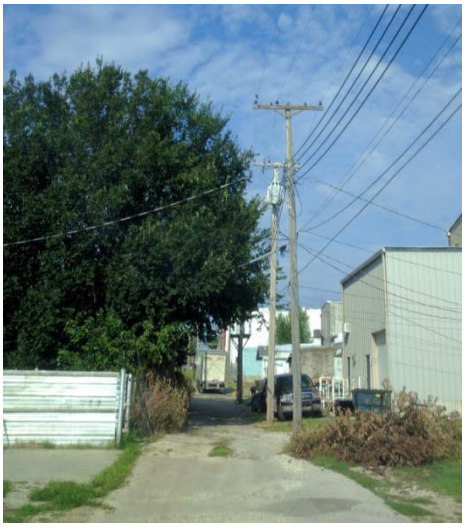
Kansas Municipal Energy Agency

KMEA
KANSAS MUNICIPAL ENERGY AGENCY

THE CITY OF GARNETT KANSAS 1861
Small, Serene, Simply Garnett.

Distribution System Assessment for the City of Garnett, Kansas Final



October 11, 2016

Sega®
ENGINEERING & TECHNICAL SERVICES

Project No. 16-0178

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CERTIFICATION

CERTIFICATION

I hereby certify that this document was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Kansas.

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LIST OF ACRONYMS

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Garnett	City of Garnett, Kansas
KCP&L	Kansas City Power & Light
KMEA	Kansas Municipal Energy Agency
NESC	National Electrical Safety Code
SCADA	Supervisory Control and Data Acquisition
Sega	Sega Inc.

SECTION 1

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Kansas Municipal Energy Agency (KMEA) has contracted Sega Inc. (Sega) to provide an assessment of the current state of their electric distribution grid for KMEA's participating member cities. Sega will focus their investigation on best distribution construction practices, safety of equipment, apparent age and condition of equipment, and compliance with the National Electrical Safety Code (NESC).

Sega and KMEA visited Garnett, Kansas to visually inspect the system. Sega concluded the City of Garnett, Kansas (Garnett) has a good system that, with preventative measures, could be well maintained for years to come. The construction standards used follow NESC recommended clearances and use sound construction practices. There are sufficient ties for most circuits. An adequate number of capacitor banks are being used to regulate voltage. Most poles are in good shape and are guyed appropriately. Transformers are in working order. Switches are operable and fusing is in place where needed. The street lighting is sufficient and installed appropriately. The power factor and voltage are being actively monitored.

The items that Sega recommends for the preventative measures explained in this report are listed below:

1. Convert the 2.4-kV business district circuit to 4.16-kV.
2. Add SCADA controls for North Substation circuits to be remotely monitored and controlled at the power plant.
3. Expand the use of temperature-controlled capacitor banks.
4. Update mapping of circuit routing.
5. Add switch numbers to switches on the system and include those numbers on the circuit mapping.
6. Install lightning arrestors at all underground dip/riser poles.
7. Establish a pole replacement program.
8. Establish a tree trimming program.

SECTION 2

INTRODUCTION

INTRODUCTION

2.1 PURPOSE

The purpose of this assessment is to provide KMEA and its participating member cities with information on the current state of their electric distribution grid. Sega has been contracted by KMEA to visit each participating city, evaluate the distribution system, and provide a written report on the findings. Sega will focus their investigation on best distribution construction practices, safety of equipment, apparent age and condition of equipment, and compliance with NESC. It is the goal of this report to help KMEA and its members in identifying areas of improvement to their system.

2.2 DESCRIPTION OF SYSTEM

The city serves electric power via 4.16-kV wye and 2.4-kV delta distribution circuits. Most of the city is fed from the 4.16-kV wye circuits with a 2.4-kV delta circuit feeding the downtown business district area of Garnett. Garnett has three substations serving their system, the South Substation, the Southeast Substation, and the North Substation. Kansas City Power & Light (KCP&L) provides sub-transmission power to the city at 34.5-kV that ties into both the Southeast and North Substations.

SECTION 3

DISTRIBUTION SYSTEM ASSESSMENT

DISTRIBUTION SYSTEM ASSESSMENT

3.1 STATE OF THE SYSTEM

The Garnett distribution system is generally in good condition. The construction standards used to build the lines are sufficient and provide adequate clearance and working room. There are adequate capacitor banks on the system to regulate the voltage. There were sufficient ties between circuits except for the 2.4-kV circuit which cannot be backed up by other circuits. The street lighting is sufficient and installed appropriately. The power factor and voltage are being actively monitored.

There are some maintenance and system improvements that Sega recommends to make the system better. Sega recommends converting the 2.4-kV circuit in the downtown area to 4.16-kV to reduce losses on the line as well as for ties between circuits.

There are some temperature control capacitor banks on the system while the rest are manually controlled. Sega recommends expanding the use of temperature-controlled capacitor banks to reduce maintenance time in switching them on and off during transitional temperature periods such as during fall when daytime temperatures can be in the 80s and nighttime temperatures can decrease to the mid 50s.

Figure 3.1 - Capacitor Bank Without Controls

To better track and resolve outages, Sega recommends adding Supervisory Control and Data Acquisition (SCADA) controls for the North Substation existing circuits back at the power plant. This will enable city employees to monitor circuits on a regular basis and control circuits in the power plant while crews are working on an outage. Another two items that could be done concurrently to help in outage situations is updated circuit mapping and switch numbering. There have been some system improvements and changes since the last map was created. Once the system is remapped and switches are numbered, it will be easier to tell where to isolate the problem to reduce the customer outages. These can be valuable in a storm event with emergency crews on site.

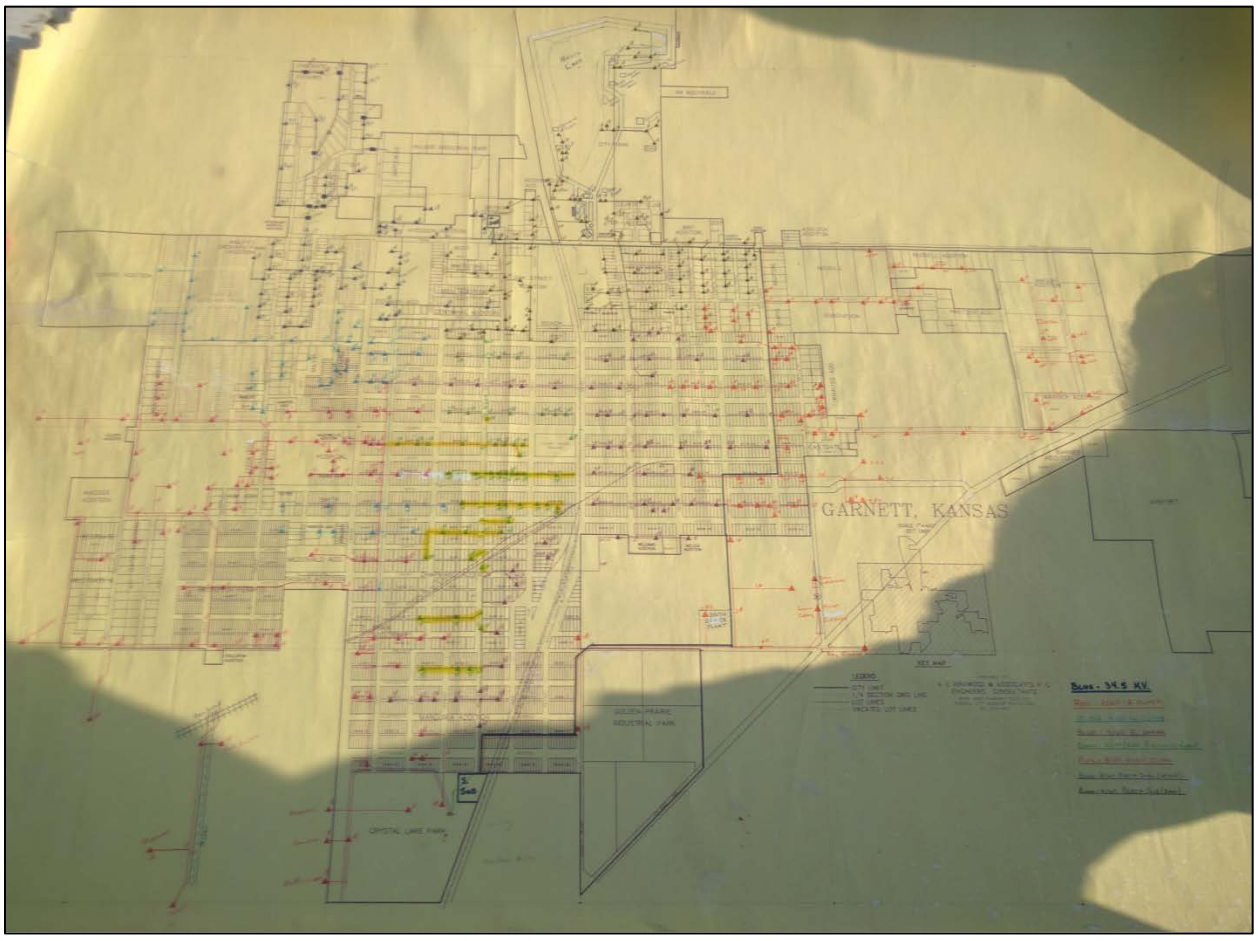

Figure 3.2 - Current System Map

3.2 STATE OF THE EQUIPMENT

Like the overall system, the equipment in Garnett is in pretty good shape. Most poles are in good shape and are guyed appropriately. Transformers are in working order. Switches are operable and fusing is in place where needed. Sega has a few recommendations for maintaining a quality system.

Sega recommends installing lightning arrestors at all underground dip/riser poles. Most poles with transformers have arrestors installed but there are not lightning arrestors on the underground dip/riser poles. The capacitance of underground circuits is quite high compared to overhead circuits. Due to this capacitance, a lightning surge is likely to double its voltage in the underground circuits. The arrestors at these locations would prevent a lightning strike from affecting the underground cable which would take longer to fix if there was a fault.

Figure 3.3 - Missing Arrestors on Riser Pole

Sega also recommends establishing a pole replacement program and a tree-trimming program. The linemen have already established a priority list for poles to be replaced soon which should be updated periodically, likely every two to three years. Allocating funds every year for this effort will maintain the system and keep it from falling behind on maintenance. Tree trimming had not been done in a couple years and there were a few places that needed some trimming. Creating a funding stream for a multi-year program to trim the entire system over a five-year period will keep the trees trimmed back and the line clearances maintained.

Figure 3.4 - Tree Trimming

SECTION 4

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS AND RECOMMENDATIONS

4.1 SUMMARY

The City of Garnett has a good system that, with preventative measures, could be well maintained for years to come. The items that Sega recommends for the preventative measures explained in this report are listed below:

1. Convert the 2.4-kV business district circuit to 4.16-kV.
2. Add SCADA controls for North Substation circuits to be remotely monitored and controlled at the power plant.
3. Expand the use of temperature-controlled capacitor banks.
4. Update mapping of circuit routing.
5. Add switch numbers to switches on the system and include those numbers on the circuit mapping.
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7. Establish a pole replacement program.
8. Establish a tree trimming program.

SECTION 5

APPENDICES

APPENDIX A

CITY OF GARNETT DISTRIBUTION SYSTEM MAP

City of Garnett, KS

Electrical System Map

Legend

- 2400 Business Loop
- 34.5-kV
- 4.16-kV Tie SE Sub to Power Plant
- E. Inner
- E. Outer
- North Sub (West)
- North Sub (East)
- W. Inner
- W. Outer

Lakeridge Rd
Lakeview Dr
Home Run Dr
N Lake Rd
W Park Rd
E Park Rd
N Cleveland St
N Hayes St
N Grant St
N Lincoln St
S Lincoln St
N Walnut St
N Oak St
Prairie Spirit Rail Trail
N Pine St
N Cedar St
N Orange St
N Spruce St
N Ash St
N Olive St
S Willow St
E Monroe Ave
Catalpa St
1st Ave
W 1st Ave
E 1st Ave
S Grant St
W 2nd Ave
S Cedar St
W 3rd Ave
E 3rd Ave
E 4th Ave
W 4th Ave
S Westgate Rd
W 5th Ave
W 6th Ave
S Oak St
S Main St
S Pine St
S Cedar St
S Olive St
W 7th Ave
E 7th Ave
High St
W 8th Ave
31
W 9th Ave
S Hayes St
NE Neosho Rd
W 10th Ave
W 11th Ave
W 12th Ave
Main St
NE 1700
W 13th Ave
E 13th Ave
Westgate Rd
Lincoln Rd
169
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