



Department Source: City Utilities - Water and Light

To: City Council

From: City Manager & Staff

Council Meeting Date: November 4, 2019

Re: Report on Electric Utility preventative maintenance, tree trimming, under grounding, prevention identification, improvements, and the metrics used to measure success and effectiveness.

Executive Summary

Council has requested a report on Electric Utility preventative maintenance, tree trimming, undergrounding, prevention identification, improvements, and the metrics used to measure success and effectiveness.

Discussion

The Electric Utility has many programs that it utilizes to maintain the 933 miles of transmission and distribution lines that form the electric system that services its customers. These include capital investment through a Capital Improvement Program (CIP), vegetation management, active prevention identification, and state of the art tools to monitor and control the City's electric system.

The City has a Capital Improvement Program that funds several projects that are used to maintain the electric system. The City appropriates funds to several Capital Improvement Projects on an annual basis to serve as the source of funding for maintaining its electric system. The table below was taken from the FY 2020 budget and highlights the annual projects and funding levels that were adopted with the FY 2020 budget and have been proposed for FY 2021 through FY 2024.

Project	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
1 13.8 kV Overhead System Replacement - E0118 [ID: 651]					
Total	\$500,000	\$500,000	\$500,000	\$600,000	\$600,000
5 13.8 kV Underground System Replacement - E0107 [ID: 562]					
Total	\$50,000	\$950,000	\$200,000	\$200,000	\$200,000
6 161 & 69 kV Transformer Replacement - E0192 [ID: 1776]					
Total		\$600,000	\$300,000	\$300,000	\$300,000
7 161&69 kV Transmission System Replacement - E0101 [ID: 567]					
Total	\$50,000	\$500,000	\$200,000	\$200,000	\$200,000
10 Conversion of Overhead to Underground - E0027 [ID: 555]					
Total	\$500,000	\$500,000	\$500,000	\$800,000	\$800,000
14 New & Replace Transformers & Capacitors - E0021 [ID: 559]					
Total		\$3,400,000	\$1,000,000	\$1,000,000	\$1,000,000
17 Replace 13.8 kV Switchgear at Substations - E0189 [ID: 1773]					
Total		\$350,000	\$350,000		\$350,000
18 Replace 69 & 161 kV Circuit Breakers - E0153 [ID: 1109]					
Total		\$750,000	\$250,000	\$250,000	\$250,000
31 Protective Relay Upgrade - E0145 [ID: 984]					
Total		\$100,000	\$100,000	\$100,000	



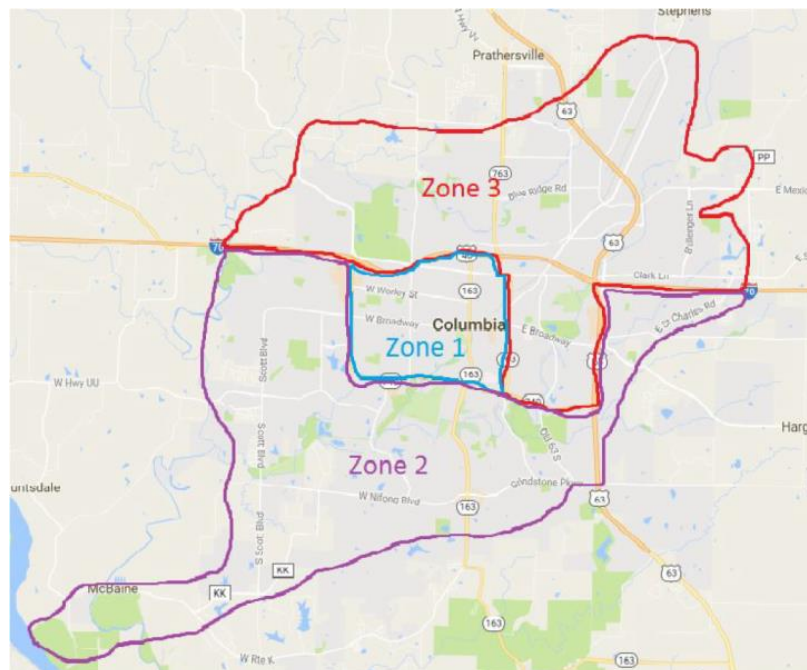
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The Electric Utility follows guidelines established in its Vegetation Management Program (VMP) (see attached). The VMP adheres to industry standards for best management practices outlined by Tree Line USA. Tree Line USA is a certification awarded by the Arbor Day Foundation, recognizing best practices in utility arboriculture following 5 core standards:

1. Quality Tree Care — Industry standards for pruning, planting, removals, trenching, and tunneling near trees.
2. Annual Worker Training — Utility employees and contract workers are trained in best practices.
3. Tree Planting and Public Education — Tree planting and public education programs are available to the public and paying customers, demonstrating proper tree planting, placement, and pruning while expanding the tree canopy in the community.
4. Tree-Based Energy Conservation Program — A formal tree-based energy conservation program is in place, putting special consideration on the value of trees in conserving energy.
5. Arbor Day Celebration — Sponsorship of or participation in annual Arbor Day events at the community level are documented, including collaboration with community groups whenever possible.

The utility performs routine inspections and vegetation removal on a triennial maintenance schedule for the 13.8 kV Electric Distribution System. These areas are typically trimmed during dormant season to reduce stress and regrowth with the exception of hazards and reliability issues that may emerge. The map below indicates the three zones of used for annual maintenance.

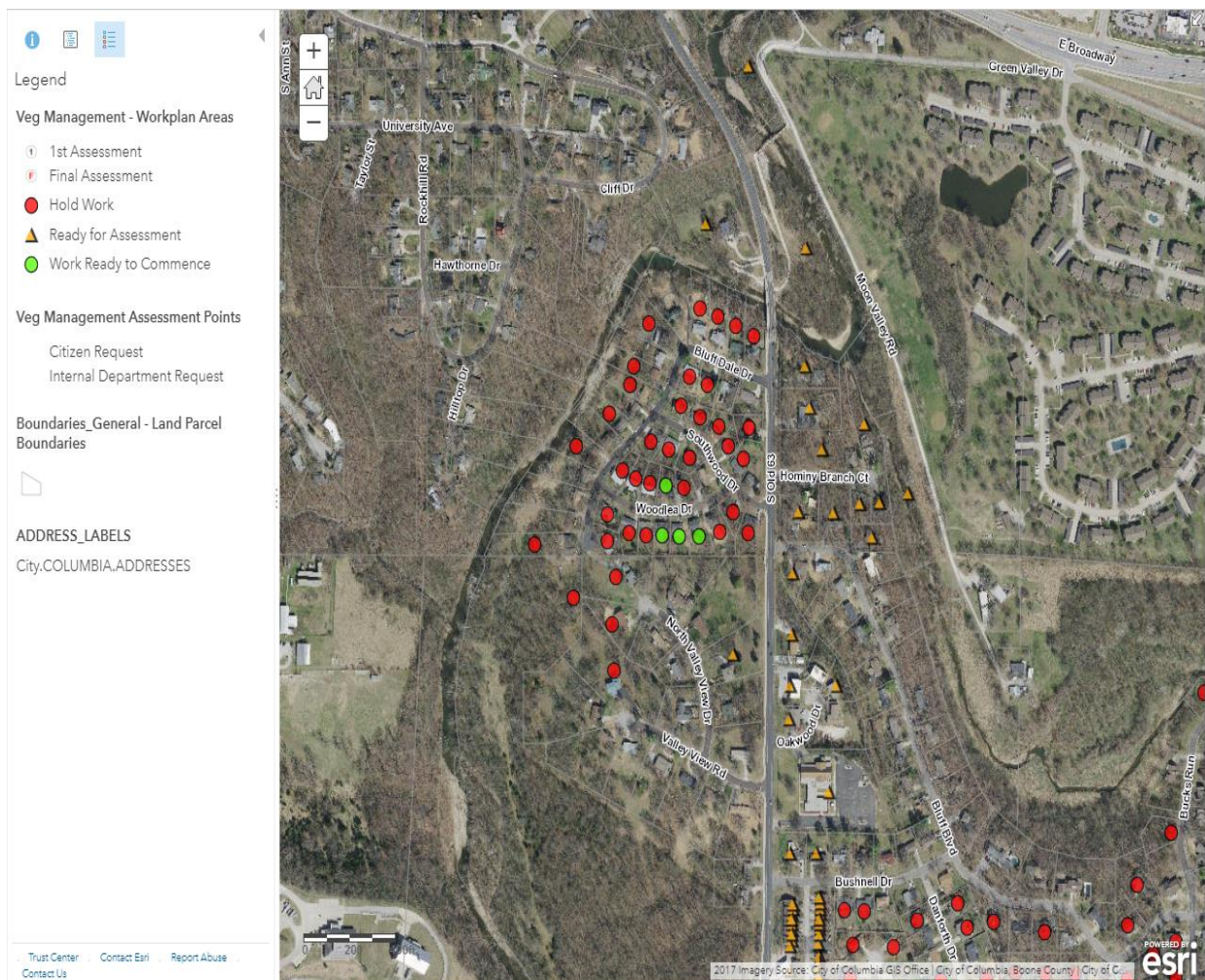




The VMP is implemented using three basic teams:

1. Consulting Utility Foresters (internal staff): tasked with performing routine assessments, customer outreach and recognition of tree hazards
2. Contracted Tree Trimming Crews: Utilizing industry leading equipment and techniques, allowing for safe, efficient and sustainable practices.
3. Trade A Tree program: Promoting "Right Tree Right Place" by providing free suitable tree plantings as replacement for tree or vegetation creating safety or reliability hazards, utilizing local nurseries to provide quality viable trees, service and education for tree care.

Documentation and positive communications are integral parts of all daily work functions. Utilizing a mobile work order system, staff is able to track initial assessments, crew assignments, tree removal, trade a tree recipients, final inspections and other critical information. The screenshot below is an example highlighting addresses ready for assessment, addresses ready for vegetation maintenance, and addresses still requiring further work prior to commencing maintenance.





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Customers are notified via door hanger of routine work and how to contact the utility with any questions. A permission slip is used for documenting the customer acknowledgement and agreement for removal of specified tree(s), see below.



Columbia Water & Light Vegetation Removal Request

As part of our commitment to providing safe and reliable electric service to you and your neighbors, Columbia Water & Light provides a vegetation removal service. Your permission is required to perform the work described below.

Owner's Name (please print) _____

Address _____

Daytime Phone _____ Cell _____

E-mail Address _____ Other contact info _____

REMOVE VEGETATION AS FOLLOWS:

Job site comments:

For qualified tree removals, the stump will be cut as low as possible to ground. The stump will **NOT** be removed. Smaller branches will be chipped and hauled away. Larger limbs and trunk, will be cut in 16" to 20" lengths and wood will be left at the job site.

CUSTOMER APPROVAL: I certify that I am the owner of the property listed above, that I give permission to perform work as described above, and that, to the best of my knowledge, understanding and belief, the vegetation to be removed is not subject to any conservation easements or other encumbrances that would prohibit its removal.

Owner's signature _____

Approving Water & Light Representative _____ Number trees/bushes approved _____ Date _____

For inquiries:

Michael Forck, 1524 E Business Loop 70, Columbia, MO, 65201. 573-817-6493 or michael.forck@como.gov



The City currently uses several tools to help prevent outages and guide maintenance efforts on an annual basis. One of the tools is infrared camera technology to identify and locate hot spots so that the utility can prevent outages by adjusting or replacing equipment before it fails. The utility is usually capable of getting the entire overhead system done once per year. Below is a report from a recent infrared scan.



Infrared Inspection Report Location 4985 on HC 223 935
W. Old Plank Road 8/12/19

Measurements

Bx1	Max	96.0 °F
	Min	63.0 °F
	Average	87.0 °F
Sp1		92.7 °F
Sp2		91.6 °F
Sp3		92.0 °F
Sp4		93.2 °F
Sp5		94.7 °F
Sp6		93.0 °F

Parameters

Emissivity	0.85
Ref. temp.	85 °F
Distance	30 ft
Atmospheric temp.	85 °F
Ext. optics temp.	1 °F
Ext. optics trans.	1
Relative humidity	71 %

Geolocation

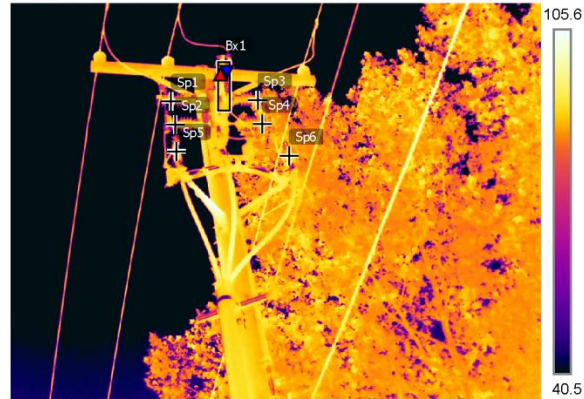
Compass	204° SW
Location	N 38° 53' 15.69", W 92° 21' 21.16"

<http://maps.google.com/?z=17&l=38.8877,-92.3559>

Note

Loc 4985 8_12_19

8/12/2019 12:44:40 PM



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FLIR T1020

72501278

8/12/2019 12:44:40 PM



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The City also performs pole inspections, typically once every five years. Lee Inspection and Consulting Services completed the last pole inspection in 2017. Since that time the utility has utilized its electrical contractor, PAR, to perform the majority of the maintenance from the reports generated with the goal of completing the recommended work within 5 years. The utility has focused on the poles with the least favorable reports.

The utility also uses drone technology to inspect its overhead electric systems. The drone allows a small crew, usually 3, to inspect multiple structures at a time without having to climb or reach the pole with a bucket truck. Like the infrared camera, this technology helps identify issues to prevent outages by adjusting or replacing equipment before it fails. The picture below shows a woodpecker hole on Harmony Branch circuit 233.

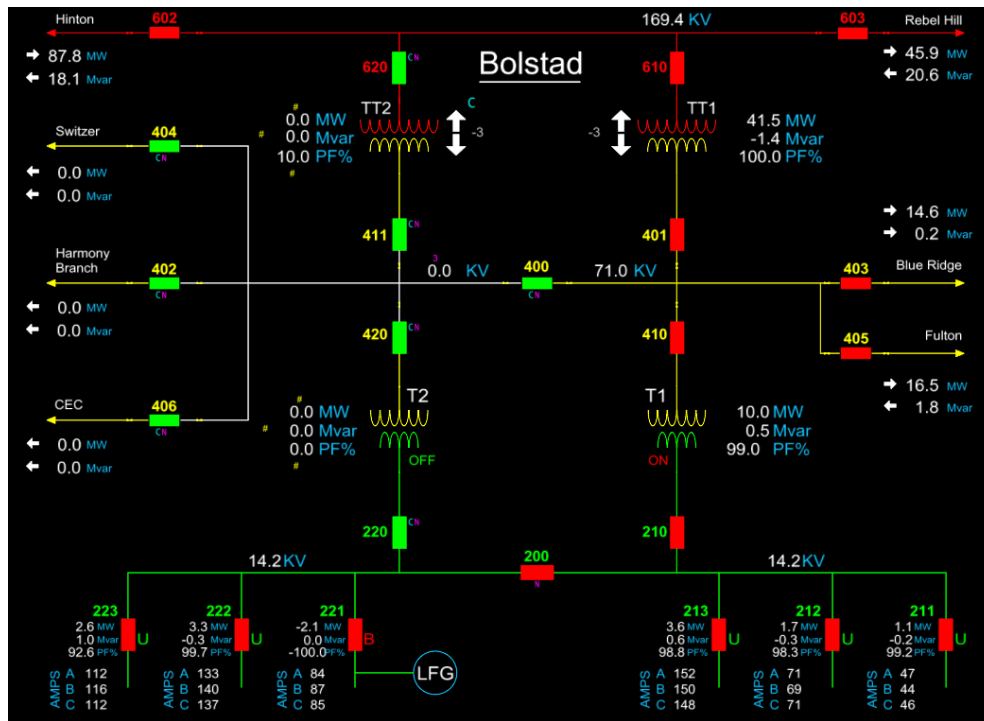


Engineers, Control Room Operators and Electric Distribution Coordinators utilize an Energy Management System (EMS) to monitor the transmission and distribution systems (see screenshot below). Engineers utilize this to review historic loading on transformers and circuits. This information can be used to create work orders to help shift load from one substation feeder to another or to balance the phases on a particular circuit. Control Room Operators and Electric Distribution Coordinators utilize to this system to monitor and control the system in real time. This is utilized daily to keep crews safe and to minimize outages by having situational awareness of the electric system.

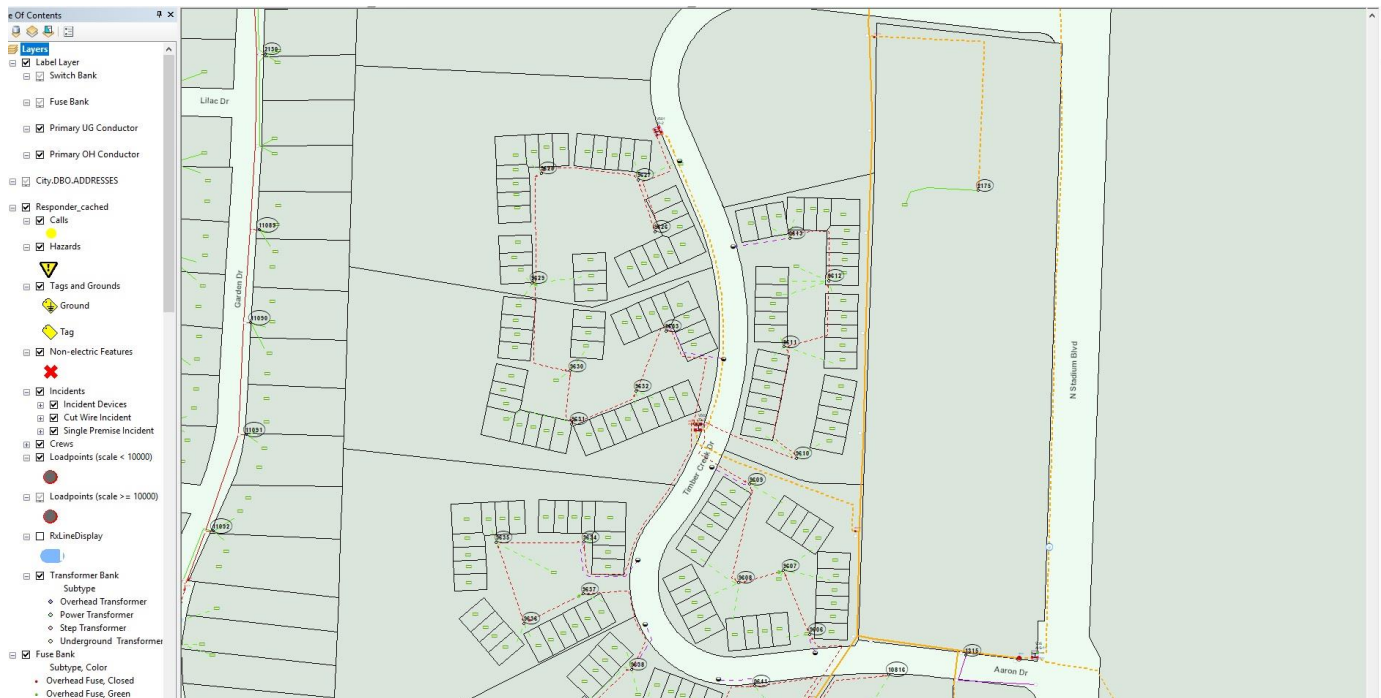


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The City also has an Outage Management System (OMS) that it uses to help reduce the amount of time that outages last. The OMS takes input from an Interactive Voice Response (IVR) system that is able to automatically process incoming calls from customers reporting outages. These two systems assist staff during an outage by predicting the most likely cause and location of issues that are causing an outage, see screenshot below.





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The City owns and operates a 13.8 kV electric distribution system. This distribution system is derived from eight substations with over sixty feeders from station class transformers that step power down from the 161 kV or 69 kV transmission system that surrounds the City of Columbia. Most of the equipment utilized to create the 13.8 kV distribution system is operated and maintained to be replaced at failure. This is mainly due to the fact that most equipment failure is caused by unpredictable events such as storms, wildlife, vegetation interference, automobile accidents, etc. Because of this unpredictability, the distribution system is designed to be able to be operated with any one element out of service. Report REP85-15 highlighted the capability of the Perche Creek substation and its ability to withstand a failure of one of its transformers. The report also reviewed the mitigation plans to switch load onto adjacent substation circuits should an incident occur. This philosophy can be used at any of the City's eight substations should similar events happen.

The City currently utilizes the American Public Power Association's eReliability Tracker program. The eReliability Tracker is a web-based tool to collect, categorize, and summarize outage information. The City uses this tool to track reliability performance and calculate IEEE 1366 reliability indices (see eReliability Report attached). The two main indices that are utilized are the System Average Interruption Duration Index (SAIDI) and the System Average Interruption Frequency Index (SAIFI). SAIDI provides the average length of time per customer that an outage lasts and SAIFI provides the average frequency of outages per customer per year.

The report also provides other information that used to help guide inspection and maintenance activities such as worst performing circuits, top outage causes and top outages to date.

Every year, the American Public Power Association recognizes certain utilities that subscribe to the eReliability Tracker for excellence in reliability. Recipients are determined by comparing their reliability data with the national reliability data published by the Energy Information Administration. To receive a certificate, the utility must be in the first quartile of utilities for System Average Interruption Duration Index (SAIDI) based on the EIA data. The City has received this Certificate in 2018 and 2019 for calendar years 2017 and 2018 respectively, see the 2018 certificate attached.

The City has also been recognized multiple times by the American Public Power Association as a Reliable Public Power Provider (RP3). At the November 5, 2018 City Council meeting the City was presented with its latest certification, see attached. The Association's RP3 program is based on industry-recognized leading practices in the following four categories:

- Reliability
- Safety
- Workforce Development
- System Improvement



Fiscal Impact

Short-Term Impact: None

Long-Term Impact: None

Strategic & Comprehensive Plan Impact

[Strategic Plan Impacts:](#)

Primary Impact: Infrastructure, Secondary Impact: Not Applicable, Tertiary Impact: Not Applicable

[Comprehensive Plan Impacts:](#)

Primary Impact: Infrastructure, Secondary Impact: Not applicable, Tertiary Impact: Not Applicable

Legislative History

Date	Action
11/5/2018	SI13-18 American Public Power Association - Reliable Public Power Provider (RP3) award.
10/7/2019	REP85-19 Capacity of the Perche Creek Substation.

Suggested Council Action

Staff recommends Council accept report as submitted.