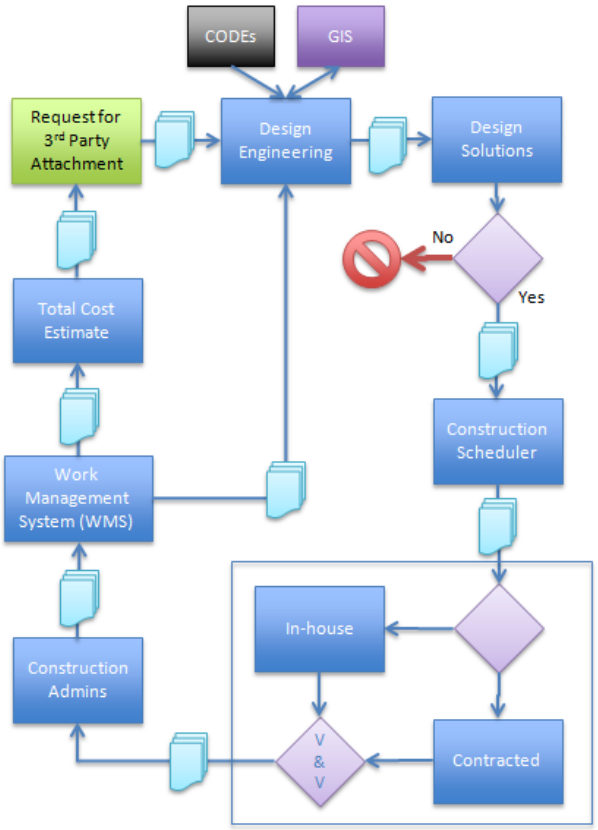


Figure 2: Make Ready Use Case Process

Tree Trimming

1. Trimming required every 3 years (covers approximately 80% of the circuit)
2. Design Engineering verifies new pole locations are included
3. Trimming work is conducted
4. NOVEC tree trimming supervisor reviews trimmed circuit
5. Costs are paid to Tree Trimmer Service

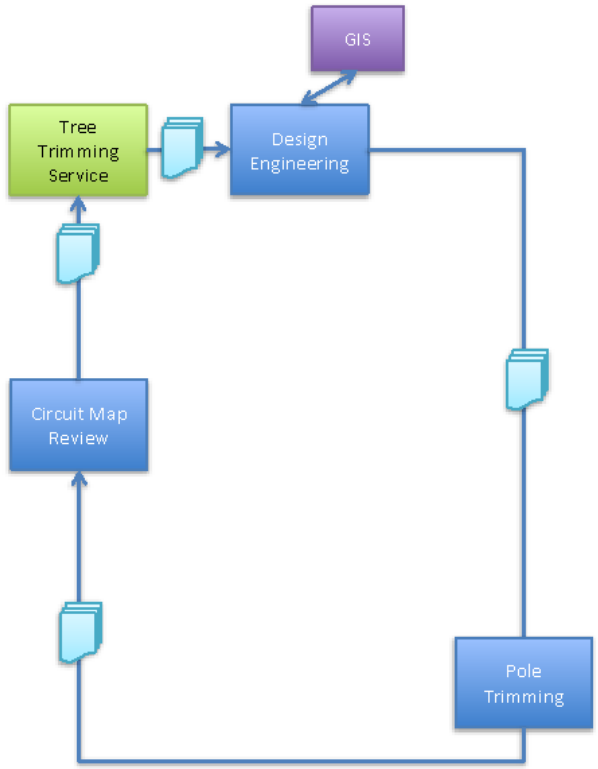


Figure 3: Tree Trimming Use Case Process Flow

Pole Replacement

1. Request for Pole Replacement
2. Design Engineering
   - Evaluates current building Codes
   - Conducts a field assessment
3. Design Solutions
   - Generates work order for installation
   - Generates list of materials
4. Construction Scheduler
   - Generates Job Package
     - Work time estimates
     - Maps & Materials
     - Staking Sheet
       - Inventory & As-built form
   - Note: this doesn't include 3rd party attachment handling requirements
5. Work completed 'In-house' or 'Contracted'
   - Supervisor reviews & signs off
     - As-built list
     - Green Sheet
6. Construction Admins
   - Input units / quantity into WMS
   - Capture deltas from Job Package
   - Note: Time deltas could be attributed to 3rd Party Attachment handling
7. Work Management System
   - Contains final details for Cost Estimate
   - Provides as-built data to Design Engineering
     - Updates GIS
8. Total Cost Estimate
   - Used for overall overhead reporting to be included in total electricity costs

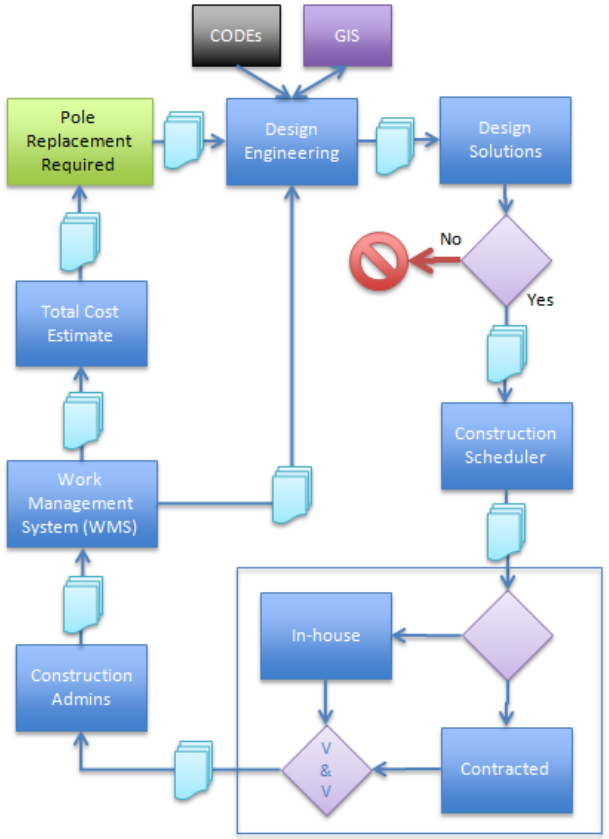


Figure 4: Pole Replacement Use Case Process Flow

Permit Process

1. Is this a new 3rd party attachment?
   - If YES go to step 2
   - IF NO go to step 6
2. Request for 3rd party attachment initiated by 3rd Party
   - 3rd party must fill out NOVEC's joint use and request form (PAPER)
   - 3rd party fills out the details of the pole and the attachment they want to place
3. NOVEC Admin Services Manager takes receipt of 3rd party attachment sheet
   - Delivery done BY HAND to NOVEC's main office
   - Payment delivered at that time by 3rd party
4. NOVEC Design Engineers Evaluate
   - Determination made if the pole needs to be changed in order to accommodate
   - If YES go to MAKE READY USE CASE process flow
   - IF NO follow the arrow to next step in process flow
5. NOVEC Admin Services team adds new 3rd party data
   - Data is placed into billing database for future annual billings to 3rd parties
6. Existing 3rd party attachments database
   - Database kept to invoice 3rd party users yearly per agreement fees

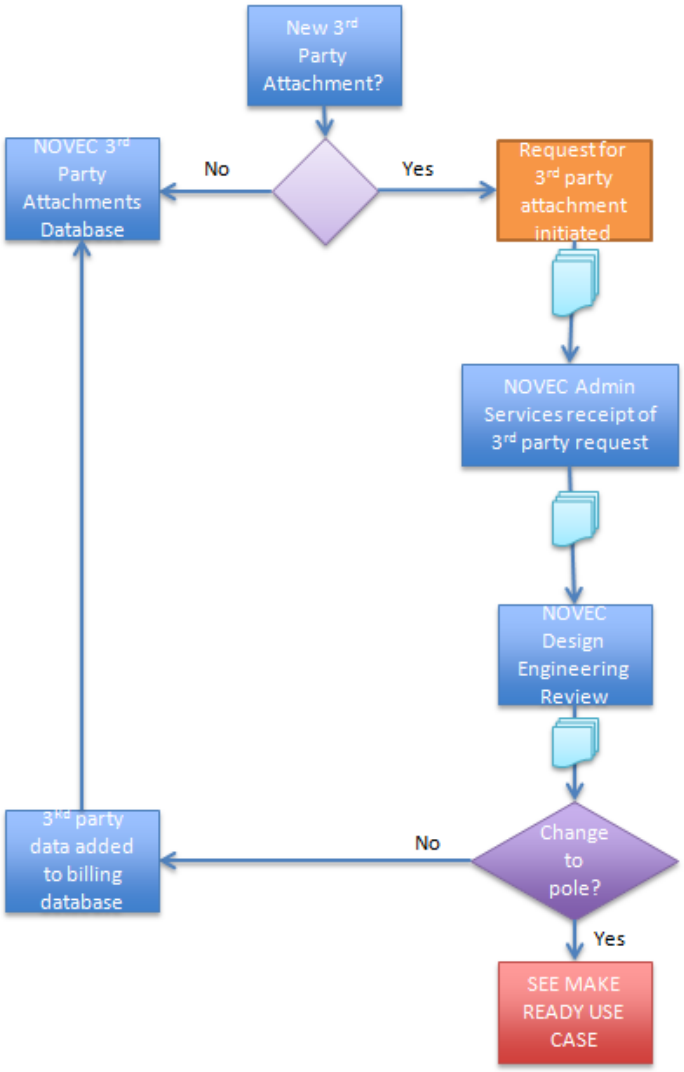


Figure 5: Permit Use Case Process Flow

What the team found from this interview was that NOVEC still heavily relies on a paper driven process for 3rd party attachment tracking. In the processes outlined above NOVEC uses its IT system to transfer information to and from many nodes, however, getting any new information on a 3rd party attachment or even updating old 3rd party attachment information in the GIS and WMIS systems is completely left out of the make ready, tree trimming and pole replacement processes above. Currently, even if there was a discovery of a new 3rd party attachment, there is no step in the make ready, tree trimming or pole replacement processes that causes the field worker to note it or return that information back to the home office where it would be able to be incorporated back into the NOVEC pole database. This was one important finding of the gap analysis.

6.5 Decennial Census

The team learned about NOVEC's decennial census of their 60,000 poles. This census was taken last in 2010/12. In it, NOVEC hired a contractor, Davey Resource Group, to go survey each and every one of their poles and locate it properly in space (verify the pole's location), determine the type of pole it was and catalogue each attachment on the poles, to include 3rd party attachments. This survey cost NOVEC $427,016 to conduct and took 22 months to complete. This survey by Davey Resource Group included checking every pole in the system for 3rd party attachments and performed the requisite measurements to ensure that there were correct clearances between the poles and the road, trees and the 3rd party attachments. The data output from this survey was a Microsoft Access database and Microsoft Excel spreadsheets. These pieces of information were then incorporated into the already existing GIS databases that NOVEC uses to update the pertinent pole information. The team was given the excel output to analyze by NOVEC. This spreadsheet had 11 columns of unique information either found in the survey or compiled as a result of the survey. This information included pole ID number, pole material, pole height and 3rd party attachments on a pole and whether or not they were authorized. The important item that was learned from this data was that during the survey, as information came into the home office from the field, the home office team assigned to this project had to (in many cases) search through paper files to find out if there were permits on file for that pole and that company's attachment. The whole process of finding non-compliant 3rd parties was manually done. This was another item that highlighted to the team the need to help NOVEC automate some of these processes.

6.5.1 Census Data Analysis

The team performed data analysis on this information. Several items of note for this gap analysis were found. The first is that on 56% of the poles there is no 3rd party attachment. Verizon is the company with the most 3rd party attachments. They have attachments on 32% of NOVEC's poles. They are followed by Comcast and Cox in population. As a part of this analysis the team graphed the breakdown of poles and 3rd parties on poles. This breakdown can be seen in Figure 6 below.

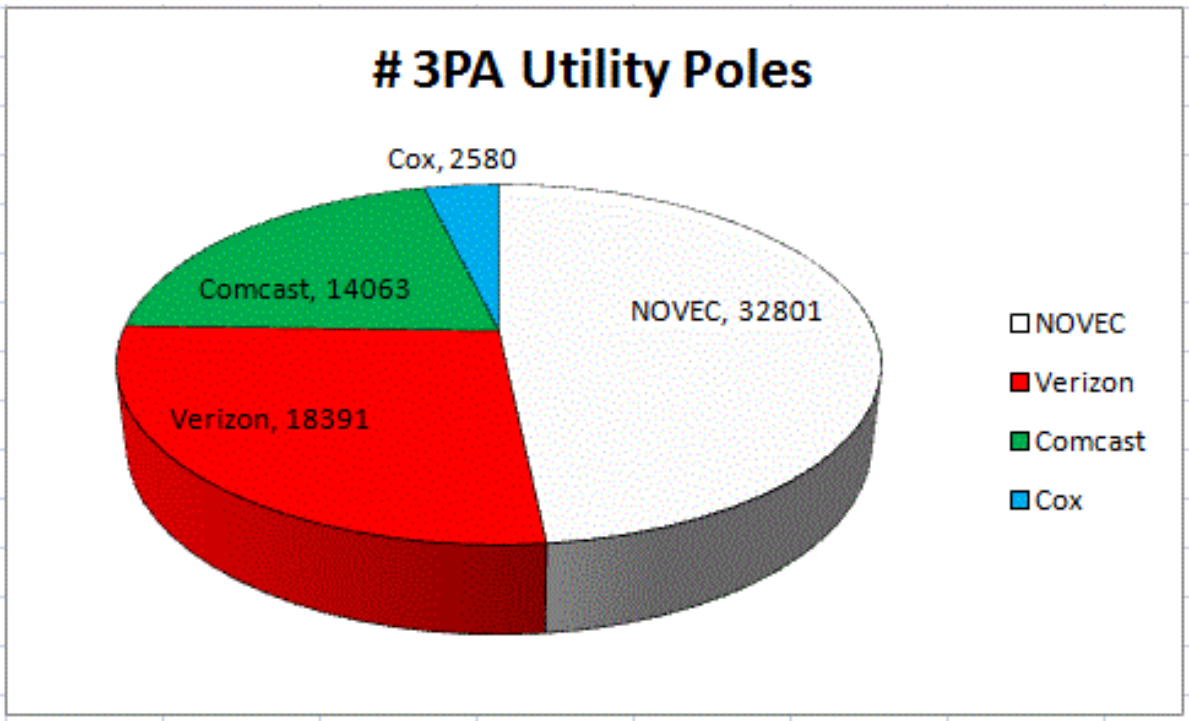


Figure 6: Distribution of 3rd Parties on NOVEC Poles

The team also performed an analysis of the data to understand where NOVEC had poles that had more than one 3rd party who had attachments on the same pole. (e.g. Comcast and Verizon having attachments on the same pole.) Figure 7 shows the breakdown of these various combinations.

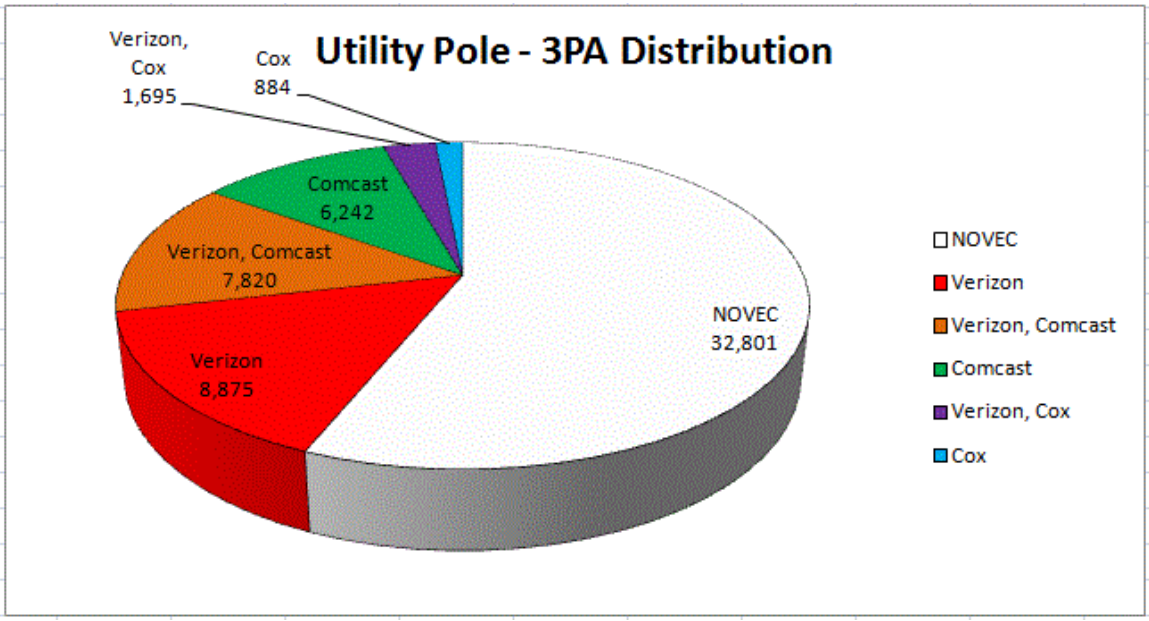


Figure 7: Distribution of Pole Usage

Another interesting piece of data for this problem that was found during the analysis of the survey data was when the team compared the number of 3rd party attachments to the number of permits on file. Below in Figure 8 the disparity between the number of permits on file and the number of attachments for Joint Use Poles (JUP) is shown.

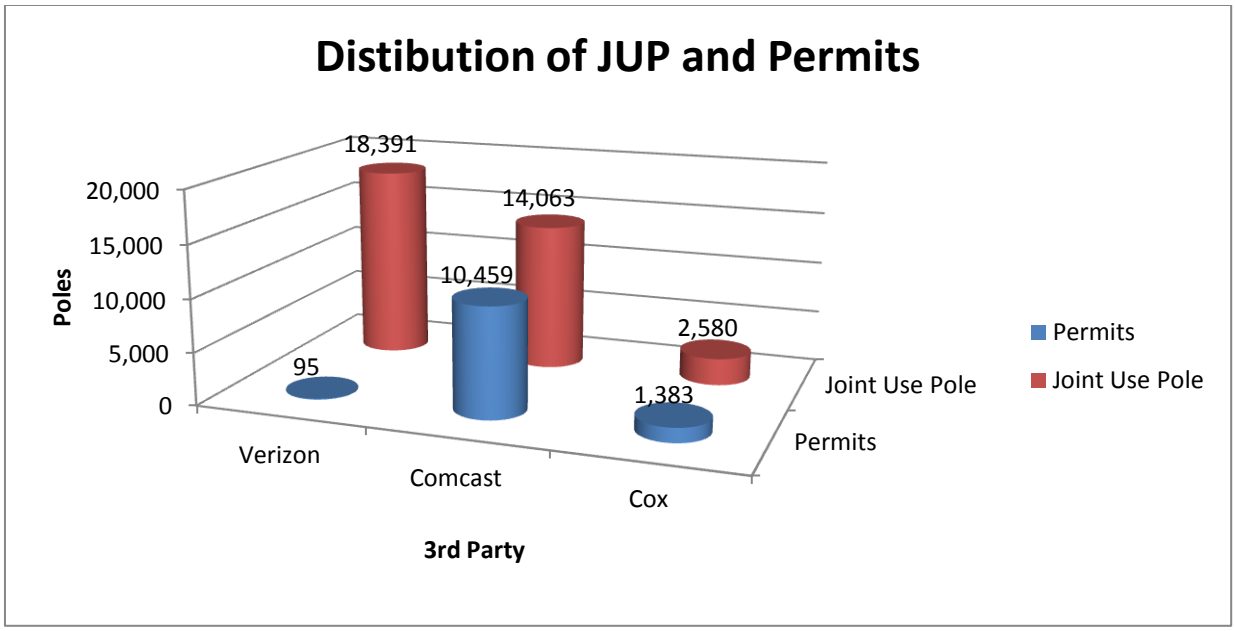


Figure 8: Permits vs. Actual Attachments for 3rd Parties on NOVEC Poles

What is illustrated in this graphic is that there is a large disparity between what NOVEC is able to bill (based off permits) and what is actually on their infrastructure. Verizon has a compliance rate of less than 1%. Comcast has a compliance rate of 74%. Cox has a compliance rate of 54%.

The team believes that one factor that contributes to this lack of compliance is the fact that the current permitting process is done on paper. Even more challenging is the fact that one paper request has to be completed for each pole with an attachment. (see Appendix D - Artifacts from the Gap Analysis for an example of a current form that the 3rd parties are filling out) There is not an easy interface that tracks these requests formally or enters them into a NOVEC database that will tie back to the Work Management and GIS Systems. This was identified as a current gap. NOVEC does not have any automated way to enable easier compliance by the 3rd parties. Making this process automated will help NOVEC track new requests and make it compellingly easy for the 3rd parties to comply with the correct process.

6.5.2 GIS and Census data analysis

As a part of our data analysis efforts the team requested and received the entire set of pole GIS data from NOVEC. A member of the team then wrote a small program to correlate the pole ID number in the excel census data to the pole ID number in the GIS file. That merged data was then overlaid into a Google Earth map and the poles were plotted over top of a map. What resulted was a display of where these poles existed. This info-map also breaks down the 3rd party attachment company's locations on NOVEC poles. The following figures show these breakouts by location.

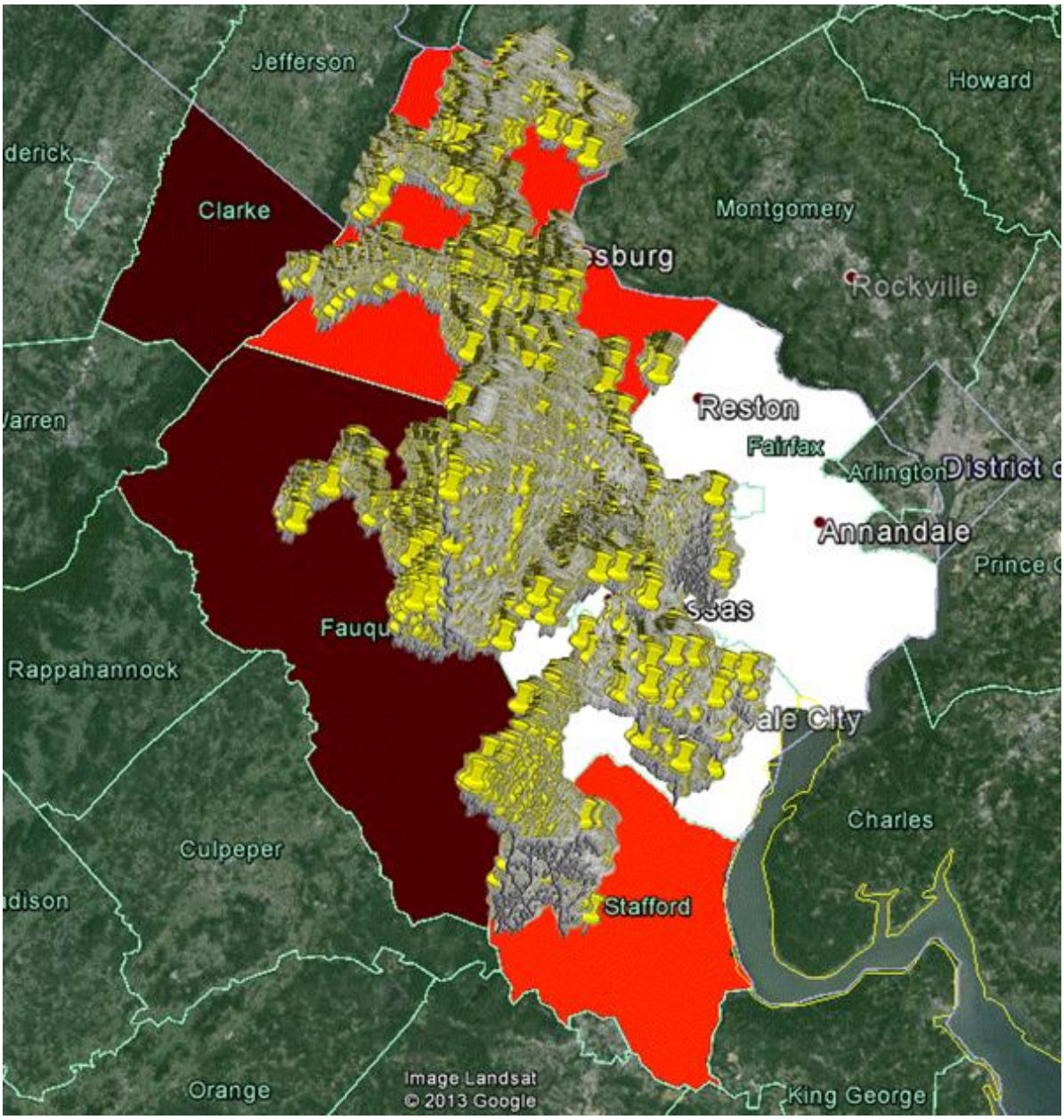


Figure 9: NOVEC Total Utility Pole Distribution

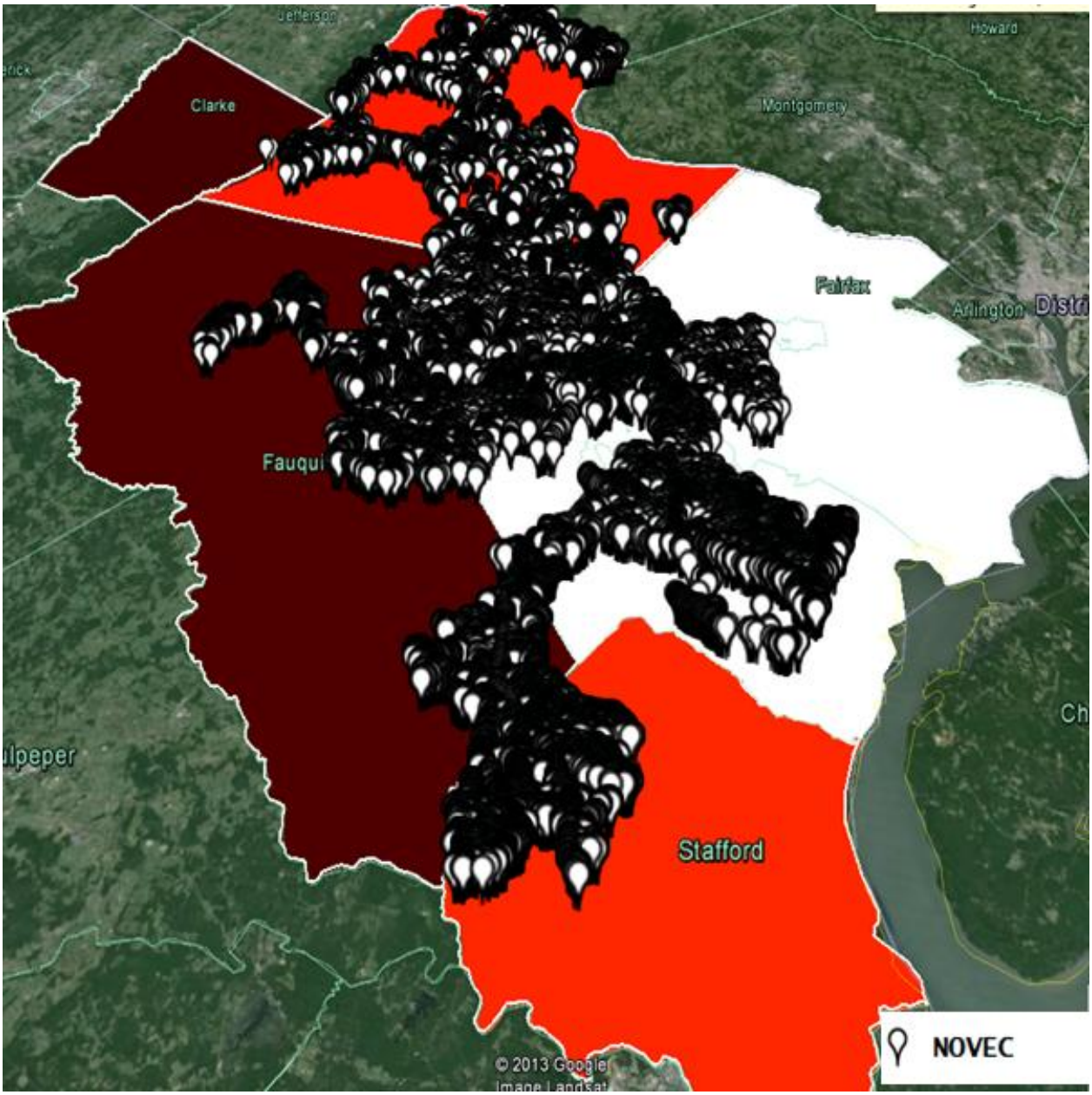


Figure 10: NOVEC use only poles

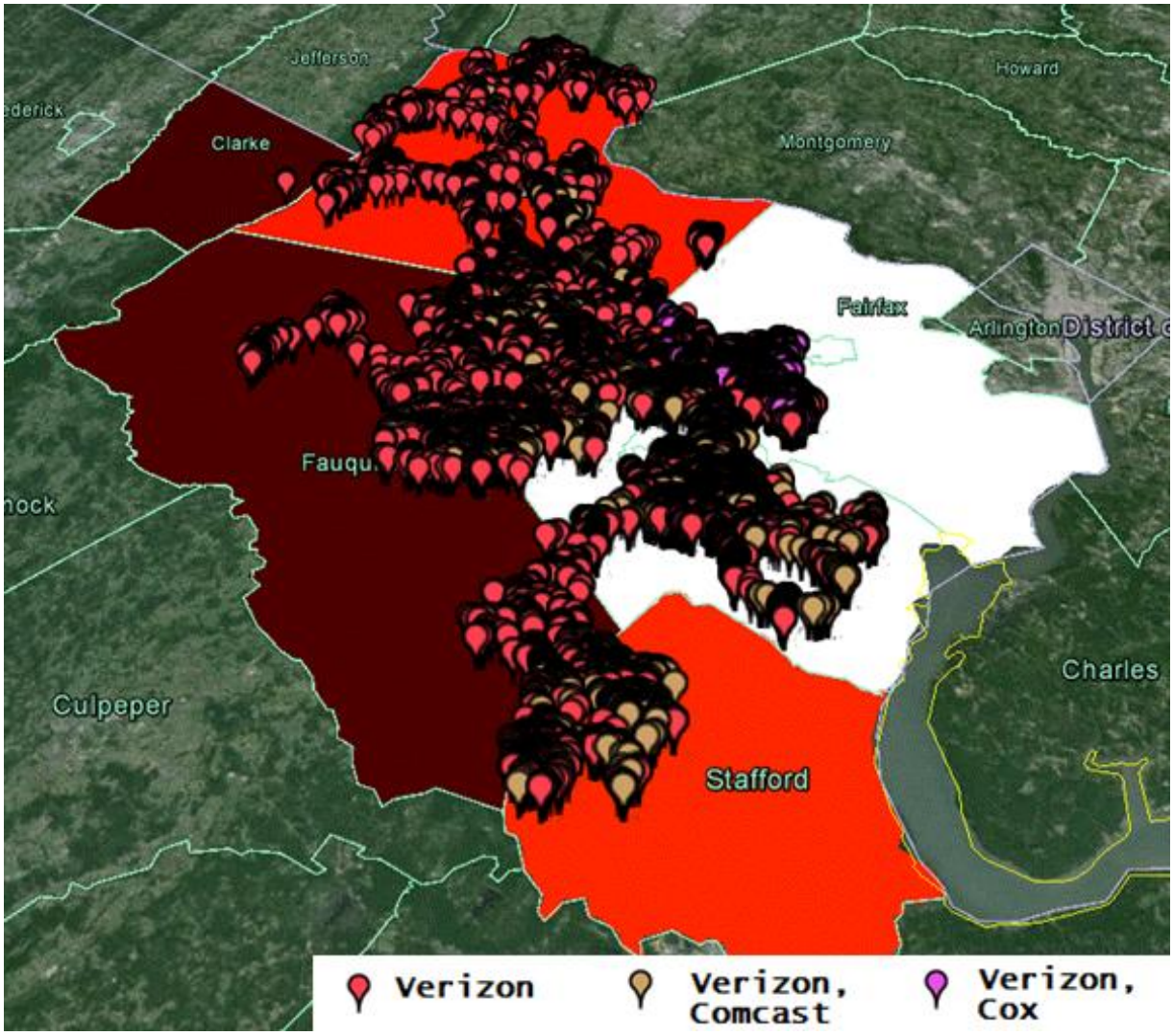


Figure 11: Verizon Poles

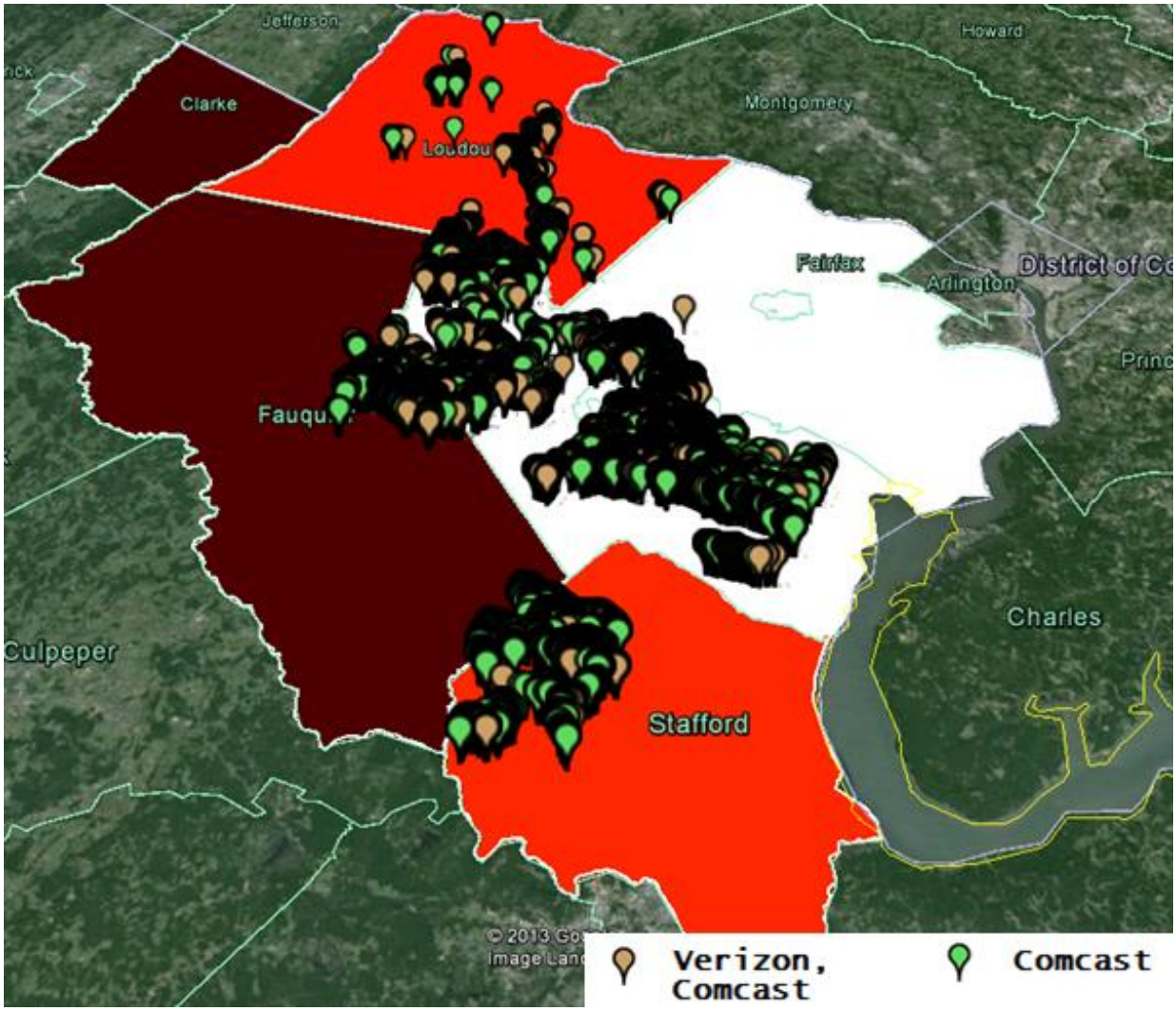


Figure 12: Comcast Poles

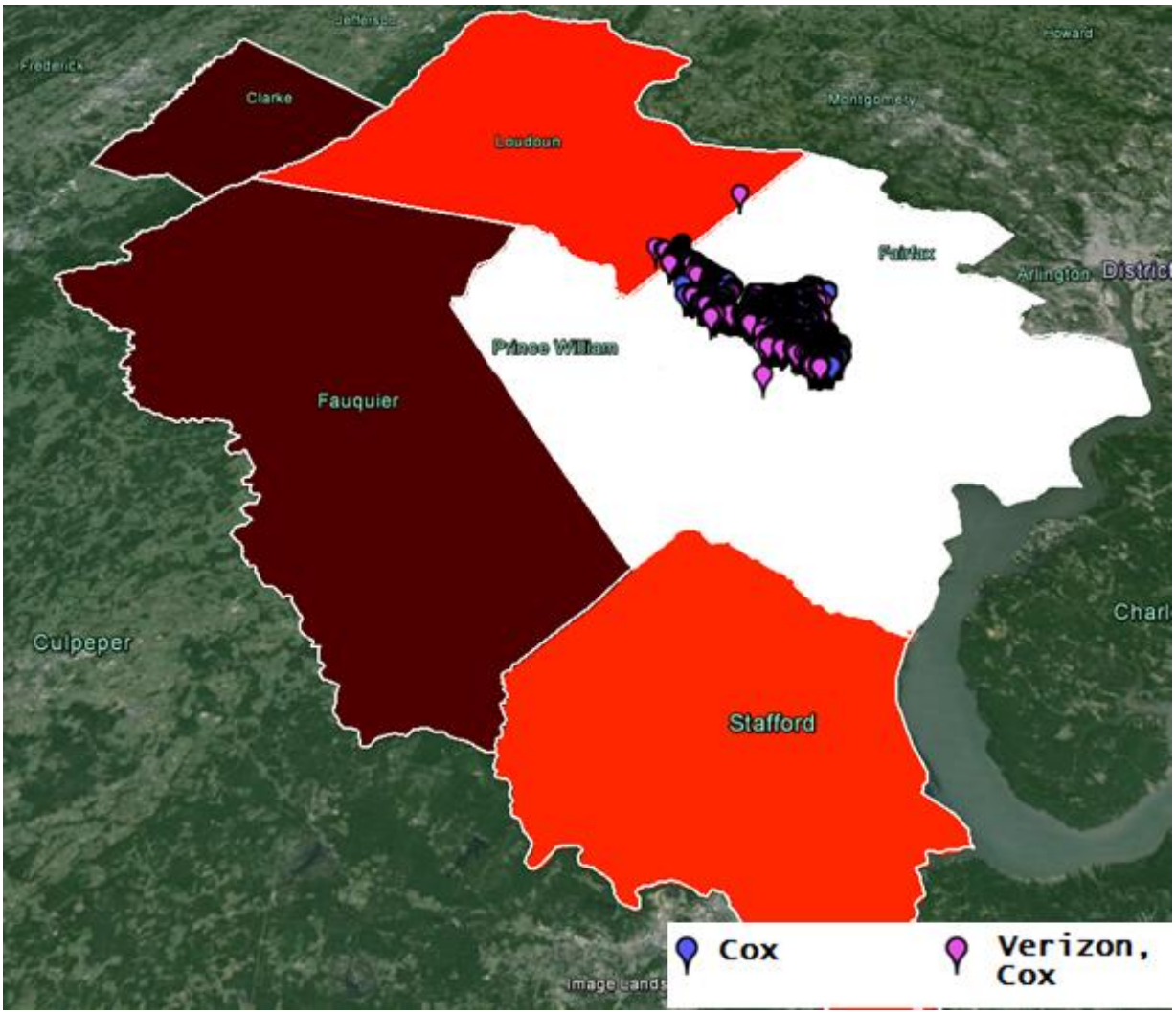


Figure 13: Cox Poles

The team created the above graphics to help us understand where these distributions lie and how dense they were in NOVEC's territory. These graphics, while not necessarily applicable to helping us find the problem, did help us understand the scope and magnitude of NOVE's issues.

6.6 NOVEC's Current IT Infrastructure

NOVEC, being a utility company has a very complex IT infrastructure. One of our colleagues in SYST 599, Alireza Bitaraf Haghighi, (Team Cloud Computing) had worked for NOVEC as an intern this past year. Because of this experience with NOVEC, Ali was able to provide our group with a wire diagram (system interface) of NOVEC's current IT infrastructure. This wire diagram shows the data sharing relationships between the different components of NOVEC's IT infrastructure. Figure 14 shows a wire diagram of the various programs and systems within NOVEC's current IT infrastructure.

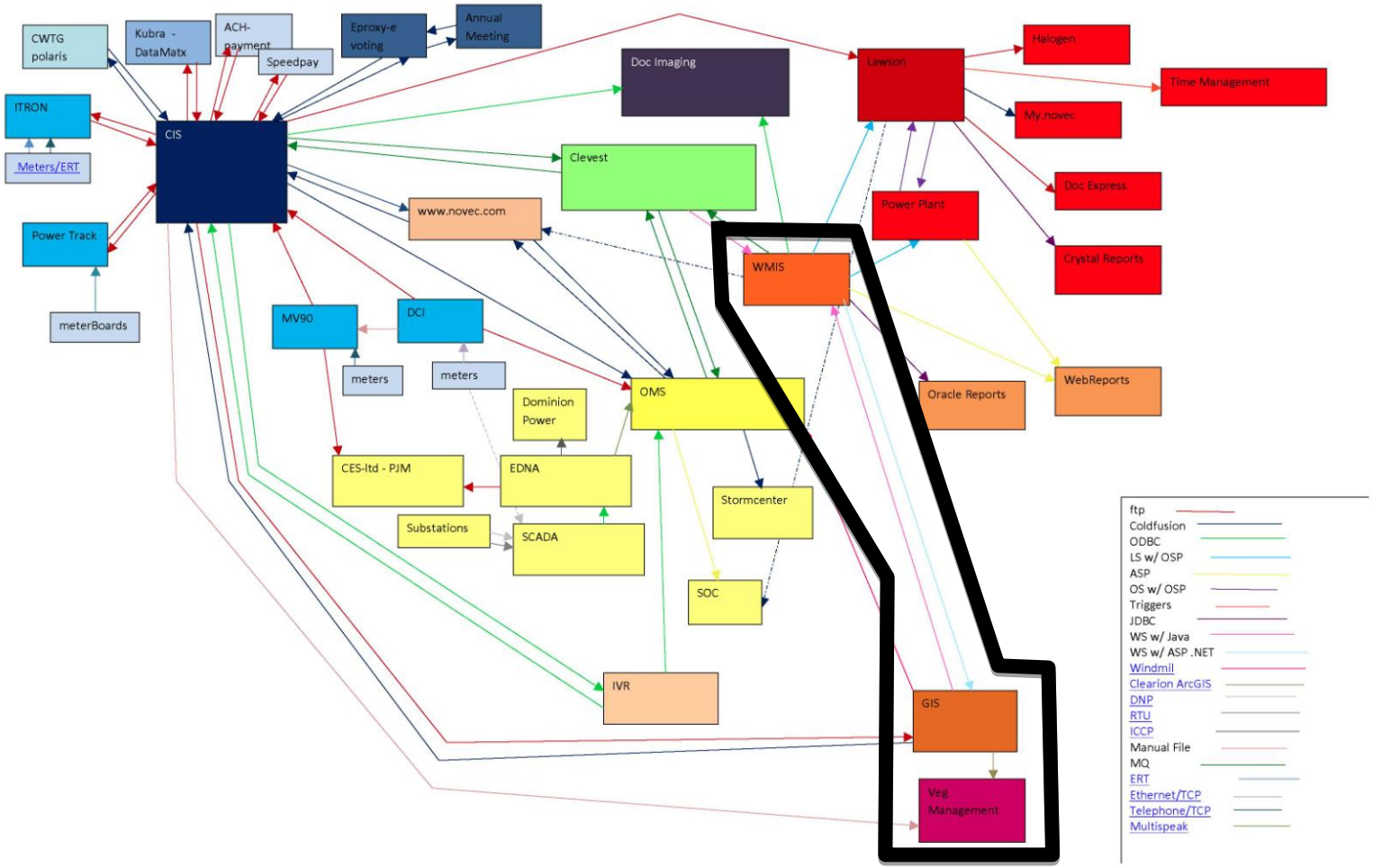


Figure 14: Wire Diagram of NOVEC's Current IT Infrastructure

Of interest to the group was section of the infrastructure that is outlined in the black box in the Figure 14. These three items are the GIS system, vegetation management system and the Work Management Information System. The team limited the project's scope to these systems after meeting with Mr. Barfield and coming to understand that these were the areas of the infrastructure that our particular problem intersected with the most.

6.7 Work Management System

The central IT system for this problem set is NOVEC's Work Management System (WMIS). The WMIS is central because this is where all of the inputs and outputs for doing work occur. The WMIS controls the flow of work and billing from the central office to where it is executed in the field. The WMIS is how the field-work is communicated within NOVEC. The WMIS works as follows: The designer engineers create a work request in order to add to or change a pole. The basic information, after being verified by the engineers, is entered into WMIS. This information includes the GIS data on the pole, the bill of materials for how to construct the work (staking sheet), and the design cost estimate. This request, once completed in WMIS is then printed off and dispatched to a crew to do the job.

While this type of 'make ready' work only accounts for 3-4% of NOVEC's annual requests, the team found several deficiencies with the system. Again, this is a paper driven process. Once the work request is created, it is printed and handed to a work crew. The team found that on the staking sheet there is a column labeled 'as-built.' This column allows the field crew to make changes to the estimate to accurately reflect what is on the pole so the data can be updated in the GIS system. What is not on the staking sheet is any indication that the pole in question to be modified has any third party attachments on it. Therefore there is no linkage between the data that NOVEC has in its GIS system on third party attachments and what is actually seen in the field.

The team feels that this is a significant gap because if the work crews are not prompted to observe or record any information on the 3rd party attachments that are present on the pole, they have no incentive or knowledge to alert NOVEC when there is a discrepancy on the pole. A very simple solution to this is to modify the WMIS system to add this prompt to the staking sheet. Not only would this prompt the field crew to look for the 3rd party attachment and figure out if it is authorized but it also helps to close the loop back at the main office. This then keeps the data in the GIS current for those poles which are visited. In an early meeting with Mr. Barfield, the team was provided with a copy of a work request. This copy can be found in Appendix D - Artifacts from the Gap Analysis.

6.8 GIS System

NOVEC has a well-established GIS system. During the course of the semester the team was able to meet with NOVEC's GIS team leads. From this interview we were able to learn about their GIS system. The team was also given a copy of NOVEC's GIS pole database to utilize for our own analysis of the problem. NOVEC uses ArcGIS as their basic GIS system. ArcGIS is an ESRI GIS software product that allows NOVEC to have access to geographical data for their service area. On top of ArcGIS they use a Schneider Electric product called ArcFM. ArcFM is a piece of software that sits on top of ArcGIS and allows for NOVEC to work with Schenider to customize the GIS platform to its needs. ArcFM is customized specifically for NOVEC's needs as a power utility.

The features within ArcFM the team was concerned with for this project were pieces of metadata related to 3rd party attachments. The team found that although NOVEC has updated its GIS platform to include an attribute of metadata related to 3rd party attachments within their GIS database, the data is only as good as the last survey's data. This means that there is no current plan to keep the data fresh and current. This was identified as a gap in their current system. Another gap identified within the GIS system is that there is no current link between the GIS system's 3rd party information and the WMIS. This means that even though the GIS system has a metadata layer for 3rd party attachments, this metadata is not transferred to the WMIS' database. Due to this there is a gap present since the data is present but never moved to the WMIS where the data could be included in a Work Request. This is another place where the field crews could help close the loop on newly found 3rd party attachments when they are in the field. The GIS metadata not being linked back to the WMIS system also does not allow the billing section to be able to bill the 3rd parties based upon the poles in the system. This is another gap we identified in the current GIS system.

6.9 Vegetation Management System

The vegetation management system is another subset of NOVEC's IT infrastructure. The Vegetation Management System is a subset of the ArcFM GIS program. NOVEC trims all of the trees and vegetation along its right of way over a three year period. After the entire circuit is completed, the circuit begins again. This maintenance work is accomplished in the field by tree trimming crews who are subcontractors to NOVEC. The team was able to go out to the field and interview one of these crews while they were performing work. What the team found was that these crews are given a circuit map by NOVEC's tree trimming supervisor Mr. Rick Carpenter. Mr. Carpenter works with the GIS team to generate these circuit maps. These maps are generated from the GIS system and keep track on where in the entire NOVEC circuit the tree trimming teams have been and where they need to travel to next. Once the contractor is finished with their operation Mr. Carpenter and/or one of his colleagues will drive the circuit and verify that the work has been done to NOVEC's standards. The team determined that this provides NOVEC with an opportunity to have the supervisor update the system during the trimming circuit inspections. A copy of one of the circuit maps is in Appendix D - Artifacts from the Gap Analysis.

6.10 Cost Recapture Opportunities and Trend Analysis

As part of the system gap analysis we decided to project the survey and permit application results forward ten years from the completion of the 2010-2012 survey. The GIS database indicates 966 new poles were added to the NOVEC system during 2012. Through the first nine months of 2013, NOVEC added 1011 poles to the system, with the last 12 months averaging 1260 new utility poles per year. Based on the permitting history for Verizon, Comcast and Cox we project the distribution of new, JUP, permitted and unauthorized 3PA through 2022 (see Figure 15).

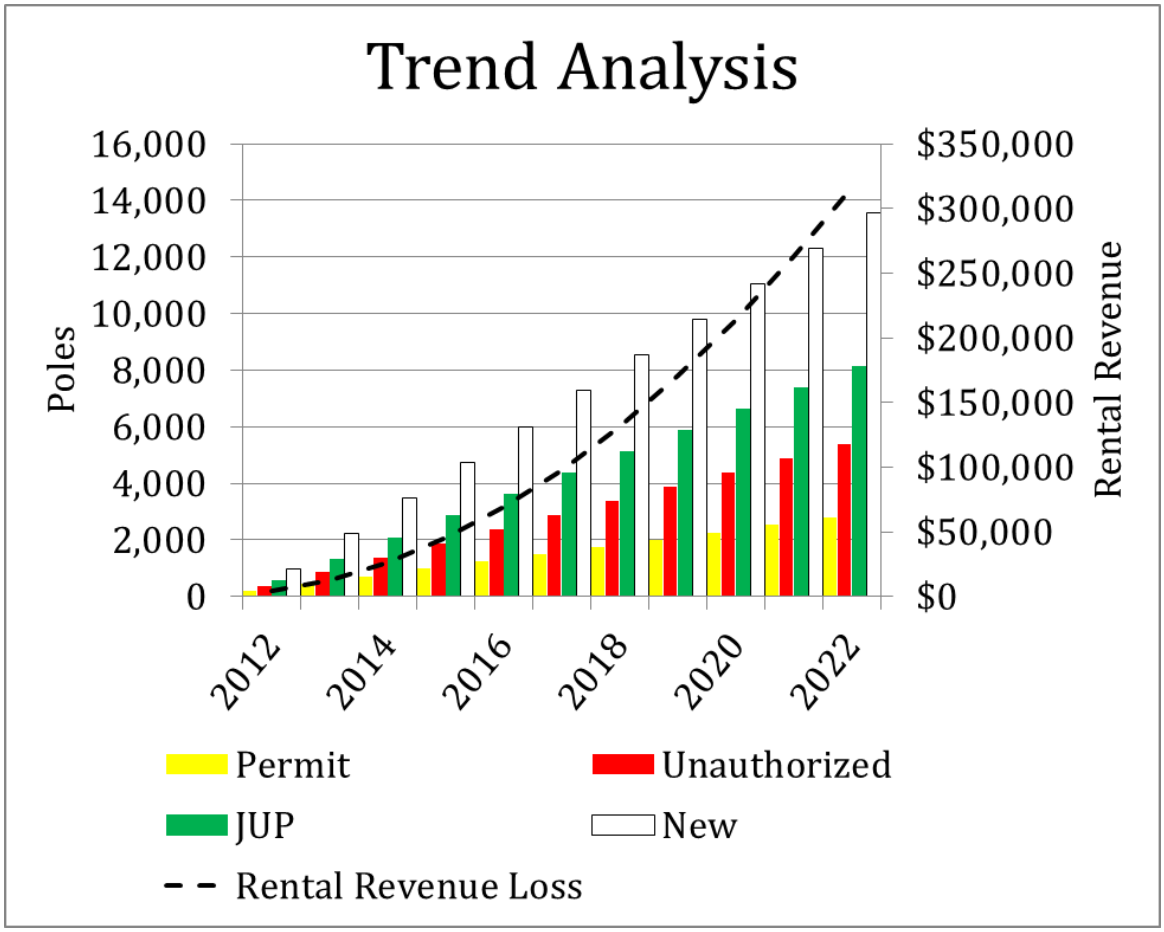


Figure 15: Ten Year JUP Trends

According to the FCC, the "rental rates for each foot of utility pole attachment space paid by communications companies to attach to a utility pole vary widely—from approximately $7 per foot per year for cable operators to $10 per foot per year for competitive telecommunications companies to more than $20 per foot per year for some incumbent local exchange carriers (ILECs)", http://www.broadband.gov/plan/6-infrastructure/. To calculate lost rental revenue, we utilized a figure of $10 per foot per year for each company attaching to NOVEC's infrastructure.

In further discussions with NOVEC, they indicated that an approved permit application would fall into one of two categories of Make-Ready Work.

- $4k - $5k per pole for upgrades or pole replacement
- $500 per pole for moving lines to comply with safety standards

NOVEC stated Make-Ready Work distribution for these categories is 50% each, yielding an annual loss of Make-Ready work associated with 3rd party attachments of $1.25 million per year. This appears to be the major disincentive for telecom and cable companies to comply with NOVEC's permitting process.

6.11 Summary of Findings

Over the course of this analysis the team found several gaps which NOVEC can exploit in order to better understand their costs associated with 3rd party attachments. Possible solutions to these gaps will be explained in the following sections. Below is a summary listing of the gaps identified:

Finding #1: NOVEC relies heavily on paper and informal processes

The team found that many of the processes associated with NOVEC's 3rd party attachment problem are still handled in paper or are done informally (email or phone calls). The current permitting process is done on paper and is usually turned in by the 3rd party to NOVEC in person at their offices. This process is very informal and makes it very convenient for a 3rd party to ignore the entire process. The team feels that there needs to be a more formal process for 3rd parties to go through. Not only should this process address the application and payment process but also the addition of the GIS data back into the system.

The current work requests are still completed on paper. These work requests are not married electronically between the field workers and those engineers generating the requests in the office. This process has the redundant step of having the field worker transcribe what actually happens in the field and then someone has to enter that data back into the WMIS system. These paper processes are informal and do not make it easy for data to come from the 3rd parties or back from the field and end up in NOVEC's current GIS database. There is no current way to close the loop on any newly discovered 3rd party attachments.

Finding #2: NOVEC's GIS Database has current 3rd party attachment data with no process to maintain

The team found that while NOVEC made a considerable investment in their decennial census to map all of their poles, no effort was made to make this data useful to the WMIS. Because this data does not migrate back into the WMIS there is no place on the work requests for the field workers to be prompted to look for 3rd party attachments when they are out in the field. Since the field workers do not have any way to document this data, even if they notice something is different on the pole with regards to a 3rd party attachment, they can take no action on NOVEC's behalf to report their findings. The team also found that the make ready use case only covered 3-4% of the entire circuit in a given year. This means that a NOVEC electrical work crew will most likely never cover 100% of their territory in a timely manner (>10 years). The team did find that the tree trimming crews do cover 100% of NOVEC's territory every three years. If the 3rd party data could be maintained by NOVEC, it would allow them to cut costs to their decennial census.

Finding #3: Large opportunity exists to improve recapture of costs from non-permitted joint use

Based upon the basic cost data assumptions and analysis of 3rd party attachments above, the team identified a significant amount of money that NOVEC is losing out on in the current process. While NOVEC understands this very well, there are very few current mechanisms by which NOVEC can enforce the need to have the 3rd parties permit their attachments. Currently there is no regulatory governing body which would serve to help NOVEC enforce the agreements with the 3rd parties.

7. Solution Space

The system NOVEC has in place for handling 3rd party attachments on their utility poles has opportunities for efficiency gains with the following focus:

1. Improve the process for handling pole permits
2. Improve opportunities for employees to audit joint use in the field and within the GIS database
3. Provide a single database for storing information about all 3rd party attachments

The above statements do not prescribe a design solution; they describe the functions that would enable NOVEC to further improve the system performance. To verify these statements are feasible and also inform a set of system requirements necessary to describe a set of system functions that would provide the improvements in NOVECs system a reference design was generated. Along with the reference design a set of sequence diagram (see Appendix C – Reference Design Sequence Diagrams) were also generated to further inform the requirements and interfaces to validate the overall intent of the proposed system.

8. Reference Design

Based on the analysis of current NOVEC business processes, the team identified a number of enhancements designed to address the problem statement identified in the section titled Problem Definition. Figure 16 represents a System Use Case of related business processes with new stakeholder interactions represented.

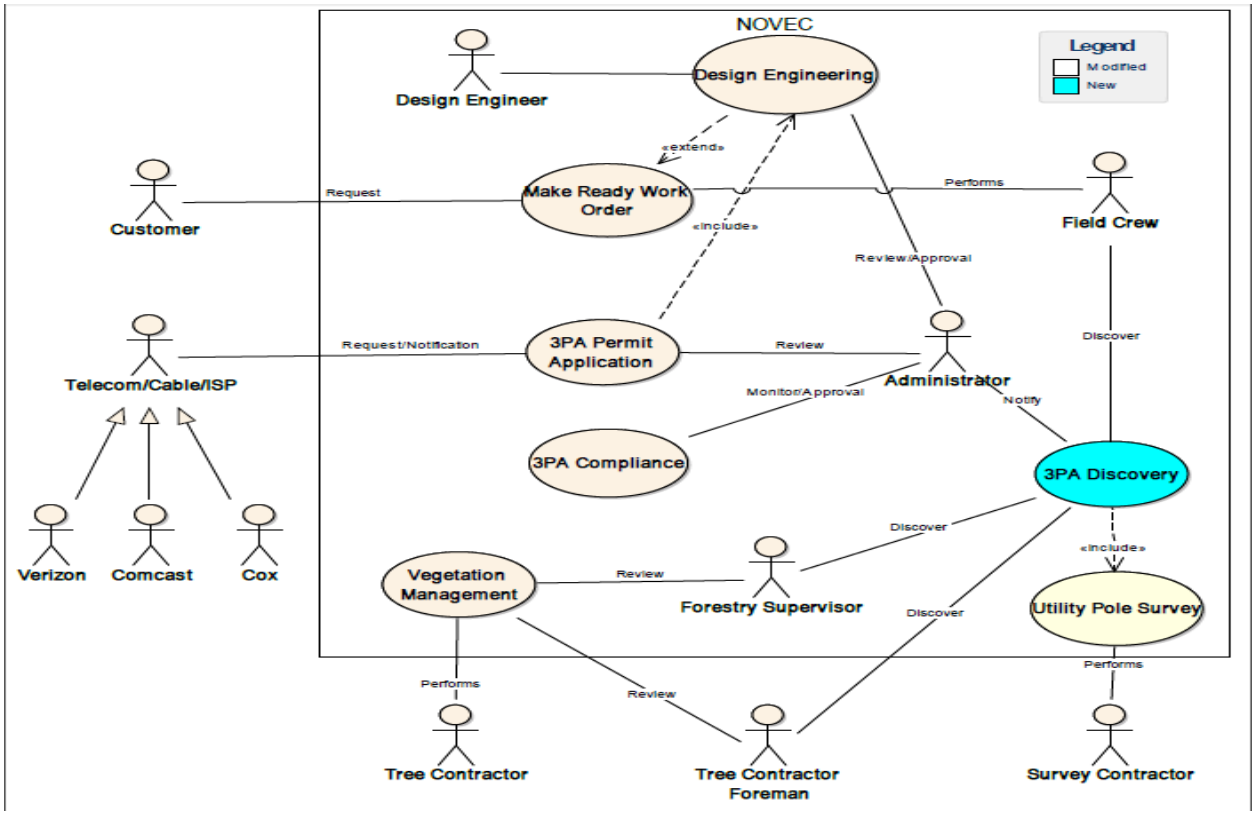


Figure 16: NOVEC System Use Case recommendations

8.1 3PA Permit Application

The principal external stakeholders in these processes are those companies attaching to NOVEC's utility pole infrastructure, i.e. Verizon, Comcast and Cox. The 3PA Permit Application use case is the principal interaction of Telecom, Cable and ISP's with NOVEC and as identified in the Gap Analysis, represents the biggest gap identified in current business processes. The root causes associated with non-compliance for this process are addressed in two fashions: (1) Simplify and automate the Permit Application process by providing a secure and intuitive service to handle request by 3rd party companies. Transitioning from a paper-driven process to a digital work flow will simplify data input by 3rd parties, while automating the internal distribution and approvals to appropriate NOVEC personnel. Secondly a digital work-flow will speed up the approval process. Finally, approved permit applications will be incorporated into NOVEC's IT system for future reference. Figure 17 is a prototype of the 3PA Permit Application use case. By providing real-time access to NOVECs JUP data, 3rd parties are able to quickly and accurately submit a permit using a secure web portal.

Figure 17: 3PA Permit Application Prototype

The revised 3PA Permit application process segues into both the Make Ready Work and Design Engineering use cases, providing design engineers access to application data electronically as well as provided geo-referenced imagery for the application. Here 3rd Parties would be required to capture a photo of the pole and enter relevant attribute information. This calibrated photo is then used to measure the attachment heights. This information is used when applying for a permit as it clearly shows the heights of the proposed attachment points as depicted in Figure 18and Figure 19 below.

Figure 18: 3PA Permit Application attachment (before)

Figure 19: 3PA Permit Application attachment (after)

Finally 3rd parties would submit an image of the as-built system taken by the line crew or contractor as verifiable proof that the permitted work was performed to specification (Figure 19). In this scenario, the design engineer would be able to review and approve applications without having to perform a physical inspection of the utility pole, again expediting the permit application process. Communications between NOVEC and 3rd parties would be captured for compliance and auditing purposes.

8.2 3rd Party Attachment Discovery

A new 3rd Party Attachment Discovery use case is proposed for NOVEC to mitigate the existing problem of un-authorized attachments to NOVEC infrastructure. In this scenario, we propose NOVEC adapt processes for the Tree-trimming review work executed by subcontractor foreman and the Forestry supervisor. The concept is to provide these stakeholders with an updated circuit map (used to execute tree-trimming routes by crews) with color-coded joint use indicators per pole (see Figure 21).

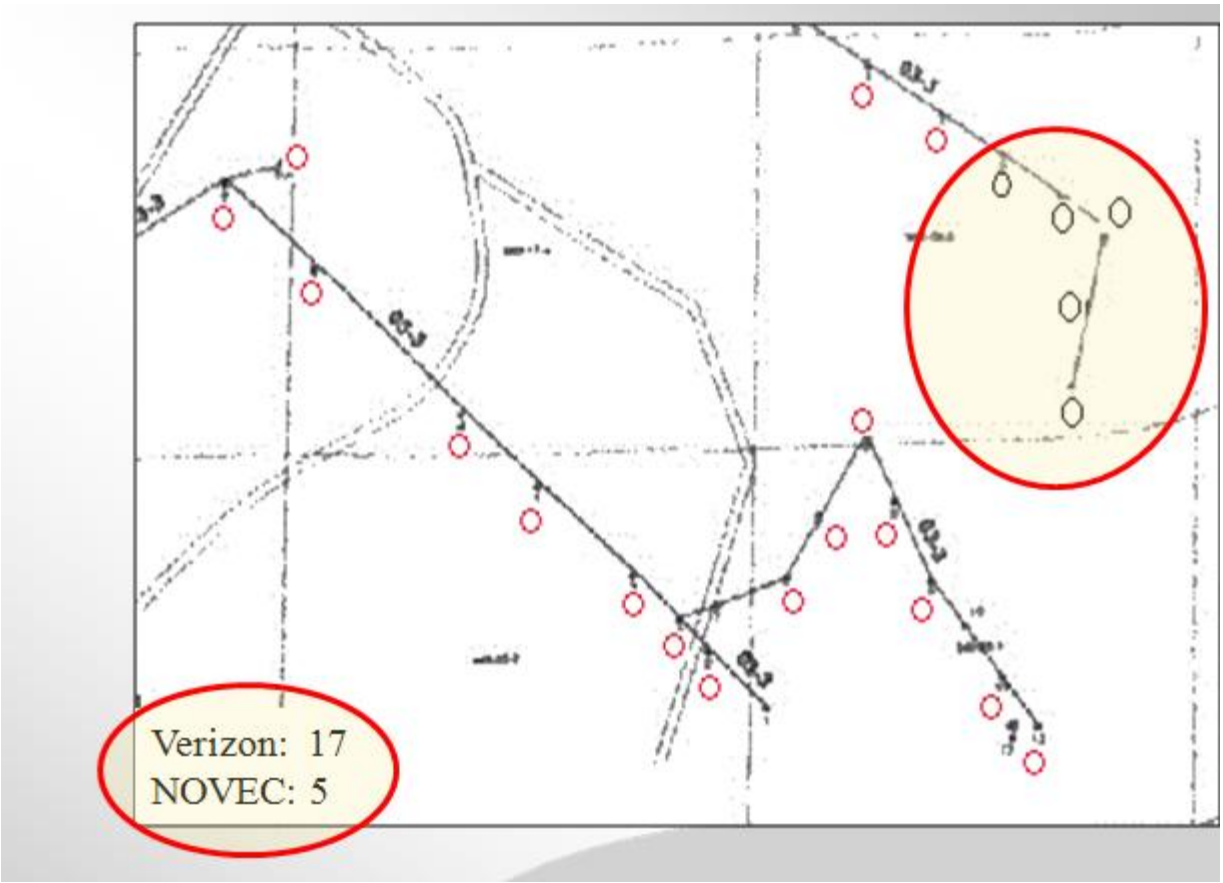


Figure 20 Tree-Trimming Map with JUP attributes

As part of their review of completed tree-trimming work, these actors would make a visual inspection of any pole marked as NOVEC on the circuit map to confirm there are no un-authorized attachments. If one or more joint use wires are discovered, the foreman would notify administrative personnel associated with 3PA Compliance use case to investigate further. A network based electronic version of the circuit map with JUP indicators is also proposed. Figure 21 illustrates this revised use case where the tree subcontractor foreman would do a visual inspection of the NOVEC only poles on the circuit map and if 3 party attachments were identified, would notify the Forestry supervisor. The supervisor in-turn would specifically re-inspect the pole in question and capture geo-referenced image for submission to NOVEC compliance personnel (see Figure 17).

Figure 21: 3PA Tree-Trimming Circuit Map

Given the tree-trimming crews visit the entire circuit every three and 1/2 years, this would identify un-authorized attachments in 1/3 the time (vice ten year survey). It would also augment the GIS database with an imagery catalogue for future design engineering work and/or permit application reviews.

8.3 3rd Party Attachment Compliance

The 3PA compliance use case collapses the inputs and outputs from Permit Application/ Design Engineering and Discovery use cases to present personnel with necessary insight into the approval process and discovery process. This will facilitate both internal and external communication regarding approved and un-approved joint use attachments. Authorized NOVEC users (administrators/design engineers/accounting) would be able to see all relevant data associated with requests, approvals and un-authorized attachments (Figure 22).

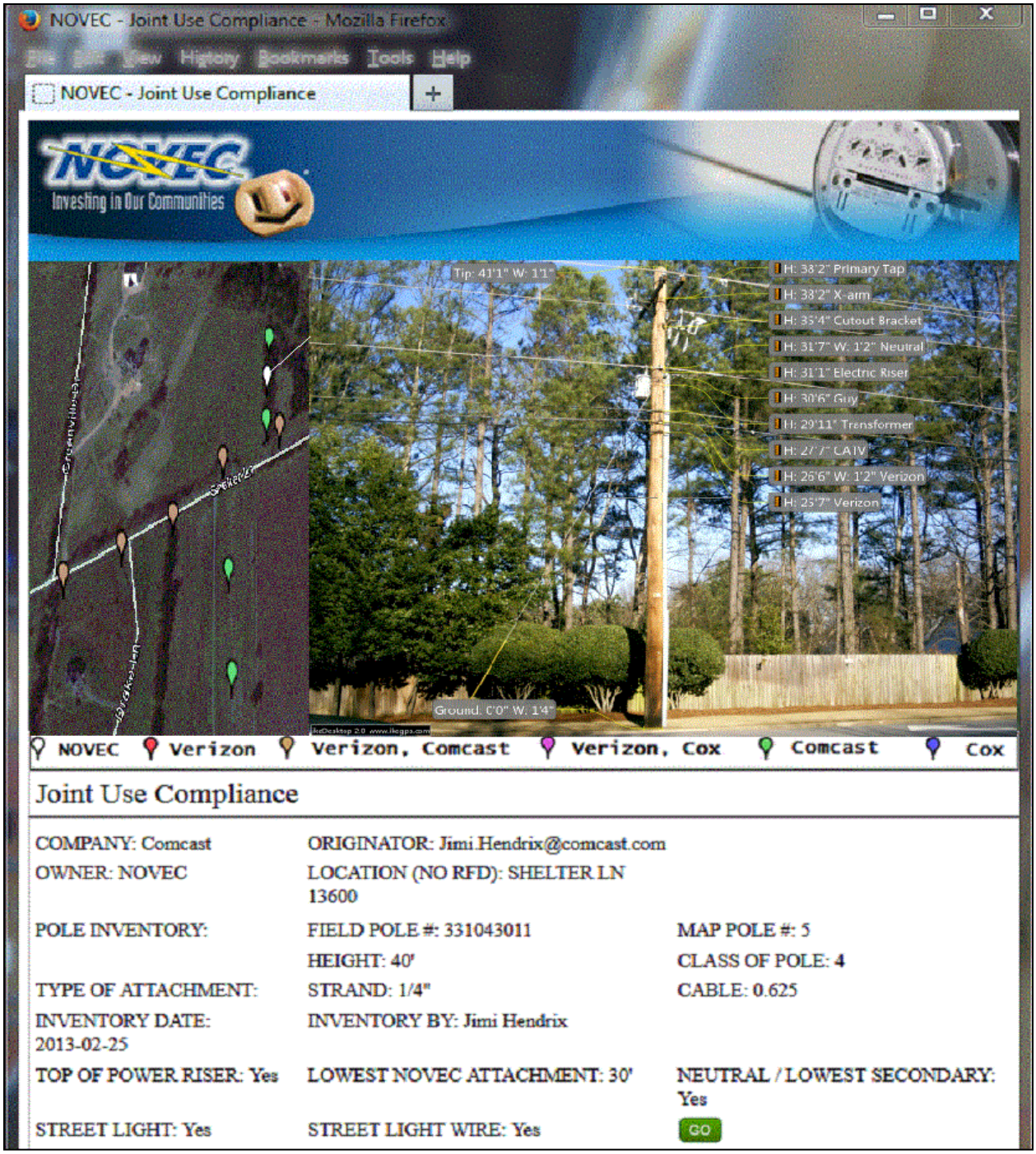


Figure 22: 3rd Party Attachment Compliance Prototype

8.4 Requirements Model

In the development of use cases, the team identified the following high-level system requirements to address stakeholder needs. SSS 01-03 address needed changes to the ArcFM system to enable existing paper artifacts to possess important JUP attribute data. These requirements also support transfer of JUP datum to other systems, including a new system component, the 3rd Party Attachment Application Service (3PAA). SSS 04 requires the WMIS system to include JUP data on all work orders (for Field Crews) that will facilitate more accurate allocation

of shared maintenance costs. Finally SSS 05-10 cover new system requirements for the 3PAA to collect, disseminate and track 3PA.

Req. ID	Description
SSS_01	The ArcFM shall generate overlays with JUP attributes
SSS_02	The ArcFM shall export ESRI shape files with JUP attributes
SSS_03	The ArcFM shall generate Circuit Maps with JUP attributes
SSS_04	The WMIS shall include JUP data on Work Orders
SSS_05	The 3PAA shall update GIS database with discovered JUP data
SSS_06	The 3PAA shall update GIS database with approved permit application JUP data
SSS_07	The 3PAA shall display ESRI shape files with JUP attributes
SSS_08	The 3PAA shall be capable of recording the number of attachments and ownership of attachments per utility pole.
SSS_09	The 3PAA shall export Geo-Reference Imagery to GIS database
SSS_10	The 3PAA shall import Geo-Reference Imagery with JUP data

Table 1: Proposed NOVEC System Requirements

8.5 Architectural Model

Figure 23 illustrates the team's proposed architecture designed to satisfy the proposed use case modifications and system requirements derived. The architecture leverages existing services and systems provided in NOVEC's current IT architecture. The legacy ArcFM systems provide 3PAA access to ESRI shapefiles containing JUP data. The 3PAA backend service isolates front end components from direct access to either ArcFM or ArcGIS. The 3PAA backend acts as both a firewall and a translator of unique GIS protocol data into more widely used formats.

The 3PAA Joint Use Req./Notify components provide authorized external users access to an electronic web-based permit Application service that exposes JUP data and automates significant elements of the Permit Application process, including routing, approvals, and updates to the GIS database.

The 3PAA Monitor/Approval component again exposes electronic records for both permitting and discovery of unauthorized 3rd party attachments for use by authorized NOVEC personnel.

The 3PAA Discovery component utilizes an electronic dropbox to accept data discovered by subcontractors and NOVEC personnel related to unauthorized attachments. The component routes discovered data to appropriate personnel for review and approval. Assuming acceptance of information, the GIS database would be updated to reflect new JUP data and associated geo-referenced imagery for future use.

The 3PAA JUP Audit device is a combined GPS, laser range finder, 3D compass and digital camera. The device simplifies the capture of attachment data and provides detailed measurements and geo-referenced imagery for use in permit applications, monitoring and discovery.

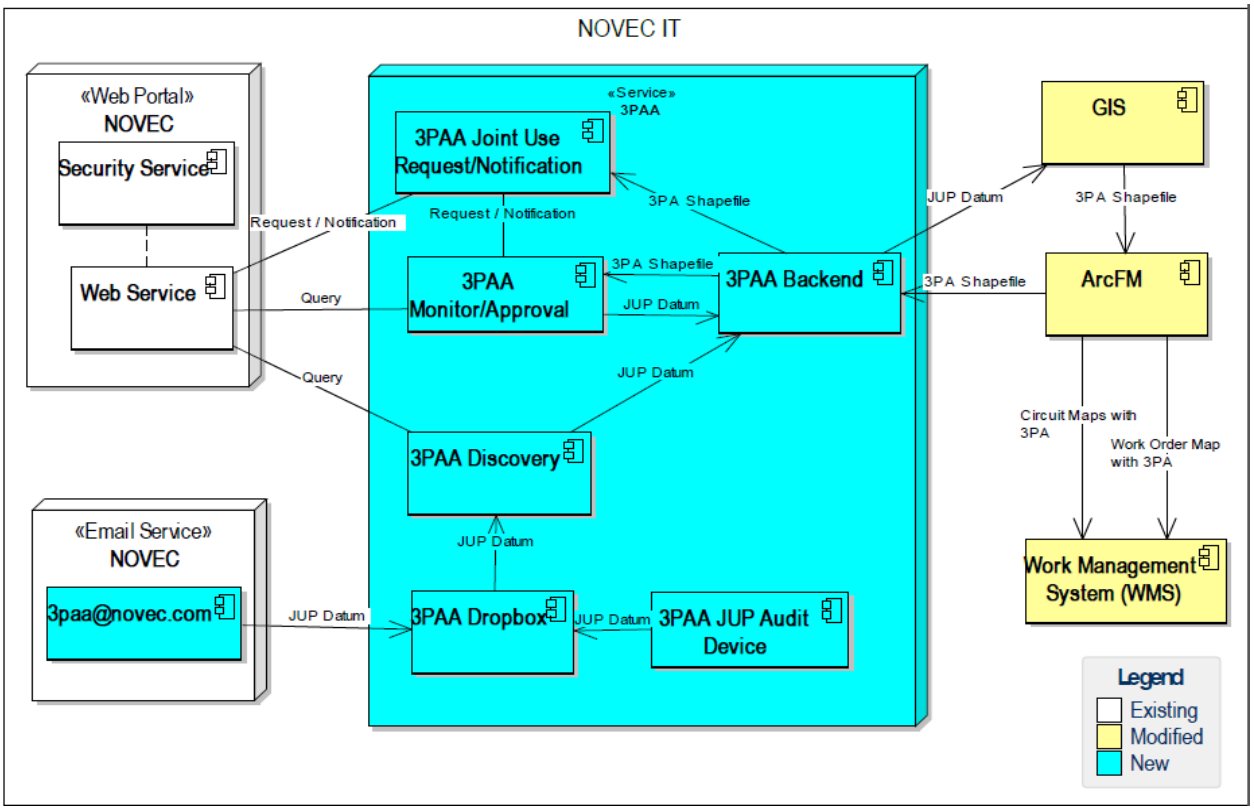


Figure 23: Proposed NOVEC IT Architecture

8.6 Technology Survey

The team performed a survey of technologies that support JUP compliance/auditing devices and found the ikeGPS™, which provides a quick and auditable method of measuring the height and spacing of utility pole attachment points. The ikeGPS (Figure 24) integrates a computer, a 3D compass, a high resolution camera and a laser range finder into a single rugged handheld device. Since the camera is calibrated and aligned with the laser rangefinder, post-processing software, can calculate distances between points on the pole (Figure 25).

Figure 24: ikeGPS Audit Device

Inclusion of the ikeGPS system within 3PAA will capture very detailed measurements for use in compliance/auditing and design engineering processes (Figure 25). It also provides an opportunity for NOVEC to conduct it's own utility pole survey designed to build a complete geo-referenced imagry catalogue for use by NOVEC personnel in many work processes.

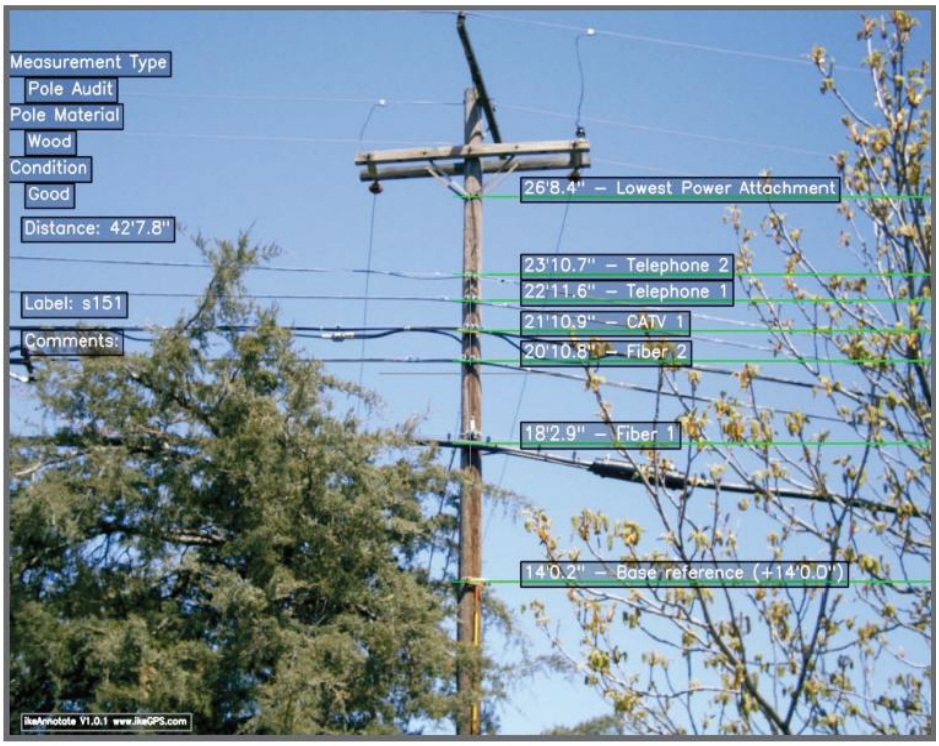


Figure 25: ikeGPS Imagery

8.7 Rough Order Magnitude (ROM) Estimate

The ROM is an estimation of the level of effort and cost to complete a proposed architecture (+/- 50% based on expert knowledge and experience of the team). The cost estimate is divided into the following areas:

1. ArcFM/WMIS Architecture Enhancements (SSS 01-04)

Discussion with NOVEC GIS experts indicated that ArcFM allows experts to create new templates (ESRI overlays) that include additional data attributes. Based on this, the team estimates 200 hours of Labor (NOVEC) to create new JUP overlays that can be exported to 3PAA as well as incorporated into WMIS paperwork. Using a standard labor rate of $75/hour the ROM is ~$15,000.

2. 3PAA Architecture (SSS 05-12)

The team estimated significant lines of code based on similar web-based services using existing infrastructure and estimates ~5,000 lines of code to implement requirements and proposed use cases. The team assumes use of an existing GIS display framework (Google Earth, Google Maps) with no additional licensing cost. Using the COCCOM II basic parametric cost model and the same labor rates ($75/hour), the model estimates ~$142,000 in Non-recurring engineering (NRE) cost (Figure 26). The reference architecture includes the purchase by NOVEC of five (5) ikeGPS units ($10,000 each) with one license of ikeAnnotate ($10,000) software for imagery post-processing. Total investment is ~$202,000.

Figure 26: COCOMO II Cost Model

Finally the team considered what would it cost NOVEC to perform its' own pole survey using ikeGPS integrated into the 3PAA framework. Using a case study provided CN Utility Consulting (CNUC) a utility vegetation management company, an estimated 45 Poles per day could be surveyed by a single individual (http://www.ikegps.com/download-ikegps-pole-height-white-paper). Amortizing the original survey cost of ~$427,000 the team estimated a survey could be performed every 6.5 years for the same cost (Labor rate equivalent to Job Site Inspector). The real benefit would a complete imagery catalogue of the entire circuit.

9. Conclusions & Recommendations

The completed a set of systems engineering analysis to included:

- Refining the project problem definition
- Elicitation of preferences for focus from the customer

- Gap analysis to document and understand processes critical to the defined project problem
- Additional customer elicitation based on gap analysis findings and refocus elicited based on findings
- A reference design (3PAA) generated for informing feasibility of requirements defined in the system capability document
- A set of sequence diagrams detailing interfaces and interactions between 3PAA subsystems components
- Initial System Capabilities Document containing top level requirements necessary to provide sufficient detail to developers when soliciting design solutions
- Initial cost estimations to aid in down selection of developer responses to solicitations

Through the analysis conducted by the team, NOVEC discovered a new opportunity to recapture 3rd party attachment fees due to multi-year durations of time where non-permitted join use poles were remaining unaccounted. The current permit process makes it difficult for NOVEC to recover its full costs associated with 3rd party attachments. NOVEC can take steps to improve auditing functions specifically designed to minimize non-permitted joint use of their utility pole network. The team has provided detailed analysis, uncovered new opportunities and provided NOVEC with a set of documents necessary to begin eliciting developer proposals to evaluate options to improve the capture of joint use fees.

9.1 System Capabilities Document

The purpose of providing NOVEC with a System Capability Document (SCD) (see Appendix B – System Capabilities Document) is to provide a set of top level requirements that would describe a potential update to the current NOVEC infrastructure that handles permitting, maintaining, and auditing all 3rd party attachments in the NOVEC utility pole network. The requirements were derived from the reference design and detailed sequence diagrams provided in Appendix C – Reference Design Sequence Diagrams. The document, in conjunction with the reference design, provides a context to solicit potential bids from developers detailing costs and time required to perform these tasks. Top level requirements were provided to describe the functions necessary to perform the process improvements discovered by the team; however NOVEC should consider developing more detailed requirements to further describe the functions and interfaces of the desired solution.

9.2 Findings & Recommendations

Findings:

- Significant opportunity exists to recapture rental fees for non-permitted joint use
- Joint use permit process can realize improvements in customer response time by going digital
- Capabilities for reducing joint use auditing efforts exist and require upfront investment in training & infrastructure
- Using the GIS system as the focal point for capturing joint use to support finance, permit processes, and auditing functions provides opportunities for efficiency and savings across NOVEC departments

Recommendations:

- Utilize System Requirements Document and 3PAA Reference Design to solicit and measure cost estimates for implementing digital process improvements
- Train and enable tree trimming inspectors to provide joint use auditing
- Use findings and proposed technology improvement to better equip NOVEC Pole Auditors
- Future GMU efforts might focus on maintenance cost allocation, 3PAA enhancements and 3PAA Survey Prototype

Appendix A – Project Problem Definition Approach

1. Overview

The following is a method used to take a step back from a provided problem statement and ensure a broad approach to the problem taken using several points of view. The problem situation section help evaluate points of view that include external stakeholders and how they may add or detract to an overall solution. The problem formulation section helps organize potential actions available to stakeholders that can affect the potential outcomes a given engineering team may consider for a solution or inputs to include in modeling the problem.

2. Problem Situation Evaluation

This section walks through decomposing the problem situation provided by NOVEC. This approach helps define who is interacting with the problem, resources committed to the work, which ultimately leads to a deeper understanding of how each stakeholder is committed to the situation. The problem situation is represented as the following triplet:

$$P = <A, O, S>$$

where:

- A are the actors involved in the process (as described by the client and perceived by the analyst);
- O are the objects (stakes) of the different actors;
- S are the resources committed by each actor on each object of his concern.

The problem situation has been decomposed for NOVEC (P_N), the companies requesting 3rd party attachments (P_3), and government regulators (P_G).

2.1 NOVEC

The problem situation NOVEC is defined as follows:

$$P_N = [A_N, O_N, S_N]$$

where:

- A_N = [Engineering, Tree Trimmers, Finance]
- O_N = [cost recapture efficiency, public safety, customer satisfaction]
- S_N = [10 year survey, 1 Full-time Employee to Audit, GIS DB, Tree Trimming]

2.2 Companies Requesting 3rd Party Pole Attachments

The problem situation for the companies requesting 3rd party attachments is defined as follows:

$$P_3 = [A_3, O_3, S_3]$$

where:

- A_3 = [Engineering, Business Development, Finance, Lobbyists]
- O_3 = [cost savings, customer satisfaction]

- S_3 = [GIS DB]

2.3 Government Regulators Managing Pole Attachment

The problem situation for the government regulators managing pole attachment is defined as follows:

$$P_G = [A_G, O_G, S_G]$$

where:

- A_G = Communication Regulators
- O_G = [public safety, customer communication opportunities, economic growth]
- S_G = [new policy development, deregulation enforcement]

3. Potential Problem Formulations

The problem formulation translates the client's concern, using the decision support language, into a formal problem (a problem to which decision support techniques and methods apply). The problem formulation is defined as follows:

$$\Gamma = <A, V, \Pi>$$

where:

- A: is a set of potential actions that can be undertaken by the client with respect to the problem situation P;
- V : is a set of points of view from which the potential actions are observed, analyzed, evaluated, compared, etc.;
- Π: is a problem statement which anticipates what is expected to be done with the elements of A.

There are 3 problem formulations considered which include selection of a perspective to take when solving the problem described in the problem situation.

3.1 Streamline Permit Process

The problem formulation for the permit process improvement is defined as follows:

$$\Gamma_P = [A_P, V_P, \Pi_P]$$

where:

- A_P = Process Improvement (GIS, electronic workflows)
- V_P = Customers (3rd Party Attachers), Design Engineering, Design Solutions, construction scheduler, construction admins
- Π_P = Evaluate the current Permit (Make Ready) workflow for areas that efficiency can be increased through alternative process and tech insertion

3.2 Provide Continual Audit Mechanism

The problem formulation for the audit mechanism is defined as follows:

$$\Gamma_A = [A_A, V_A, \Pi_A]$$

where:

- A_A = Continual Auditor Staff, provide targeted auditing solutions, continual auditing mechanisms (Ex. tree trimmer audit opportunities)
- V_A = Design Engineering, Design Solutions, construction scheduler, construction admins, attachment billing (NOVEC accounting)
- Π_A = Provide streamlined GIS workflows to enable auditors to efficiently maintain an accurate database of 3rd party attachments that will be used for billing pole rental fees

3.3 Seek Government Support for Penalizing Permit Violations

The problem formulation for the government regulators is defined as follows:

$$\Gamma_G = [A_G, V_G, \Pi_G]$$

where:

- A_G = provide data showing # of violations, provide details for impacts to public safety, provide overview of loopholes being exploited by 3rd Party Attachers
- V_G = 3rd Party Attachers (cost benefit of permit vs. no permit), Public Safety, NOVEC responsibility in supporting gov't regulations (currently maybe more than they should have)
- Π_G = Provide gov't substantial evidence permit enforcement should be handled by the gov't (using penalties sufficient to encourage using permits)

4. Analysis Conclusions

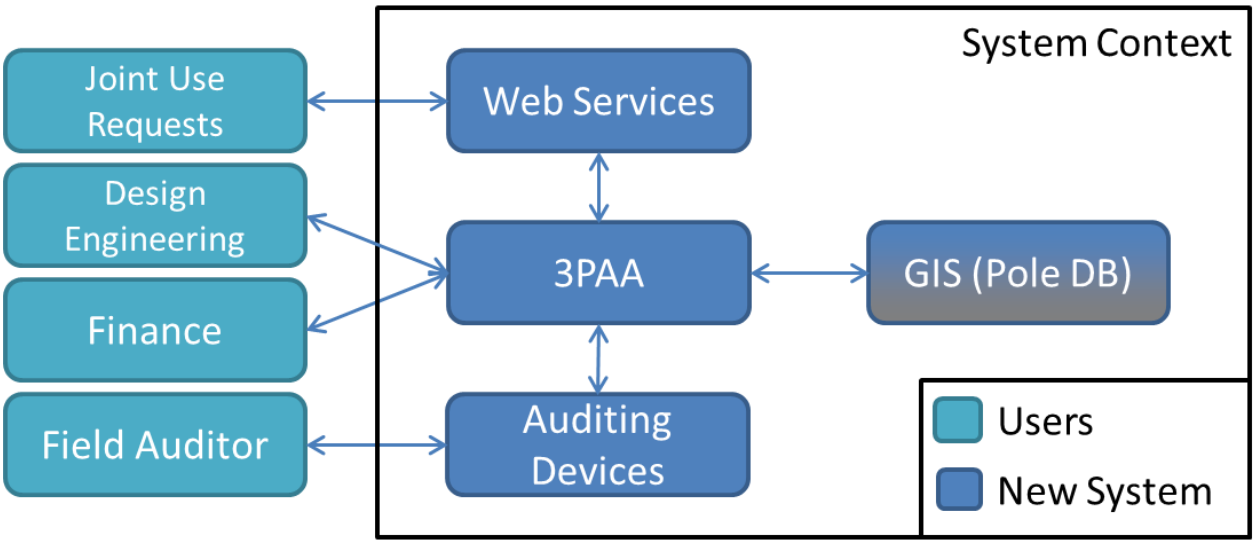
The team provided NOVEC with all of the problem formulation options and it was quickly decided through customer feedback to pursue process improvement and an auditing method to help maintain the permit database. All efforts to provide insight into the government regulator perspective were deferred to future activities this effort would further enable through providing deeper insight into joint use cost recapture.

Appendix B – System Capabilities Document

1. System Overview

NOVEC seeks a system capable of providing in-field auditing functions for across their utility pole infrastructure. The requested design focuses all pole information accessed by design engineering, tree trimming, field auditors, companies seeking joint use pole permits and all aspects of joint use billing into a single pole database maintained in NOVECs existing GIS database.

1.1 System Description



1.2 Enabling Capabilities

The following is a detailed description of the capabilities that would enable improvement in process that would impact both the customer experience as well as multiple departments within NOVEC.

1.2.1 Web Portal Services

A web portal that enables customers requiring joint use permits to select poles, provide joint use data, submit requests, check status and be notified of approval would further encourage customers to process joint use permits.

1.2.2 Pole Auditing Services

Many opportunities exist to provide joint use pole database access to employees responsible or available to conduct pole auditing for joint use. By providing mechanisms for onsite access to the joint use database opportunities exist for solutions ranging from smart phones to custom devices to enable employees to conduct joint use audits on the spot or be alerted to potential key locations while performing maintenance (tree trimming) or repair. This function also includes the capability to ingest imagery for documenting pole audits that include joint use.

1.2.3 GIS Tracking of Joint Use

The system also requires a single electronic database that is accessible from multiple divisions at NOVEC for storing all joint use data to include customer data and joint use permits. This function enables multiple users to access joint use information reducing cost while allowing remote access for auditing.

2. Scope

The document, in conjunction with the reference design, provides a context to solicit potential bids from developers detailing costs and time required to perform these tasks. Top level requirements were provided to describe the functions necessary to perform the process improvements discovered by the team; however NOVEC should consider developing more detailed requirements to further describe the functions and interfaces of the desired solution.

3. Requirements

3.1 System Requirements

The system shall be capable of ingesting, storing and making available geo-referenced imagery of utility poles.

The system shall protect against catastrophic loss of data.

The system shall provide a web interface for customers to make permit requests for 3rd party attachments.

3.2 Web Portal Services

The web portal shall be capable of accepting new user requests.

The web portal shall be capable of displaying user info to existing users and allow modification to user data.

The web portal shall be capable of capturing and storing customer information necessary to initiate the permit process, provide status and notify the customers when events requiring their input.

The web portal shall be capable of checking for existing accounts.

The web portal shall provide permit processing to authorized users.

The web portal shall be capable of providing permit status messages for pending and approved joint use permits.

The web portal shall be capable of notifying external users when additional data required for the joint use permit process is required.

The web portal shall be capable of notifying external users when a joint use permit is approved.

The web portal shall be capable of enabling users to apply for joint use on multiple poles in a single request.

The web portal shall be capable of displaying geographic views that include potential NOVEC poles capable of providing joint use access.

The web portal shall be capable of providing users with pole metadata upon users clicking on displayed poles.

The web portal shall be capable of initiating joint use permit requests per pole upon user clicking on displayed poles.

The web portal shall be capable of populating customer and pole information from 3PAA to help facilitate joint use permit requests.

The web portal shall be capable of allowing users to cancel permit requests.

The web portal shall be capable of displaying all joint use permits for a given users.

3.3 Pole Auditing Services

The pole auditing service shall be capable of providing field workers on-site, real-time access to individual pole information that includes joint use.

The pole auditing service shall provide field workers the capability to report joint use violations via wireless handheld devices.

The pole auditing service shall provide tree trimming maps with information indicating joint use status of NOVEC utility poles.

3.4 GIS Tracking of Joint Use

The 3PAA shall be capable of generating overlays with JUP attributes for web applications.

The 3PAA shall be capable of exporting ESRI shape files with JUP attributes.

The 3PAA shall be capable of generating Circuit Maps with JUP attributes.

The 3PAA shall be capable of providing JUP data on Work Orders.

The 3PAA shall update GIS database with approved permit application JUP data.

The 3PAA shall display ESRI shape files with JUP attributes.

The 3PAA shall be capable of recording the number of attachments and ownership of attachments per utility pole.

The 3PAA shall be capable of exporting Geo-Reference Imagery to GIS database.

The 3PAA shall be capable of importing Geo-Reference Imagery from GIS database.

The 3PAA shall be capable of providing reports including total number of 3rd party attachments and/or locations.

The 3PAA shall be capable of maintaining and storing user data for the authorization of account access.

The 3PAA shall be capable of receiving joint use cost estimates for make ready work from design engineering.

The 3PAA shall be capable of providing the web service with cost estimation details from design engineering.

The 3PAA shall be capable of terminating joint use records (metadata) from the GIS system.

The 3PAA shall be capable of adding joint use record information (metadata) into the GIS system.

The 3PAA shall be capable of providing joint use data per customer to finance for billing purposes.

3.5 Interfaces

The system shall provide an interface for the web service to 3PAA.

The system shall provide an interface for the web service to the Internet for external user access.

The system shall provide an interface for remote devices to access joint use pole data.

The system shall provide an interface for design engineering to access pole joint use data.

The system shall provide an interface for accounting to request billing information from the GIS system.

Appendix C – Reference Design Sequence Diagrams

1. Overview

Sequence diagrams are used to describe how the system components function together, inform requirements and as a design tool to look for gaps in the system description. The diagrams show sequential interaction between system components and external systems. Describing the interactions in detail provides a construct to verify completeness for a set of requirements used to define a new system.

The following section provides a set of functional sequence diagrams describing the interaction of the reference design, or 3PAA, which was used to verify the System Capability Document was sufficient and complete. The interactions between 3PAA and existing NOVEC systems help define interface requirements and updated required on existing systems. Through detailed analysis such as sequence diagrams and use cases, additional information can be gained as to the overall scope (cost & schedule) of the design process required to provide the new system.

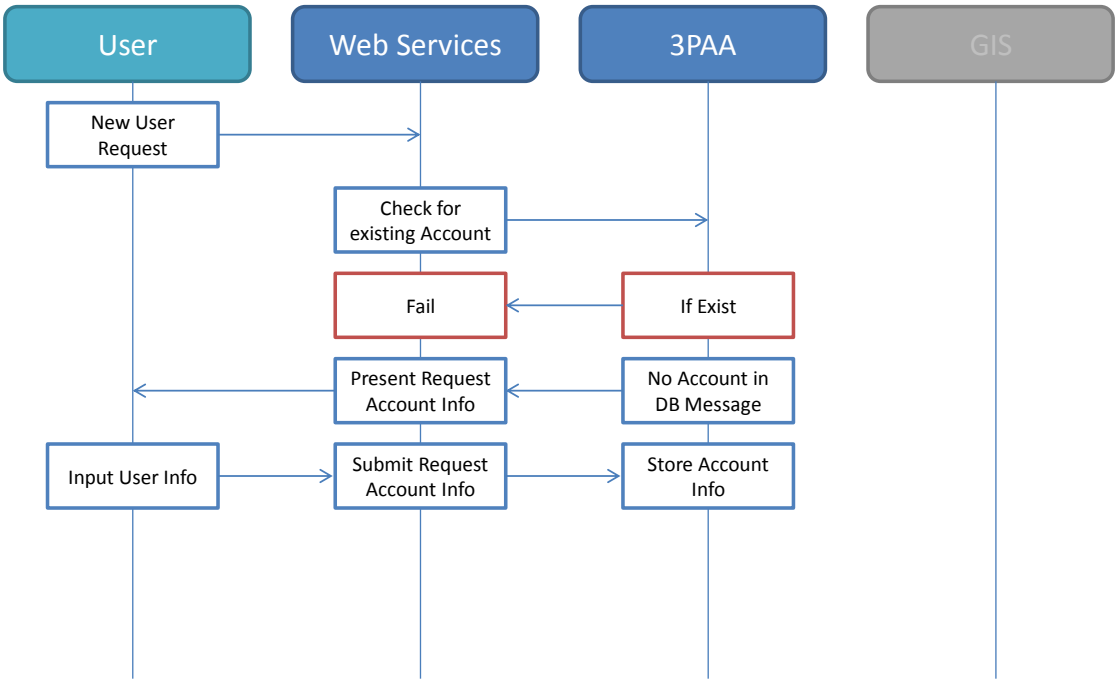
1.1 Users

- Companies interested in requesting pole attachments
- Field Auditors
- Web Services
- 3PAA System – New!
- GIS
- Design Engineering
    - Assume Design Engineering includes cost estimation capability

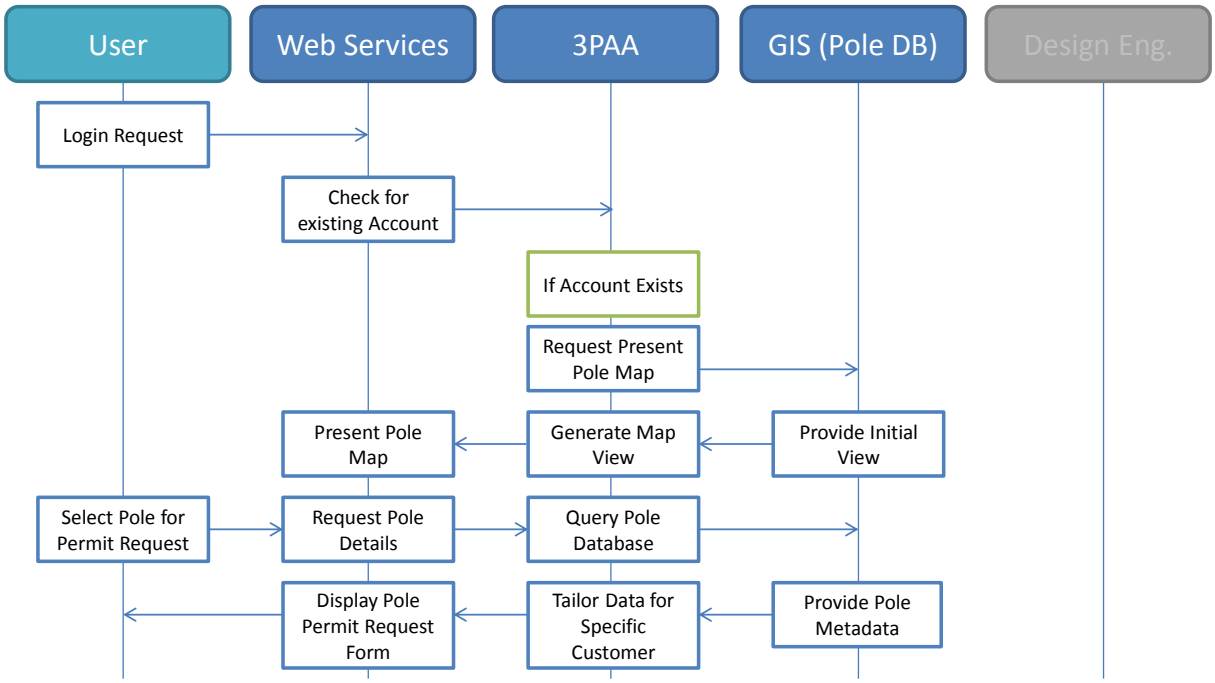
1.2 Sequence Diagrams

- New User Request
- Pole Permit Request
- Pole Permit Notification
- Pole Permit Status
- Finance Query Permits for Billing
- Field Pole Audit Request
- Flag Pole for Auditing
- Conduct Pole Auditing
- Ingest Pole Auditor Imagery

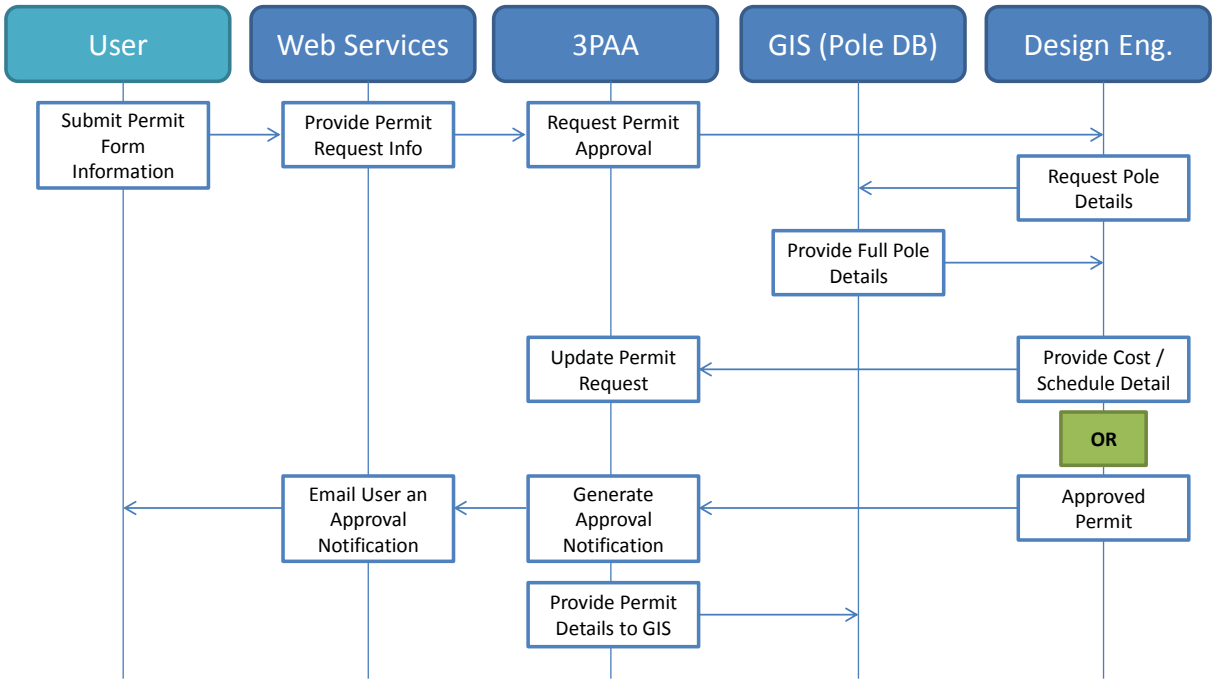
3PAA New User Request



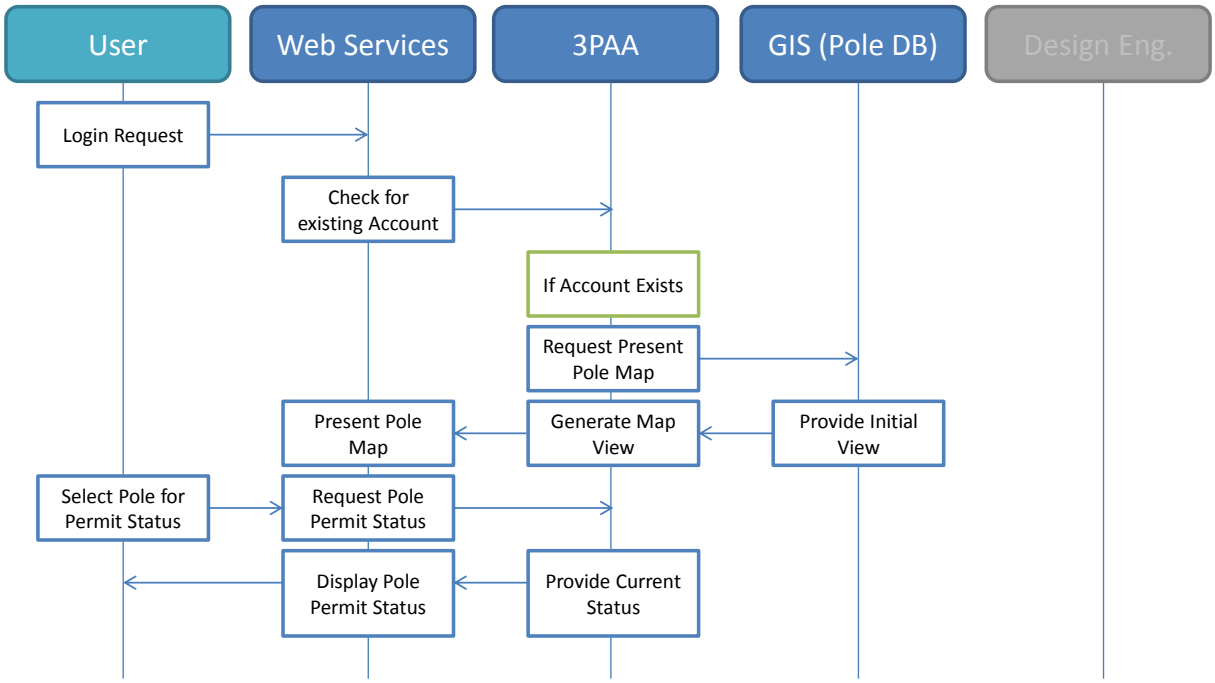
3PAA Pole Permit Request (1/2)



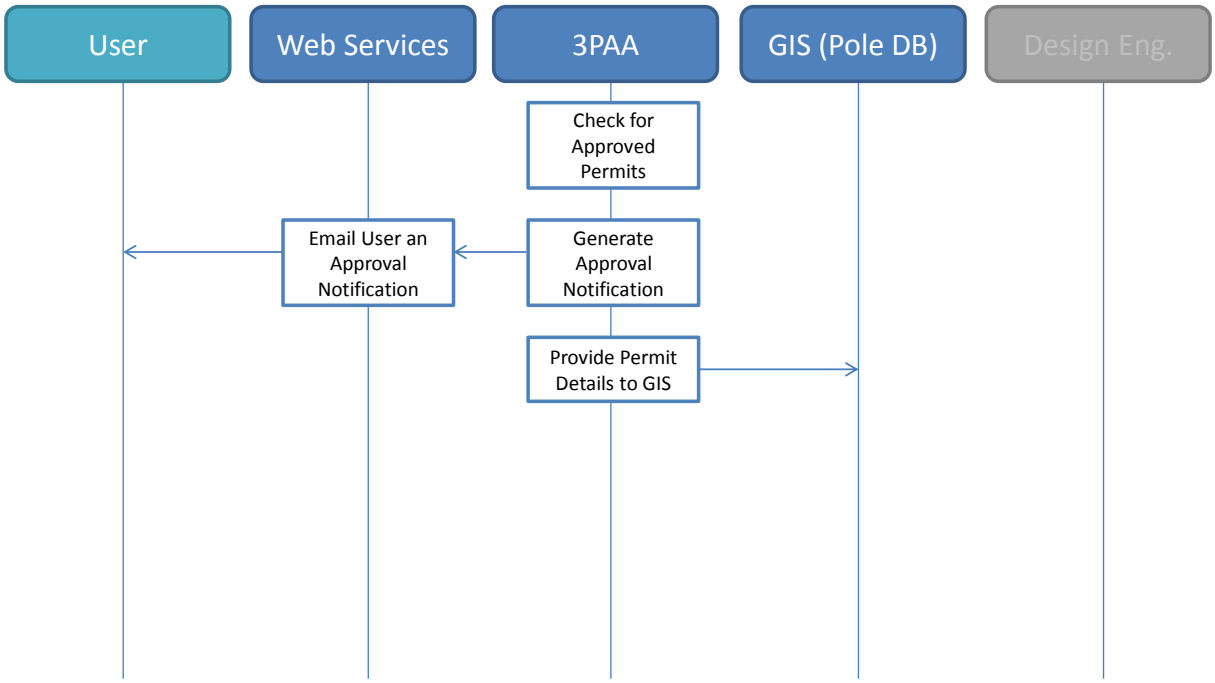
3PAA Pole Permit Request (2/2)



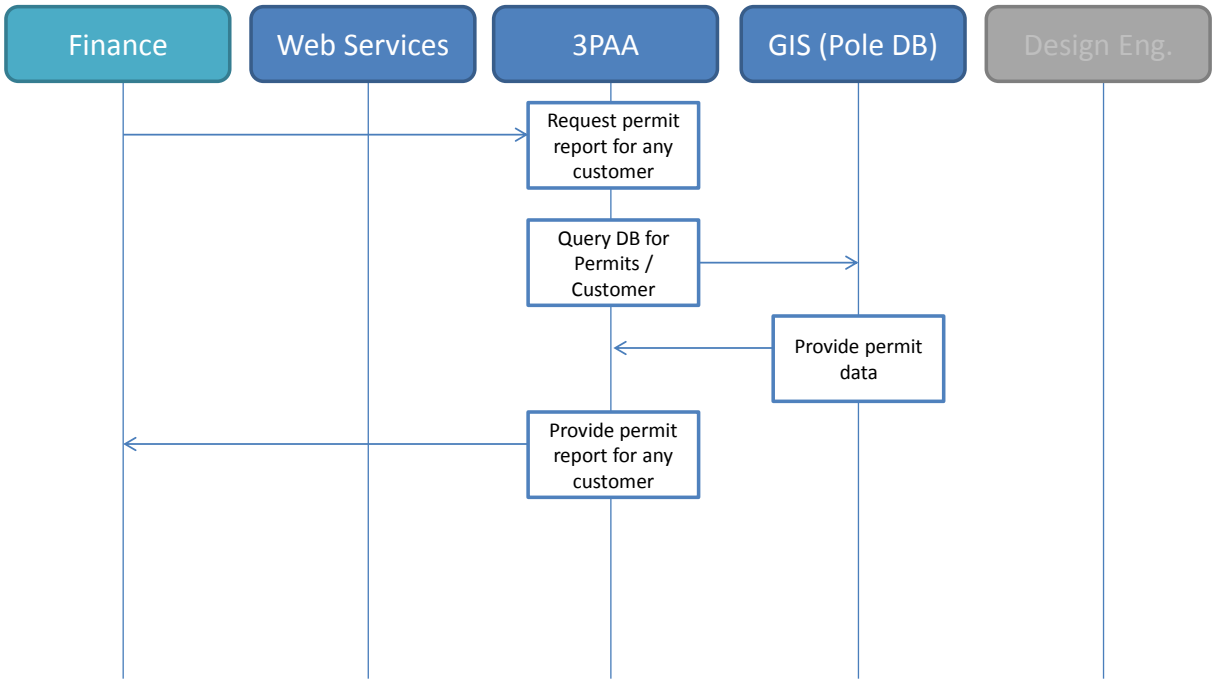
3PAA Pole Permit Status



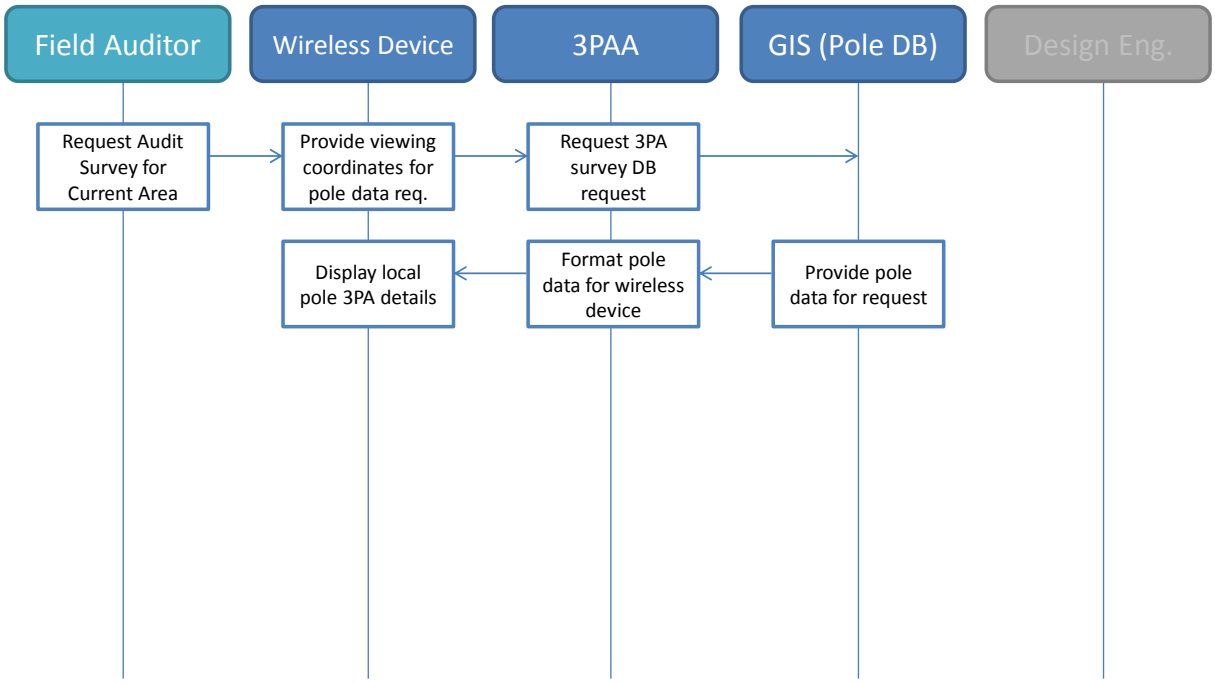
3PAA Pole Permit Notification



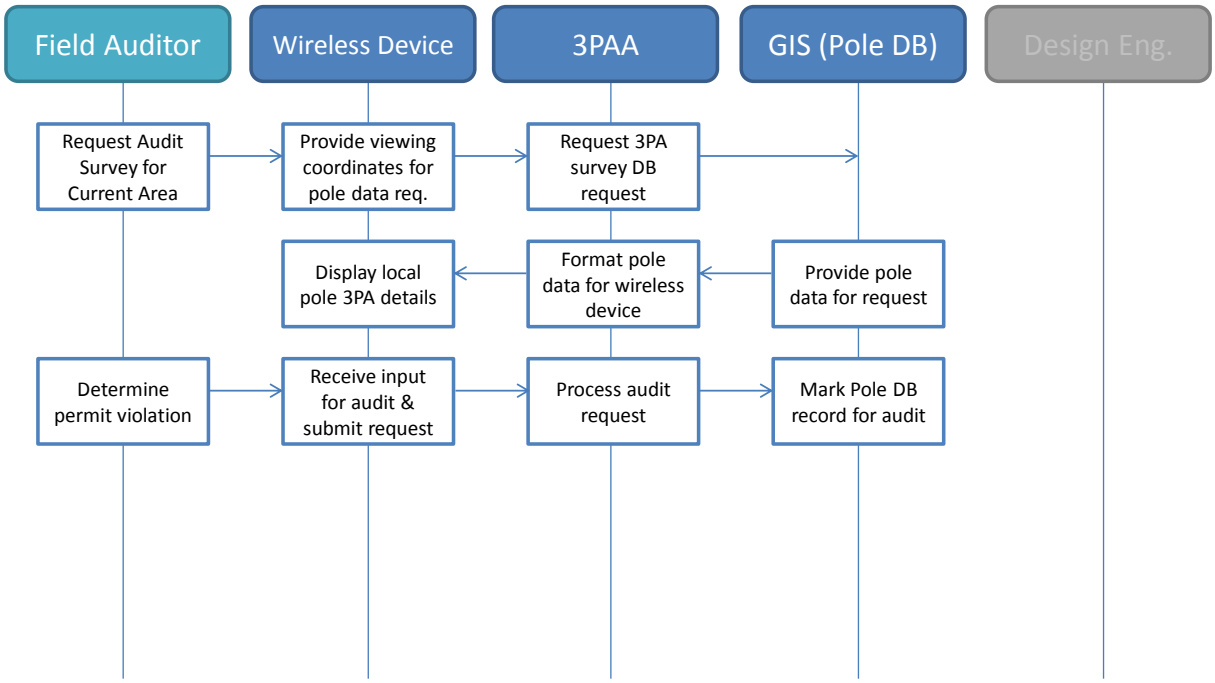
Finance Query Permits for Billing



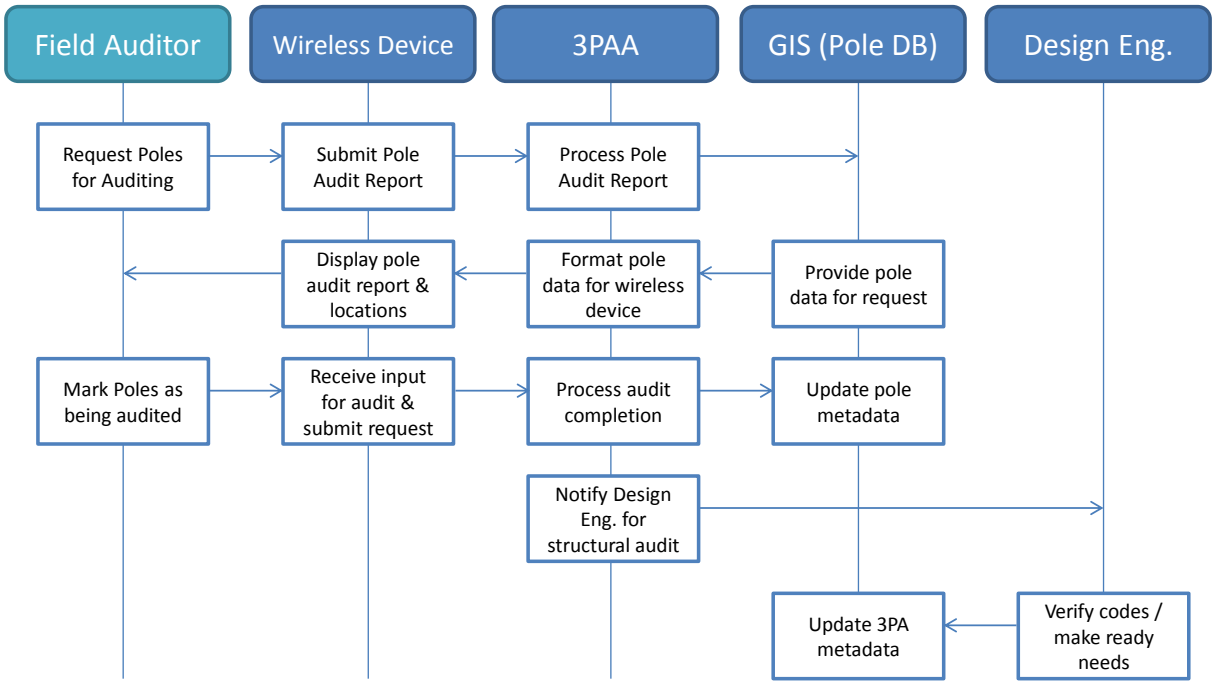
Field Pole Audit Request



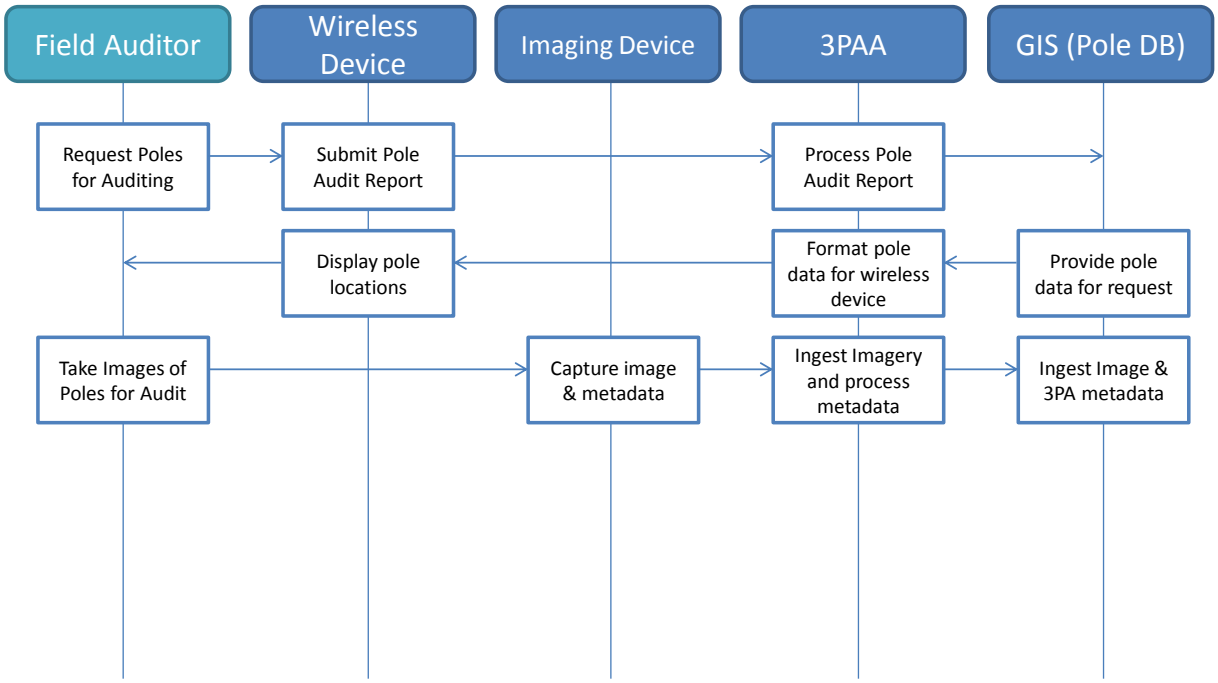
Flag Pole for Auditing



Conduct Pole Auditing



Ingest Pole Auditor Imagery



Appendix D - Artifacts from the Gap Analysis

Contained within this section are artifacts that NOVEC allowed the team to utilize to better understand their processes and procedures related to their 3rd party attachment problem.

The first artifact is an example of a work request. This work request package is comprised of the summary sheet, a staking sheet, a cost estimate and a sketch of the work to be done taken from the GIS system. It is 5 pages long.

The second artifact is an example of the sheet 3rd parties are required to fill out in order to get their attachments approved on the poles. It is 2 pages long.

The third artifact is an example of a circuit map that NOVEC generates to give to its tree trimming contractors. The contractors then follow this route to do their work. It is 1 page long.

Finally, NOVEC asked the GMU team to not disclose or post publicly the details of the GIS database. We were allowed to show several examples for demonstration purposes, but the team agreed to destroy all copies of the GIS database once the project was completed.

NOVEC
NORTHERN VIRGINIA ELECTRIC COOPERATIVE

WORK REQUEST DETAIL

WORK REQUEST: 139644

WR TYPE:	DLINE	**OPER DIST:**	GA	**ENTRY DATE:**	09/24/2013
PRIORITY/AC CODE:	2	**LOCAL CODE:**	GA2	**ENTERED BY:**	LEJ
CLASSIFICATION:	OTHER	**TAX DIST:**	OL	**DESIGNER:**	JOHNSON, LEIGH. E.
CATEGORY:	CN	**REQ COMP DATE:**	11/22/2013	**DESIGNER APPT:**	
CUST READY DATE:	10/07/2013			**DESIGNER PH#:**	() -

WR NAME: MARBURY LLC
STREET NO:
STREET: GUM SPRING RD
LOGQUARTER LN
CITY/STATE: CHANTILLY VA **ZIP:** 20152
CROSS STREET: LOG QUARTER
SUBDIVISION: MARBURY S6 PH3
PLOT: **LOT:**

PRIMARY CONTACT
MARWAN SHAHIN BUILD
Mailing ☒ 3925 OLD LEE HWY
Street ☐ FAIRFAX VA 22030
() -

WR DESC: NEW OH TO MARBURY
CUST MAP NO: **ACCT:**
CIRCUIT: 79-6 **ADC MAP:** 5520 D9
COUNTY: LOUDOUN

D.E. REVIEW: _____ _____

DEVICE POLE# 312-24-4-014

ATTRIBUTES	MANDATORY	
ADV TRENCH OPTION	N	N/A NOT APPLICABLE
BACKFILL OPTION	N	N/A NOT APPLICABLE
ESMNT PLAT NO	N	12/0105
LENGTH IN MILES	N	0
M/B ISSUE DATE	N	
M/B PICKED UP BY	N	
M/B TYPE 1-PHASE	Y	NONE
M/B TYPE 3-PHASE	N	
METER CO NO	N	
METER INSTALL DATE	N	
METER READING	N	
RUS CODE	Y	0100
SERVICES REMOVED	N	0
SUBSTATION	N	79 PLEASANT VALLEY
TYPE OF IMPROVEMENT	N	ND

OTHER CONTACTS

COMMENTS

I CERTIFY THIS JOB HAS BEEN BUILT AS NOTED ON THE STAKING/SKETCH SHEET:

○ NOVEC ○ LEO ○ ROCK ○ LEE ○ HINKLE ○ WRIGHT **BY:** **DATE:**

○ NOVEC ○ LEO ○ ROCK ○ LEE ○ HINKLE ○ WRIGHT **BY:** **DATE:**

CONTRACT TYPE:
○ COMP UNIT COST
○ STD HRLY RATE
○ SELL RATE
○ FIXED PRICE

TERMINATIONS COMPLETED:
○ NOVEC ○ LEO ○ ROCK ○ LEE ○ HINKLE ○ WRIGHT **BY:** **DATE:**

REMARKS

CHANGE ORDERS: #:
SERVICE ENERGIZED: YES / NO
METER INSTALLED: YES / NO

NOVEC
NORTHERN VIRGINIA ELECTRIC COOPERATIVE

STAKING SHEET

— DLine Chang to the distro lines (where they might encounter 3d party lines)

WORK REQUEST: 139644
REVISION NO: 1

WR TYPE:	DLINE	**OPER DIST:**	GA	**WR NAME:**	MARBURY LLC		
AC CODE:		**LOCAL DIST:**	GA2	**STREET:**	GUM SPRING		
CLASSIFICATION:	OTH	**RUS CODE:**	0100	**CITY:**	CHANTILLY	**STATE:** VA	**ZIP:** 20152
CATEGORY:	CN	**TAX DIST:**	OL	**CIRCUIT:**	79-6	**SUBSTATION:**	79 PLEASANT VALLEY

WIRE TYPE:

REEL #:

FOOTAGE:

POINT/SPAN SUMMARY **STATUS:** APPROVED DESIGN - ASBUILT MODIFICATIONS ONLY

P/S NO: 1 **FACILITY ID:** **POLE# 312-24-4-014** **LOCATION:** GUM SPRING
COMMENTS: NONE

ACTION	CU ID	CU DESC	LABOR CLS	DES PROV	ASB PROV	DESIGN	AS-BUILT
INSTALL	A5-2	12.5/7.2 KV SINGLE PHASE TAP	C	CN	CO / CN / CST	1	
INSTALL	AR1010	ROD,ARMOR 1/0 ACSR 6/1 SINGLE	C	CN	CO / CN / CST	1	
INSTALL	C7SP08	DEADEND ASSEMBLY, 3 PHASE HEAVY-SPECIAL ARM	C	CN	CO / CN / CST	1	
INSTALL	CT0001	ALL COPPER CONDUCTOR, SOLID ACWC, STRANDED TO 1/0	C	CN	CO / CN / CST	540	
INSTALL	CT0003	ALL ALUMINUM STRANDED CONDUCTORS, 2/0 ACSR TO 336.4 18/1 OR	C	CN	CO / CN / CST	500	
INSTALL	DE6010	DE CLAMP, 1/0 ACSR 6/1	C	CN	CO / CN / CST	4	
INSTALL	DE7006	DE CLAMP, #6 ACWC	C	CN	CO / CN / CST	2	
INSTALL	DELAY	TIME CAUSED BY DELAYS - 30 MIN INCREMENT	C	CN	CO / CN / CST	6	
INSTALL	E1-3	12.5/7.2 KV, 3/8" SGL DOWN GUY, THROUGH BOLT TYPE	C	CN	CO / CN / CST	1	
INSTALL	E1-3SP.96	12.5/7.2 KV, 3/8" DBL DOWN GUY W/96" STRAIN INSULATOR	C	CN	CO / CN / CST	1	
INSTALL	E3-10	12.5/7.3 KV GUY MARKER	C	CN	CO / CN / CST	2	
INSTALL	E9-2.96	12.5/7.2 KV SINGLE DOWN GUY W/96" STRAIN INSULATOR	C	CN	CO / CN / CST	1	
INSTALL	F1-2S	SCREW ANCHOR ASSEMBLY	C	CN	CO / CN / CST	1	
INSTALL	F1-3S	SCREW ANCHOR ASSEMBLY	C	CN	CO / CN / CST	1	
INSTALL	FLAGGER	AMT OF TIME SPENT FLAGGING - 30 MIN INCREMENT	C	CN	CO / CN / CST	4	
INSTALL	M2-11B	GROUNDING ASSEMBLY - GROUND ROD TYPE	C	CN	CO / CN / CST	1	
INSTALL	M2-12AR	GROUNDING ASSEMBLY, WRAP-AROUND, FOR USE WITH UG-1000 GROUND	C	CN	CO / CN / CST	1	
INSTALL	M5-1.010	CONNECTOR, HOT CLAMP #4 TO 1/0 ACSR	C	CN	CO / CN / CST	1	
INSTALL	MATERIALS	PICK UP MATERIALS - 30 MIN INCREMENT	C	CN	CO / CN / CST	2	

— Where changes are recorded

Printed: 10/04/2013 08:25:33 **ACTION CODE: I = INSTALL R = RETURN S = SCRAP A = ABANDON T = TRANSFER** Page 1 of 2

NORTHERN VIRGINIA ELECTRIC COOPERATIVE

STAKING SHEET

WORK REQUEST: 139644
REVISION NO: 1

ACTION	CU ID	CU DESC	LABOR CLS	DES PROV	ASB PROV	DESIGN	AS-BUILT
INSTALL	NOVEC DESIGN	ENGINEERING OH OR UG FACILITIES - 1 hr increments	C	CN	CO / CN / CST	10	
INSTALL	POLEDELIVERY	POLE DELIVERY - 30 MIN INCREMENT PER MAN	C	CN	CO / CN / CST	8	
INSTALL	UE2542	HAND TRENCHING 18" X 42"	C	CN	CO / CN / CST	10	
INSTALL	WP0452	POLE, 45-2	C	CN	CO / CN / CST	1	
RETURN	A6	12.5/7.2 KV PRIMARY, SINGLE PHASE VERTICAL DEADEND (DOUBLE)	C	CN	CO / CN / CST	1	
RETURN	DE6010	DE CLAMP, 1/0 ACSR 6/1	C	CN	CO / CN / CST	2	
RETURN	DE7006	DE CLAMP, #6 ACWC	C	CN	CO / CN / CST	2	
RETURN	E1-3	12.5/7.2 KV, 3/8" SGL DOWN GUY, THROUGH BOLT TYPE	C	CN	CO / CN / CST	3	
RETURN	F1-2S	SCREW ANCHOR ASSEMBLY	C	CN	CO / CN / CST	2	
RETURN	M2-12AR	GROUNDING ASSEMBLY, WRAP-AROUND, FOR USE WITH UG-1000 GROUND	C	CN	CO / CN / CST	1	
RETURN	WP0404	POLE, 40-4	C	CN	CO / CN / CST	1	
TRANSFER	M5-9LB100.367	CUTOUT 100 A LB (LOAD BREAK) 15KV, UG	C	CN	CO / CN / CST	3	
TRANSFER	UMDP3	7.2/12.5 KV THREE PHASE DISTRIBUTION DIP POLE (OH SOURCE)	C	CN	CO / CN / CST	1	
TRANSFER	UR2004	POLE RISER BOOT, 4"	C	CN	CO / CN / CST	1	
					CO / CN / CST		
					CO / CN / CST		
					CO / CN / CST		

Printed: 10/04/2013 08:25:33

ACTION CODE: I = INSTALL R = RETURN S = SCRAP A = ABANDON T = TRANSFER

Page 2 of 2

NORTHERN VIRGINIA ELECTRIC COOPERATIVE

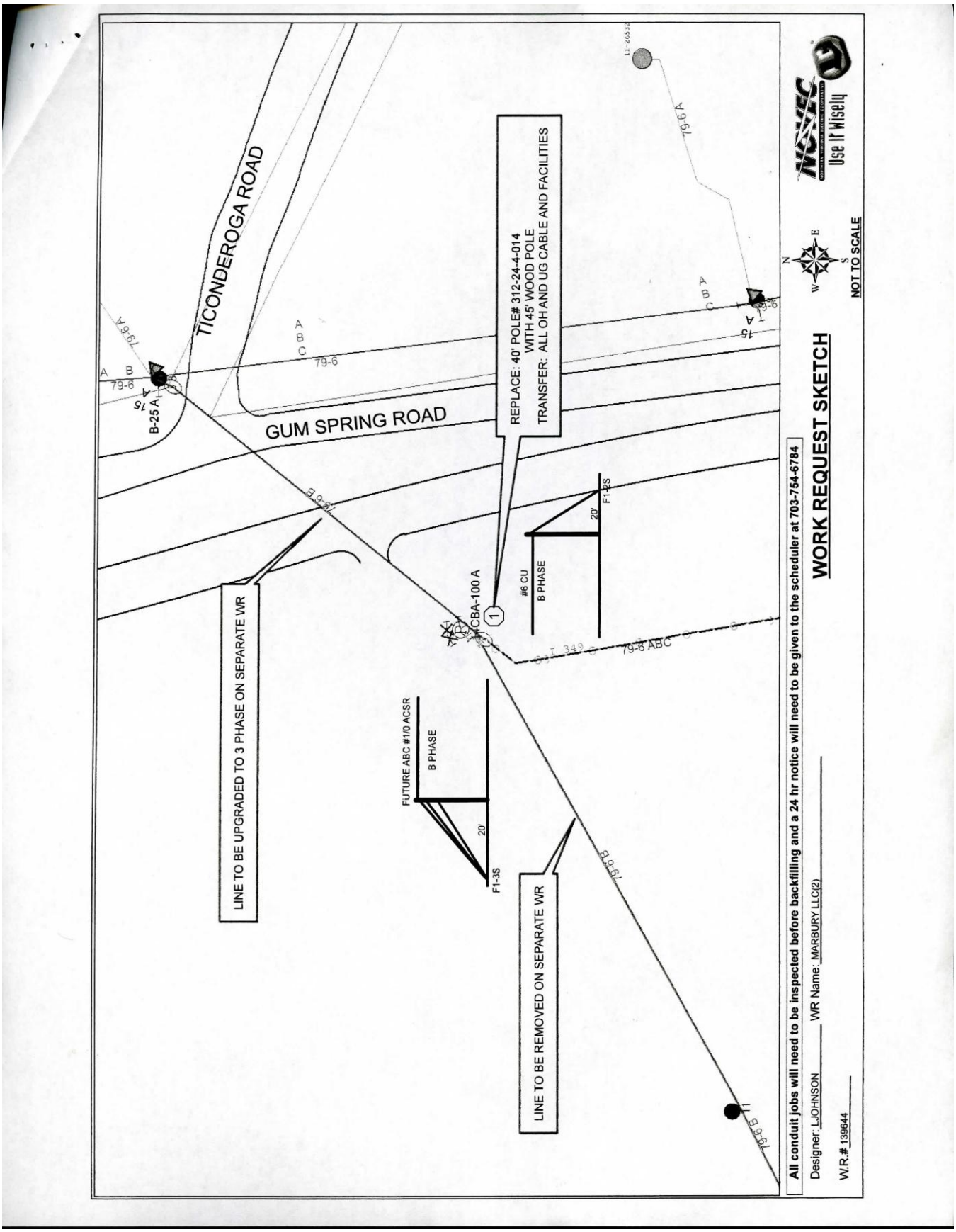
DESIGN COST ESTIMATE

WORK REQUEST: 139644
REVISION: 1

WR TYPE:	DLINE	**LOCATION NO:**		**WR OWNER:**	JOHNSON, LEIGH. E.	**CONTRIBUTIONS:**	**VOUCHERS:**
CATEGORY:	CN	**MAP NO:**	5520 D9	**REV STATUS:**	APPROVED		
RUS CODE:	0100	**WR NAME:**	MARBURY LLC				
OPER DIST:	GA	**WR DESC:**	NEW OH TO MARBURY				
TAX DIST:	OL	**REV DESC:**	MARBURY LLC(2)				

INSTALLATIONS

Id	Cu Description	Prov	Qty	Lab Hrs	Labor	Labor OH	Vehicles	Material	Matl OH	Direct	Indirect	Line Total
A5-2	12.5/7.2 KV SINGLE PHASE TAP	CN	1	1.25	24.89	9.21	0.00	0.00	0.00	24.89	9.21	34.10
A5-2	12.5/7.2 KV SINGLE PHASE TAP	CO	1	0.00	0.00	0.00	0.00	29.80	2.98	29.80	2.98	32.78
AR1010	ROD,ARMOR 1/0 ACSR 6/1 SINGLE	CN	1	0.27	23.81	8.81	0.00	0.00	0.00	23.81	8.81	32.62
AR1010	ROD,ARMOR 1/0 ACSR 6/1 SINGLE	CO	1	0.00	0.00	0.00	0.00	5.44	0.54	5.44	0.54	5.98
C7SP08	DEADEND ASSEMBLY, 3 PHASE HEAVY-SPECIAL ARM	CN	1	8.75	254.36	94.12	0.00	0.00	0.00	254.36	94.12	348.48
C7SP08	DEADEND ASSEMBLY, 3 PHASE HEAVY-SPECIAL ARM	CO	1	0.00	0.00	0.00	0.00	377.23	37.72	377.23	37.72	414.95
CT0001	ALL COPPER CONDUCTOR, SOLID ACWC, STRANDED TO 1/0	CN	540	2.00	495.13	183.20	0.00	0.00	0.00	495.13	183.20	678.32
CT0003	ALL ALUMINUM STRANDED CONDUCTORS, 2/0 ACSR TO 336.4 18/1 OR	CN	500	3.75	864.20	319.75	0.00	0.00	0.00	864.20	319.75	1,183.95
DE6010	DE CLAMP, 1/0 ACSR 6/1	CN	4	4.39	155.85	57.67	0.00	0.00	0.00	155.85	57.67	213.52
DE6010	DE CLAMP, 1/0 ACSR 6/1	CO	4	0.00	0.00	0.00	0.00	45.37	4.54	45.37	4.54	49.90
DE7006	DE CLAMP, #6 ACWC	CN	2	2.20	140.72	52.07	0.00	0.00	0.00	140.72	52.07	192.79
DE7006	DE CLAMP, #6 ACWC	CO	2	0.00	0.00	0.00	0.00	20.73	2.07	20.73	2.07	22.81
DELAY	TIME CAUSED BY DELAYS - 30 MIN INCREMENT	CN	6	3.00	194.83	72.09	0.00	0.00	0.00	194.83	72.09	266.91
E1-3	12.5/7.2 KV, 3/8" SGL DOWN GUY, THROUGH BOLT TYPE	CN	1	1.56	28.14	10.41	0.00	0.00	0.00	28.14	10.41	38.55
E1-3	12.5/7.2 KV, 3/8" SGL DOWN GUY, THROUGH BOLT TYPE	CO	1	0.00	0.00	0.00	0.00	41.14	4.11	41.14	4.11	45.25
E1-3SP.96	12.5/7.2 KV, 3/8" DBL DOWN GUY W/96" STRAIN INSULATOR	CN	1	1.56	92.01	34.04	0.00	0.00	0.00	92.01	34.04	126.05
E1-3SP.96	12.5/7.2 KV, 3/8" DBL DOWN GUY W/96" STRAIN INSULATOR	CO	1	0.00	0.00	0.00	0.00	130.82	13.08	130.82	13.08	143.90
E3-10	12.5/7.3 KV GUY MARKER	CN	2	0.51	34.63	12.81	0.00	0.00	0.00	34.63	12.81	47.45
E3-10	12.5/7.3 KV GUY MARKER	CO	2	0.00	0.00	0.00	0.00	16.82	1.68	16.82	1.68	18.50
E9-2.96	12.5/7.2 KV SINGLE DOWN GUY W/96" STRAIN INSULATOR	CN	1	1.33	140.71	52.06	0.00	0.00	0.00	140.71	52.06	192.77
E9-2.96	12.5/7.2 KV SINGLE DOWN GUY W/96" STRAIN INSULATOR	CO	1	0.00	0.00	0.00	0.00	85.72	8.57	85.72	8.57	94.30
F1-2S	SCREW ANCHOR ASSEMBLY	CN	1	2.50	119.06	44.05	0.00	0.00	0.00	119.06	44.05	163.11
F1-2S	SCREW ANCHOR ASSEMBLY	CO	1	0.00	0.00	0.00	0.00	65.13	6.51	65.13	6.51	71.65
F1-3S	SCREW ANCHOR ASSEMBLY	CN	1	2.50	92.01	34.04	0.00	0.00	0.00	92.01	34.04	126.05
F1-3S	SCREW ANCHOR ASSEMBLY	CO	1	0.00	0.00	0.00	0.00	79.08	7.91	79.08	7.91	86.99
FLAGGER	AMT OF TIME SPENT FLAGGING - 30 MIN INCREMENT	CN	4	2.00	112.56	41.65	0.00	0.00	0.00	112.56	41.65	154.21


TICONDEROGA ROAD
GUM SPRING ROAD
REPLACE: 40' POLE# 312-24-4-014
WITH 45' WOOD POLE
TRANSFER: ALL OH AND UG CABLE AND FACILITIES
LINE TO BE UPGRADED TO 3 PHASE ON SEPARATE WR
LINE TO BE REMOVED ON SEPARATE WR
FUTURE ABC #1/0 ACSR
B PHASE
20'
F1-3S
#6 CU
B PHASE
20'
F1-2S
CBA-100 A
79-6 ABC
79-6
B-25 A
WORK REQUEST SKETCH
NOT TO SCALE
Use It Wisely
All conduit jobs will need to be inspected before backfilling and a 24 hr notice will need to be given to the scheduler at 703-754-6784
Designer: L.JOHNSON
WR Name: MARBURY LLC(2)
W.R.# 139644

JOINT USE NOTIFICATION AND REQUEST

CONTROL NO. _____

TO

[x] NORTHERN VIRGINIA ELECTRIC CO.-OP OFFICE GAINESVILLE

[ ] _____ TELEPHONE CO. _____

[ ] _____ CATV. CO. Comcast

COMCAST COMPANY

BY: Steve Haskins ORIGINATOR

DATE: 2/25/13

[ ] NOTICE IS HEREBY GIVEN BY OWNER OF PROPOSED WORK AS SHOWN IN CODE COLUMN OR SKETCH.

[ ] REQUEST IS HEREBY MADE BY LICENSEE FOR POLE WORK AS SHOWN IN CODE COLUMN OR SKETCH.

[x] OWNER IS ELECTRIC CO.

[ ] OWNER IS TELEPHONE CO.

[ ] A JOINTLY ENGINEERED JOB.

LOCATION(NO.RFD NO.) 13600 Shelter Ln

TYPE OF ATTACHMENT

STRAND 1/4" ULT. STRENGTH _____ TENSION _____ = _____ STRAND WT.

CABLE .625 NO. _____ 0 _____ = _____ WT. _____

OTHER _____ NO. _____ 0 _____ = _____

	W.O.NO.	FIELD WORK BY	COMP. DATE
ELEC. CO.			
TEL. CO.			
TV. CO.		—	

POLE DATA-LICENSEE REQUEST

	CODE	HGT. ATTACH BOT.	HGT. ATTACH TOP	HGT. ATTACH REASON	STRENGTH GUY WIRE M.LBS.	POLE HT.CLASS	POLE YR.SAT.
OWN							
LIC.							

CODE

1: PLACE ATTACH.
2: TRANS. ATTACH.
3: REAR. ATTACH.
4: ATTACH. GUY
5: ERECT NEW POLE
6: RELOCATE POLE
7: CONNECT TEL. CO. GNDS.
8: REPLACE POLE A-SIZE OR HT. B-DEFECTIVE
9: INTERMEDIATE POLE
10: CH.CHAR.OF CIR.
11: OTHER
12: ABANDONMENT

*** REASON
A: POLE SPACE B: SAG C: CATV. D: OTHER
****FOR ABANDONMENTS ONLY

POLE DATA-OWNER'S REQUIREMENT

HGT. ATTACH BOT	HGT. ATTACH TOP	HGT. ATTACH REASON	STRENGTH GUY WIRE M. LBS.	POLE HT. CLASS	POLE YR. SAT.

COST DATA

ADDT. HY.	UNEXP. LIFE CHARGE	REARR	INTERMEDIATE POLE	GROUND ATTACH.	TOTAL ESTIMATED COST	TOTAL ACTUAL COST

[ ] PERMISSION GRANTED _____ 19__. SUBJECT TO YOUR AGREEMENT TO CHANGES AND REARRANGEMENTS AT A TOTAL - ESTIMATED COST AS SHOWN.

[x] PERMISSION GRANTED 4/5 ~~19~~ 2013 Attach per pole inventory sheet and Maintain all NESC clearances

[ ] PERMISSION DENIED REASON

BY: Angel STms (RECIPIENT) DATE: 4/5/13

[ ] ENCLOSED IS OUR CHECK IN THE AMOUNT OF THE ABOVE ESTIMATED COST, WHICH SHALL SERVE AS DEPOSIT AGAINST THE TOTAL ACTUAL COST. THIS IS YOUR AUTHORIZATION TO BEGIN THE MAKE-READY NECESSARY FOR OUR ATTACHMENT.

[ ] OUR COMPANY HEREBY WITHDRAWS REQUEST.

BY: _____ TITLE UTILITY COORDINATOR DATE: _____

ESTIMATED COST PAID _____ . 19__. ABOVE WORK COMPLETED, POLES READY FOR ATTACHMENTS.

BY: _____ TITLE _____ DATE: _____

IF ANY ADDITIONAL REPLACEMENTS AND REARRANGEMENTS OTHER THAN THOSE DESCRIBED HEREIN BECOME INVOLED BEFORE DELIVERY OF LICENSEE'S APPROVAL OF SUCH REPLACEMENTS AND REARRANGEMENTS AND ACCEPTANCE OF COST TO LICENSOR, THE APPLICATION MUST BE REPROCESSED TO REFLECT SUCH ADDITIONAL REPLACEMENTS AND REARRANGEMENTS BEFORE THE LICENSE BECOMES EFFECTIVE.

PLEASE KEEP IN MIND THE PROVISIONS OF ARTICLES II (D), IV (A), IV (D), VI (F), AND VIII (A). TO PARAPHASE, ANY ATTACHMENT PRIVILEGES GRANTED TO THE LICENSEE SHALL BE SUBJECT TO ANY RIGHTS OR PRIVILEGES WHICH HAVE BEEN CONFERRED BY NOVEC TO ANY PRIOR LICENSEE. PRIOR TO MAKING ANY ATTACHMENTS THE LICENSEE SHALL NOTIFY ANY SUCH OTHER PARTIES IN WRITING. SHOULD NOVEC OR ANOTHER PUPLIC UTILITY WITH WHOM NOVEC HAS A JOINT USE AGREEMENT NEDD AT ANY TIME THE SPACE OCCUPIED BY LICENSEE'S ATTACHMENTS, LICENSEE WILL BE NOTIFIED THAT IT SHALL EITHER SURRENDER ITS LICENSE AND VACATE SPACE OR AUTHORIZE REPLACEMENT OF THE POLES OR REARRANGEMENTS AS NECESSARY.

POLE INVENTORY

COMCAST-13-005 (5)

FIELD POLE# 331-04-3-011
OLD POLE# _____
MAP POLE# 5
TEL POLE# _____

INVENTORY DATE: 2/25/13
INVENTORY BY: SH
JURISDICTION: PWC

LOWEST NOVEC ATTACHMENT: 31'3"
NEUTRAL / LOWEST SECONDARY
31'3"

TOP OF POWER RISER ✓

OWNER:
NOVEC ✓
OTHER _____

TRANSFORMER:
YES (NO)

BOT. OF TRANSFORMER ✓

STREET LIGHT
YES / (NO)
STREET LIGHT WIRE ✓

HEIGHT/CLASS OF POLE 40'-4

CATV ANCHOR: YES / (NO)
REQUIRED: YES / (NO)
POWER SUPPLY: YES / (NO)

RECOMMENDATIONS
CATV: _____

TELE: _____

POWER: _____

FIBER OPTIC YES / NO
CATV NAME: Comcast
CATV BOTTOM _____
CATV TOP _____
NO. OF CABLES _____

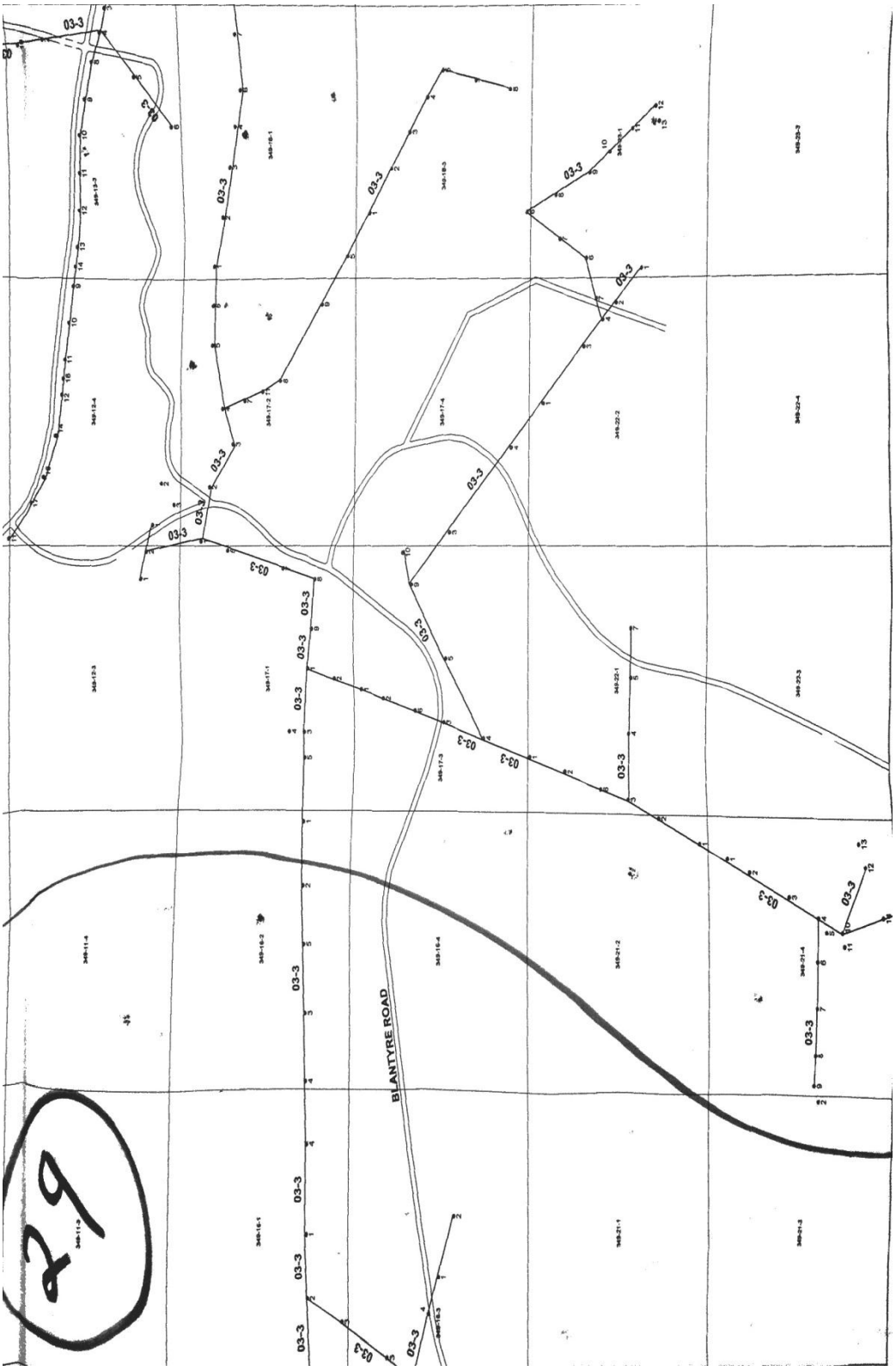
TELE NAME: G.T.E. / B.A.
TELE BOTTOM _____
TELE TOP _____
NO. OF CABLES _____
OTHER: _____
OTHER BOTTOM _____
OTHER TOP _____
NO. OF CABLES _____

SURVEYED: _____
DATE: _____

CLEARANCE OK: _____
Maintain 40" clearance below lowest CATV CO ATTACH AT NESC Attachment

DATA ENTRY: _____

MID SPAN VIOLATION: YES / (NO) (SEE NOTES ON BACK)


BLANTYRE ROAD
29