KAYSVILLE CITY POWER
2020–2029 LONG RANGE PLAN

Prepared For

Kaysville City Power
721 W Old Mill Lane
Kaysville, UT 84037

Prepared By:

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"Engineering with Distinction"

ECI
ELECTRICAL CONSULTANTS, INC.

ENGINEER'S CERTIFICATION
2020-2029 Long Range Plan
Kaysville City Power
721 W Old Mill Lane
Kaysville, UT 84037

Upon completion of construction of the facilities proposed herein, the system will provide adequate and dependable service to approximately 9,993 meters and 53 MW of peak non-coincidental load, as projected in the load forecast.

The recommended system improvements included in this report are in general agreement with the Kaysville City Power Planning Criteria.

I certify that this report was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer.

Name David South, P.E.

July 17, 2020
Date

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Reg. No.

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1.0 OVERVIEW & PURPOSE

1.1 Overview

This report contains an Analysis of the Present System and the 2020–2029 Long Range Plan for Kaysville City Power (KCP). The Executive Summary, *Section 2.0*, contains the required information for KCP's Management to include in financial forecasts and a summary of the recommended plan. The Planning Criteria is described in *Section 3.0*, while *Section 4.0* provides a review of historical trends and load forecasts. *Section 5.0* of this report examines performance of the existing distribution system for voltage drop, voltage and current imbalance, line loading, equipment capacity, power factor and losses with present peak and projected 10-year peak conditions. The Mechanical condition of the plant is also addressed, along with the reliability of service to members.

Kaysville City Power (KCP) service territory includes the Kaysville, Utah area in Davis County. KCP operates 157 miles of distribution lines and 4 substations.

1.2 Purpose

The purpose of this report is to provide Kaysville City Power with an orderly plan for carrying out construction and other needed improvements. Complementary to this purpose is the study's goal of planning and completing improvements in the most economic manner possible.

A second major purpose of this report is to provide the most up-to-date forecast possible of financial requirements for the next ten (10) years. These cost estimates provide KCP with the data necessary for completion of their annual business work plans and budgets and serve as a basis for long-term financial forecasts.

Service reliability and quality of service are the very essence of operational goals in any electric utility. The function of system planning is to evaluate the existing and projected system configuration, voltage levels, and load balance in a manner that endeavors to increase the quality of service. It is a continuing effort and in order to serve its intended purpose, planning must change dynamically as governing conditions change. This plan provides the Owners' and Engineers' current philosophy on those specific improvements which will best meet the present needs of the system.

2.0 EXECUTIVE SUMMARY

This report represents results of a 10-year Long Range Plan prepared by Electrical Consultants, Inc. (ECI) for Kaysville City Power (KCP). The purpose of this plan, as outlined in *Section 1.0* of this report, is to provide KCP with an orderly plan for carrying out construction and other needed improvements in the most economic manner possible. The plan includes KCP's entire distribution system, as well as its transmission system.

All recommendations were designed to be in general concurrence with planning criteria and to ensure that no adverse impacts to the integrity of KCP's system were imposed. Single-contingency outages were investigated through analysis of load-flow and voltage-drop studies to address system requirements during such operating conditions. The Mechanical conditions of KCP's plant, along with the reliability of service to members, were also factored into the recommendations for system improvement. Planning criteria and historical system information are discussed in *Sections 3.0 and 4.0,* respectively. A thorough review of the existing system performance with present and projected 10-year loading is provided in *Section 5.0*, accompanied by maps provided in the *Appendix*.

2.1 Existing System Performance

Based upon historic kW usage, KCP's system has a projected compounded annual growth rate of 0.52%, with losses at the end of the 10-year study period. This growth rate projects a possible peak of approximately 53 MW at the end of the planning period. Growth on KCP's system is variable, and has numerous locations with concentrated growth. The analysis for the system was based upon a non-coincident peak of 48 MW with a projected 10-year loading level of 53 MW.

Analysis of the existing system generally portrays a system that is well-maintained, resulting in few inadequacies. There are areas on the Main service area that have levels below 118.0 volts on the 10-year system.

2.2 Recommended Plan Description

The large portion of projects recommended for the 10-year plan consist of improvements for replacing aging conductor and increasing load transfer capabilities. These projects consist mostly of increasing existing conductor size to a larger conductor to alleviate any conductor overloading during load transfer and increasing system reliability during normal conditions.

Major projects include:

1. Installation of a 15/20/25 MVA transformer at Burton Lane substation
2. Installation of a 15/20/25 MVA transformer at Schick substation
3. Upgrade West and Schick substations
4. Installation of a 15/20/25 MVA transformer at West substation
5. Rebuild overhead line along S Angel Street
6. Rebuild overhead line along E 500 N back to the Main substation
7. Rebuild overhead line along Green road and S 600 E
8. Rebuild overhead and underground south of West substation along N 600 W and S Kays Drive
9. Rebuild overhead and underground between Schick and West
10. Rebuild overhead line along N Main Street and W Mutton Hollow Road
11. Construct new feeders out of West and Schick substations
12. Rebuild underground south of Schick substation
13. Rebuild overhead line along S Sunset Drive

The total cost of recommended projects for the planning period is estimated at $1,128,000, and the total cost of contingency projects for the planning period is estimated at $2,810,000. The recommended costs by substations table lists the projects by substation service area. Costs provided do not include cost for Right-of-Way (ROW) or permitting.

Project Code	Sub	Priority	Mul	Miles/ Qty	Construction Description	Unit Cost	Total Cost
Substation: Main							
MN-10A	Main	10	1	.6	Rebuild 3-phase 477 kcmil ACSR with 3-phase 556 kcmil ACSR	$216,652	$130,000
MN-10B	Main	10	1	.2	Rebuild 3-phase #4/0 AWG ACSR with 3-phase 477 kcmil ACSR	$216,652	$43,000
MN-1A	Main	1	1	1	Install GOAB Switch Equipment	$10,000	$10,000
MN-2A	Main	2	1	.6	Rebuild 3-phase #6 HDC with 3-phase #1/0 ACSR	$213,378	$128,000
MN-3A	Main	3	1	.6	Rebuild 3-phase #2 AWG ACSR with 3-phase #4/0 AWG ACSR	$214,170	$129,000
MN-4A	Main	4	1	.5	Rebuild 3-phase 4 CU with 3-phase 477 kcmil ACSR	$216,652	$108,000
MN-7A	Main	7	1	.3	Rebuild 1-phase #2 AWG AL with 1-phase #1/0 ACSR	$202,218	$61,000
MN-9A	Main	9	1	.2	Rebuild 3-phase #6 HDC with 3-phase #4 AWG ACSR	$213,166	$43,000
					Total Main Cost	**$652,000**	
Substation: Schick							
SH-8A	Schick	8	1	.1	Rebuild 3-phase 477 kcmil ACSR with 3-phase 556 kcmil ACSR	$216,652	$22,000
					Total Schick Cost	**$22,000**	
Substation: West							

Project Code	Sub	Priority	Mul	Miles/ Qty	Construction Description	Unit Cost	Total Cost
WE-2A	West	2	1	.1	Rebuild 3-phase 477 kcmil ACSR with 3-phase 954 kcmil ACSR	$256,000	$26,000
WE-4A	West	4	1	.3	Rebuild 3-phase #1/0 ACSR with 3-phase 477 kcmil ACSR	$216,652	$65,000
WE-5A	West	5	1	.1	Rebuild 3-phase #6 HDC with 3-phase #4 AWG ACSR	$213,166	$21,000
WE-9A	West	9	1	.3	Rebuild 3-phase #4/0 AWG ACSR with 3-phase 477 kcmil ACSR	$216,652	$65,000
WE-9B	West	9	1	.4	Rebuild 3-phase #4/0 AWG AL 25KV with 3-phase 350 kcmil	$308,484	$123,000
WE-C10A	West	10	1	.5	Rebuild 3-phase #4/0 AWG AL 15KV with 3-phase 350 kcmil	$308,484	$154,000
					Total West Cost	**$454,000**	
					Total Recommended Cost	**$1,128,000**	

Project Code	Substation/ Item	Feeder	Priority	Miles/ Qty	Construction Description	Unit Cost	Total Cost
MN-1A	Main	MN	1	1	Install GOAB Switch Equipment	$10,000	$10,000
					Total Year 1 Cost		**$10,000**
MN-2A	Main	MN	2	.6	Rebuild 3-phase #6 HDC with 3-phase #1/0 ACSR	$213,378	$128,000
WE-2A	West	WE	2	.1	Rebuild 3-phase 477 kcmil ACSR with 3-phase 954 kcmil ACSR	$256,000	$26,000
					Total Year 2 Cost		**$154,000**
MN-3A	Main	MN	3	.6	Rebuild 3-phase #2 AWG ACSR with 3-phase #4/0 AWG ACSR	$214,170	$129,000
					Total Year 3 Cost		**$129,000**
MN-4A	Main	MN	4	.5	Rebuild 3-phase 4 CU with 3-phase 477 kcmil ACSR	$216,652	$108,000
WE-4A	West	WE	4	.3	Rebuild 3-phase #1/0 ACSR with 3-phase 477 kcmil ACSR	$216,652	$65,000
					Total Year 4 Cost		**$173,000**
WE-5A	West	WE	5	.1	Rebuild 3-phase #6 HDC with 3-phase #4 AWG ACSR	$213,166	$21,000
					Total Year 5 Cost		**$21,000**
MN-7A	Main	MN	7	.3	Rebuild 1-phase #2 AWG AL with 1-phase #1/0 ACSR	$202,218	$61,000
					Total Year 7 Cost		**$61,000**
SH-8A	Schick	SH	8	.1	Rebuild 3-phase 477 kcmil ACSR with 3-phase 556 kcmil ACSR	$216,652	$22,000

Project Code	Substation/ Item	Feeder	Priority	Miles/ Qty	Construction Description	Unit Cost	Total Cost
					Total Year 8 Cost		**$22,000**
MN-9A	Main	MN	9	.2	Rebuild 3-phase #6 HDC with 3-phase #4 AWG ACSR	$213,166	$43,000
WE-9A	West	WE	9	.3	Rebuild 3-phase #4/0 AWG ACSR with 3-phase 477 kcmil ACSR	$216,652	$65,000
WE-9B	West	WE	9	.4	Rebuild 3-phase #4/0 AWG AL 25KV with 3-phase 350 kcmil	$308,484	$123,000
					Total Year 9 Cost		**$231,000**
MN-10A	Main	MN	10	.6	Rebuild 3-phase 477 kcmil ACSR with 3-phase 556 kcmil ACSR	$216,652	$130,000
MN-10B	Main	MN	10	.2	Rebuild 3-phase #4/0 AWG ACSR with 3-phase 477 kcmil ACSR	$216,652	$43,000
WE-C10A	West	WE	10	.5	Rebuild 3-phase #4/0 AWG AL 15KV with 3-phase 350 kcmil	$308,484	$154,000
					Total Year 10 Cost		**$327,000**
					Total Recommended Cost		**$1,128,000**

Table 2-4-3

Contingency Cost

Project Code	Feeder	Sub	Yr of Improv	Mul	Miles/ Qty	Construction Description	Unit Cost	Total Cost
BR-C1A	BR	Burton Lane	1	1	1	Install 15/20/25 MVA LTC Expansion Equipment	$500,000	$500,000
BR-C6A	BR	Burton Lane	6	1	.4	Rebuild 3-phase #4/0 AWG ACSR with 3-phase 477 kcmil ACSR	$216,652	$86,661
BR-C6B	BR	Burton Lane	6	1	.1	Rebuild 3-phase #4/0 AWG 220 MIL EPR with 3-phase 500 kcmil	$308,484	$30,848
MN-C3A	MN	Main	3	1	0.1	Construct 3-phase 477 kcmil ACSR	$210,652	$21,065
MN-C6A	MN	Main	6	1	.2	Rebuild 3-phase #1/0 ACSR with 3-phase 477 kcmil ACSR	$216,652	$43,330
SH-C2A	SH	Schick	2	1	.3	Rebuild 1-phase #6 HDC with 3-phase 477 kcmil ACSR	$215,152	$64,546
SH-C2B	SH	Schick	2	1	.1	Rebuild 3-phase #2 AWG ACSR with 3-phase 477 kcmil ACSR	$216,652	$21,665
SH-C3A	SH	Schick	3	2	.2	Rebuild 3-phase 750 kcmil ACSR to parallel 3-phase 750 kcmil ACSR	$604,968	$120,994
SH-C4A	SH	Schick	4	1	1	Install 15/20/25 MVA LTC Expansion Equipment	$500,000	$500,000
SH-C9A	SH	Schick	9	1	0.4	Rebuild 3-phase #4/0 AWG AL 15KV with 3-phase 750 kcmil	$308,484	$123,394
WE-C10B	WE	West	10	1	.5	Rebuild 3-phase 477 kcmil ACSR with 3-phase 556 kcmil ACSR	$216,652	$108,326
WE-C10C	WE	West	10	1	.3	Rebuild 3-phase 750 kcmil ACSR with 3-phase 1100 kcmil	$394,839	$118,452
WE-C10D	WE	West	10	1	.3	Rebuild 3-phase 477 kcmil ACSR with 3-phase 556 kcmil ACSR	$216,652	$64,996
WE-C10E	WE	West	10	1	.1	Rebuild 3-phase 477 kcmil ACSR with 3-phase 556 kcmil ACSR	$216,652	$21,665
WE-C3A	WE	West	3	1	1	Upgrade substation equipment	$500,000	$500,000
WE-C3B	WE	West	3	1	1	Install 15/20/25 MVA LTC Expansion Equipment	$500,000	$500,000

Project Code	Feeder	Sub	Yr of Improv	Mul	Miles/ Qty	Construction Description	Unit Cost	Total Cost
						Total Contingency Cost	**$2,810,191**	

Table 2-4-4

Project Code	Substation/ Item	Feeder	Yr of Improv	Miles/ Qty	Construction Description	Unit Cost	Total Cost
BR-C1A	Burton Lane	BR	1	1	Install 15/20/25 MVA LTC Expansion Equipment	$500,000	$500,000
					Total Year 1 Cost		**$500,000**
SH-C2A	Schick	SH	2	.3	Rebuild 1-phase #6 HDC with 3-phase 477 kcmil ACSR	$210,652	$64,546
SH-C2B	Schick	SH	2	.1	Rebuild 3-phase #2 AWG ACSR with 3-phase 477 kcmil ACSR	$210,652	$21,665
					Total Year 2 Cost		**$84,261**
MN-C3A	Main	MN	3	0.1	Construct 3-phase 477 kcmil ACSR	$210,652	$21,065
SH-C3A	Schick	SH	3	.2	Rebuild 3-phase 750 kcmil ACSR to parallel 3-phase 750 kcmil ACSR	$302,484	$120,994
WE-C3A	West	WE	3	1	Upgrade substation equipment	$500,000	$500,000
WE-C3B	West	WE	3	1	Install 15/20/25 MVA LTC Expansion Equipment	$500,000	$500,000
					Total Year 3 Cost		**$1,142,059**
SH-C4A	Schick	SH	4	1	Install 15/20/25 MVA LTC Expansion Equipment	$500,000	$500,000
					Total Year 4 Cost		**$500,000**
BR-C6A	Burton Lane	BR	6	.4	Rebuild 3-phase #4/0 AWG ACSR with 3-phase 477 kcmil ACSR	$210,652	$86,661
BR-C6B	Burton Lane	BR	6	.1	Rebuild 3-phase #4/0 AWG 220 MIL EPR with 3-phase 500 kcmil	$302,484	$30,848
MN-C6A	Main	MN	6	.2	Rebuild 3-phase #1/0 ACSR with 3-phase 477 kcmil ACSR	$210,652	$43,330

Project Code	Substation/ Item	Feeder	Yr of Improv	Miles/ Qty	Construction Description	Unit Cost	Total Cost
					Total Year 6 Cost		**$156,640**
SH-C9A	Schick	SH	9	0.4	Rebuild 3-phase #4/0 AWG AL 15KV with 3-phase 750 kcmil	$302,484	$123,394
					Total Year 9 Cost		**$120,994**
WE-C10B	West	WE	10	.5	Rebuild 3-phase 477 kcmil ACSR with 3-phase 556 kcmil ACSR	$210,652	$108,326
WE-C10C	West	WE	10	.3	Rebuild 3-phase 750 kcmil ACSR with 3-phase 1100 kcmil	$388,839	$118,452
WE-C10D	West	WE	10	.3	Rebuild 3-phase 477 kcmil ACSR with 3-phase 556 kcmil ACSR	$210,652	$64,996
WE-C10E	West	WE	10	.1	Rebuild 3-phase 477 kcmil ACSR with 3-phase 556 kcmil ACSR	$210,652	$21,665
					Total Year 10 Cost		**$306,239**
					Total Contingency Cost		**$2,810,191**

Table 2-4-5

Alternative Cost

Project Code	Feeder	Sub	Yr of Improv	Mul	Miles/ Qty	Construction Description	Unit Cost	Total Cost
BR-ALT1A	BR	Burton Lane	1	1	1	Install additional 10/12.5 MVA transformer	$450,000	$450,000
MN-ALT10A	MN	Main	10	1	1	Extend transmission and construct substation	$500,000	$3,500,000
SH-ALT3A	SH	Schick	3	1	1.3	Construct 3-phase 477 kcmil ACSR	$210,652	$273,848
SH-ALT3B	SH	Schick	3	1	1	Upgrade substation equipment	$500,000	$500,000
WE-ALT7A	WE	West	7	1	.1	Construct 3-phase 477 kcmil ACSR	$210,652	$21,065
						Total Alternative 2 Cost	**$4,744,912.80**	

3.0 SYSTEM PLANNING CRITERIA

The System Planning Criteria presented within this section was used to guide the development of the 2020–2029 Long Range Plan. Criteria were developed to provide minimum standards for all system improvement, operation, and maintenance activities affecting system facilities. Compliance with these minimum standards will result in adequate voltage, acceptable thermal loading of system components, and a distribution system capable of providing safe, reliable service.

This study considers quality of service and service continuity to be critical issues to KCP. Geographical conditions, including occasions of severe inclement weather in this service area, serve as a factor in the results. Meeting established criteria will help KCP maintain an excellent quality of service to their consumers. KCP has, and will continue to, utilize current technologies to improve the quality of service to the membership, allow efficient operations, and provide the ability to gather data to evaluate potential improvements to the system.

All criteria were established jointly between Electrical Consultants, Inc. (ECI) and Kaysville City Power (KCP).

3.1 Electrical System Performance Criteria

This section describes basic electrical performance criteria for the system for both normal and contingency operating conditions. Regulated load flows were utilized for by-phase analysis of the performance of KCP's system.

3.1.1 Distribution System Voltage Level

Voltage levels for the plan are defined with regulated substation bus voltage set to 126.0 volts during all seasons for purposes of the voltage drop study. Maximum voltage at any point of the distribution feeders is limited to 126.0 volts.

The system developed for the plan period is designed to maintain a minimum of 118.0 volts at all distribution transformer primaries. This will result in less than an eight (8) volt drop from a "sending end" bus voltage of 126.0 volts, after applying line voltage regulators, during normal system operation. This 118.0 volt limit is consistent with ANSI standards that specify 114.0 volts minimum to the consumer premises, where the additional four (4) volt drop represents service transformer and service wire drop.

3.1.2 Voltage Regulation

This section describes the application of On-Load Tap Changers (OLTC), voltage regulators, line drop compensation, first house protection, and reverse power flow devices. Upon installation of regulators in the recommended plan, the R and X values will be computed to assure optimal settings. The criteria utilized in this study include, but are not limited to, the following:

a. Voltage limit settings of 126.0 volts for first house protection shall be utilized whenever possible to prevent excessive voltage to consumers. Significant consideration to voltage regulator compensation settings shall be given to assure that regulator controls do not inadvertently result in "out of criteria" voltages during seasonal loading conditions.

b. In lieu of regulating 126.0 volts at the substation bus, line drop compensation (LDC) settings attempt to regulate a level of system voltage at a theoretical load center on the feeder by adjusting voltage levels as a function of power flow. LDC settings will cause voltage at the substation bus and end-of-line to fluctuate, while attempting to maintain a relatively fixed voltage near the center of the feeder. Without LDC, bus voltage remains fairly constant, with relatively large voltage fluctuations at remote points on the feeder. Use of LDC may create problems for large industrial or other voltage sensitive customers located near the substation due to the frequency and magnitude of system voltage changes.

c. In order to maximize the use of the distribution system, it is necessary to operate the substation tap changers/regulators to adequately compensate for swings in the transmission voltage and provide a sufficient voltage range for allocation across the distribution system.

d. Feeder regulation, instead of bus regulation, will be considered at substations where the loading conditions or load density vary significantly between feeders.

e. Reverse power flow will be considered at strategic locations for load transfer between feeders that can be source fed from either direction.

f. Regulation at the substation, as well as one stage of regulation installed on the feeder, is acceptable in all system design; however cascaded feeder regulators will be considered on a case-by-case basis. Cascaded regulators may provide the best long-term solution for load transfer on feeders where capacity is not the limiting condition.

3.1.3 Phase Balancing

If a primary feeder has poor voltage regulation, remedial effort will first be made to evaluate loading of each phase of the three-phase feeder. If the load on the feeder is poorly balanced between phases, reasonable measures should be taken to achieve balance. Balanced conditions mean equal current in each phase with corresponding minimum regulation at system design loading.

Unbalanced feeders can result in poor voltage regulation, unnecessarily increased line losses, and facilities that may be overloaded. This is possible even if the total three-phase load is not excessive. An ideal design, although usually not achievable in practice, will provide load balance throughout the entire feeder, not just at the substation. If a feeder serves only three-phase load, then balance is typically not a problem. Phase balance is also a primary concern when considering sectionalizing.

The following items provide a general indication of potential phase balance problems. To be most effective, attempts shall be made to achieve good balance at system design loading.

a. **Substation Transformer Unbalance** – Goals of balancing substation loads include maintaining balanced flow of power on the transmission system and reducing the risk of transformer bank protective device operation. The percentage of unbalance recommended allows a reasonable margin for the effects of downstream sectionalizing during contingencies. Substation unbalance, as defined at the end of this section, should not exceed 25% or 75 amps, whichever is less, where practical.

b. **Feeder Unbalance at Substations** – The purpose of these criteria is to maintain balanced flow of power on the distribution system and reduce the risk of overloading of the substation feeder and protective devices, as well as the substation transformers. For feeders where the highest loaded phase is 149 amps or less, unbalance should not exceed 40% or 50 amps, whichever is less. For feeders where the highest loaded phase is 150 amps or more, unbalance should not exceed 25% or 75 amps, whichever is less.

c. **Feeder/Tap Unbalance** – The purpose of limiting unbalance in downstream feeders is to maintain balanced flow of power on the distribution system and reduce system losses and voltage drop. For locations where the highest loaded phase is 149 amps or less, unbalance should not exceed 40% or 50 amps, whichever is less. For locations where the highest loaded phase is 150 amps or more, unbalance should not exceed 25% or 100 amps, whichever is less.

d. **Voltage Unbalance** – Normally when loads are balanced, voltages will also be balanced. However, phase voltages may not be balanced due to an unbalance in loading. Voltage balance is of particular concern where large motors exist. Based on ANSI/IEEE Standard 141-1993, the target for maximum allowable voltage unbalance is 2%.

The formula to calculate such unbalance is:

$$Voltage\ Unbalance = \frac{Maximum\ Difference\ Phase\ Voltage - Average\ Voltage}{Average\ Voltage}$$

3.2 Capacity and Loading

This section defines criteria related to equipment loading, including the effect of seasonal conditions and ratings to be considered.

3.2.1 Load Periods

The ultimate model used for analysis is a non-coincident peak model, consisting of the highest loading level for each of the respective substations. KCP's overall summer peak is nearly twice as large as its winter peak, with the trend moving towards summer peak.

3.2.2 Equipment Loading

A key objective of this plan is to maintain peak feeder loading during normal system conditions at desired loading levels to allow for load transfer and protective coordination. Normal system loading is generally desired to be a maximum of 80% conductor loading and 50% conductor loading for feeder ties to allow load transfer.

Equipment loading, expressed as a percent of nameplate rating, should not exceed the following:

a. **Transformers** – A transformer shall not be thermally loaded by more than the following percentage of its nameplate rating:

   Continuously loaded to 130% of OA rating (no fans) during average winter daily temperatures of 32°F (0°C) plus 5°C margin.

   Continuously loaded to 108% of OA rating (no fans) during average summer daily temperature of 72°F (22°C) plus 5°C margin.

The above limits are based on Table 3 of IEEE Standard C57.91-2011 edition, shown on the following page.

Table 3 of IEEE Standard C57.91-2011 **Loading on Basis of Temperatures** (Ambient other than 30°C and Average Winding Rise Less than Limiting Values) (For Quick Approximation) (Ambient Temperature Range 0°C to 50°C)		
	% of Rating	
Type of Cooling	Decrease Load for Each °C Higher Temperature	Increase Load for Each °C Lower Temperature
Self-cooled – ONAN	1.5	1.0
Water-cooled – ONWF	1.5	1.0
Forced-air-cooled – ONAN/ONAF, ONAN/ONAF/ONAF	1.0	0.75
Forced-air-cooled – OFAF, OFWF, ODWF, and ONAN/OFAF/OFAF	1.0	0.75

-average ambient other than 30 ° C and average winding rise less than limiting values, for quick approximation, ambient temperature range – 30 ° C to 50 ° C

b. **Substation and Line Voltage Regulators** – Substation and line voltage regulators shall be monitored for possible replacement at 80% loading on feeders with high load factors during summer peak conditions and 100% during other seasonal conditions. Consideration to increase loading capability by limiting the tap range is given for substation regulators as an alternative to replacement.

c. **Hydraulic Circuit Reclosers** – Hydraulic circuit reclosers should not be loaded more than 80% during peak and load transfer conditions. Excessive loading of these devices can cause inadvertent oil flow in the device timing mechanism, causing reduced operating time and possible mis-coordination.

d. **Electronically Controlled Reclosers and Relay Controlled Breakers** – Electronically controlled reclosers and relay controlled breakers should not be loaded more than 100% during peak conditions, including load transfer conditions.

3.2.3 Conductor

Primary conductors should not be loaded over 80% of their thermal rating under normal service conditions, especially when age and condition elements are present. In addition, loading should be conservatively determined to provide sufficient load transfer capability.

Primary conductor sizing for improvements will be determined on a case-by-case basis using the following criteria:

a. Economic conductor size

b. Minimum size for main three-phase line segments for contingency load transfers determined necessary and practical between KCP and ECI

c. Standard KCP conductor sizes are as follows:

#6 HD CU	477 kcmil ACSR
#4 AWG ACSR	#1/0 AWG URD
#2 AWG ACSR	#4/0 AWG URD
#1/0 AWG ACSR	750 kcmil URD
#4/0 AWG ACSR	1100 kcmil URD

3.3 Power Factor & Losses

Power factor correction to near unity should be continued in all service areas of the system. Capacitors provide a relatively low cost means to boost voltage, improve and control power factor. These improvements usually result in some demand reductions, energy conservation and lower power costs. Some voltage regulation problems can be resolved with the judicious sizing and locating of (usually switched) capacitor banks.

3.4 Contingency System Conditions

Contingency conditions to be reviewed in this plan include loss of a single substation transformer, as well as feeder loss on a case-by-case basis.

3.5 Mechanical Condition and Reliability Criteria

The criteria described within this section must be considered in the analysis in order to provide a complete evaluation of the system. Often, plans overlook the needs of the present system and leave physically deteriorated facilities in place. In addition, several operational concerns can be addressed through the careful evaluation of these constraints with outage concerns and age of facilities. Specific Mechanical items include, but are not limited to, the following:

a. Distribution lines are to be rebuilt and/or relocated if found to be unsafe or in violation (when constructed) of the National Electric Safety Code or applicable codes and regulations.

b. Poles and/or cross arms are to be replaced if found to be physically deteriorated by visual inspection and/or tests (ordinary replacements).

c. Conductors (and associated poles and hardware, as required) shall be considered for replacement if found to contain an average of over two (2) splice(s) per phase per span in any one (1) mile increment, or if conductor is old, in poor condition, or has been annealed.

System improvements should be considered and made, if necessary, in specific areas where members have experienced more than one (1) customer hour for suburban and five (5) customer hours for rural outage hours per year, excluding outages caused by major storms or the power supplier, for the last five (5) consecutive years.

Service reliability goals should be near one (1) customer hour for suburban and two (2) customer hours for rural customers.

4.0 HISTORICAL DATA & LOAD FORECAST

4.1 Description of Service Area

Kaysville City Power serves approximately 9,993 services located in Kaysville, Utah in Davis County, through approximately 158 miles of distribution line. The KCP service area operates in a urban based economy that is mostly residential.

4.2 Line Statistics

Kaysville City Power's system operates at 12.47 kV, with approximately 9,993 services and a density of 59 consumers per mile of distribution line. A summary of the construction type is provided below in *Table 4-2-1*.

Construction Type	Miles of Line
OVERHEAD LINE	52
UNDERGROUND LINE	106
TOTAL	158

Approximate Kaysville City Power Distribution System Plant as of 2019
Table 4-2-1

The existing system is a composite of conductor types, as is indicated by the tables on the following pages. *Table 4-2-2* lists conductor miles by size and type for the system and *Table 4-2-3* lists conductor miles by size and type for each substation.

Kaysville City Power - Total Line Miles

Table 4-2-2

Conductor Type	Three Phase	Two Phase	Single Phase	Total
15KV 1100KCMIL AL	0.73	0.00	0.00	0.73
15KV 2AWG AL	18.14	0.99	56.16	75.29
15KV 4/0AWG AL	27.65	0.03	0.69	28.37
15KV 750KCMIL AL	1.13	0.00	0.00	1.13
2STR	0.00	0.00	0.11	0.11
ACSR 1/0 AWG	2.07	0.00	0.43	2.50
ACSR 2 AWG	3.38	0.07	7.25	10.71
ACSR 4/0 AWG	5.28	0.00	0.00	5.28
ACSR 477 KCMIL	12.69	0.00	0.07	12.76
COPPER 1/0 AWG	1.12	0.00	0.00	1.12
COPPER 2 AWG	1.12	0.00	0.04	1.16
COPPER 4 AWG	1.96	0.61	1.71	4.28
COPPER 6 AWG	4.47	1.32	8.68	14.47
COPPER 8 AWG	0.00	0.00	0.02	0.02
Summary for the KCP Area				
Totals	79.74	3.03	75.16	157.92

Kaysville City Power - Total Line Miles

Table 4-2-3

Substation	Conductor Type	Three Phase	Two Phase	Single Phase	Total
BURTON LANE					
	15KV 2AWG AL	4.69	0.42	15.01	20.12
	15KV 4/0AWG AL	8.18	0.00	0.29	8.47
	15KV 750KCMIL AL	0.08	0.00	0.00	0.08
	ACSR 2 AWG	0.67	0.00	0.90	1.57
	ACSR 4/0 AWG	0.93	0.00	0.00	0.93
	ACSR 477 KCMIL	3.58	0.00	0.00	3.58
	COPPER 2 AWG	0.25	0.00	0.00	0.25
Summary for BURTON LANE					
Totals		18.38	0.42	16.20	35.00
MAIN					
	15KV 1100KCMIL AL	0.52	0.00	0.00	0.52
	15KV 2AWG AL	2.58	0.36	17.51	20.45
	15KV 4/0AWG AL	3.48	0.03	0.07	3.58
	15KV 750KCMIL AL	0.51	0.00	0.00	0.51
	ACSR 1/0 AWG	1.00	0.00	0.43	1.43
	ACSR 2 AWG	1.75	0.04	3.72	5.51
	ACSR 4/0 AWG	1.01	0.00	0.00	1.01
	ACSR 477 KCMIL	4.64	0.00	0.00	4.64
	COPPER 1/0 AWG	1.12	0.00	0.00	1.12
	COPPER 2 AWG	0.70	0.00	0.03	0.73
	COPPER 4 AWG	1.25	0.61	1.01	2.87
	COPPER 6 AWG	3.45	1.27	6.09	10.80
Summary for MAIN					
Totals		22.00	2.32	28.85	53.17
SHICK					
	15KV 1100KCMIL AL	0.22	0.00	0.00	0.22
	15KV 2AWG AL	4.78	0.06	16.62	21.46
	15KV 4/0AWG AL	10.22	0.00	0.25	10.46
	15KV 750KCMIL AL	0.37	0.00	0.00	0.37
	2STR	0.00	0.00	0.11	0.11
	ACSR 1/0 AWG	0.43	0.00	0.00	0.43
	ACSR 2 AWG	0.26	0.00	1.30	1.56
	ACSR 4/0 AWG	2.53	0.00	0.00	2.53
	ACSR 477 KCMIL	3.08	0.00	0.07	3.14
	COPPER 2 AWG	0.00	0.00	0.01	0.01
	COPPER 4 AWG	0.00	0.00	0.35	0.35
	COPPER 6 AWG	0.39	0.00	0.51	0.90
Summary for SHICK					
Totals		22.27	0.06	19.21	41.55

Kaysville City Power - Total Line Miles

Table 4-2-3

Substation	Conductor Type	Three Phase	Two Phase	Single Phase	Total
WEST SUB					
	15KV 2AWG AL	6.08	0.14	7.02	13.25
	15KV 4/0AWG AL	5.77	0.00	0.08	5.86
	15KV 750KCMIL AL	0.17	0.00	0.00	0.17
	ACSR 1/0 AWG	0.64	0.00	0.00	0.64
	ACSR 2 AWG	0.70	0.03	1.33	2.07
	ACSR 4/0 AWG	0.81	0.00	0.00	0.81
	ACSR 477 KCMIL	1.40	0.00	0.00	1.40
	COPPER 2 AWG	0.17	0.00	0.00	0.17
	COPPER 4 AWG	0.71	0.00	0.35	1.06
	COPPER 6 AWG	0.63	0.05	2.09	2.77
	COPPER 8 AWG	0.00	0.00	0.02	0.02
Summary for WEST SUB					
Totals		17.09	0.23	10.89	28.21
Summary for the KCP Area					
Totals		79.74	3.03	75.16	157.92

4.3 Historical Demand and Growth Patterns

Present substation capacity and peak demand are shown in the Feeder Summary. KCP provides distribution-level voltage through four (4) substations; Burton Lane, Main, Schick and West.

Figure 4-3-1 shows the growth characteristics of KCP's entire system for the period 2010 through 2019, as well as projected load growth through year 2029. *Figures 4-3-1* through *4-3-7* display information about past peak demand for each substation between 2010 and 2019.

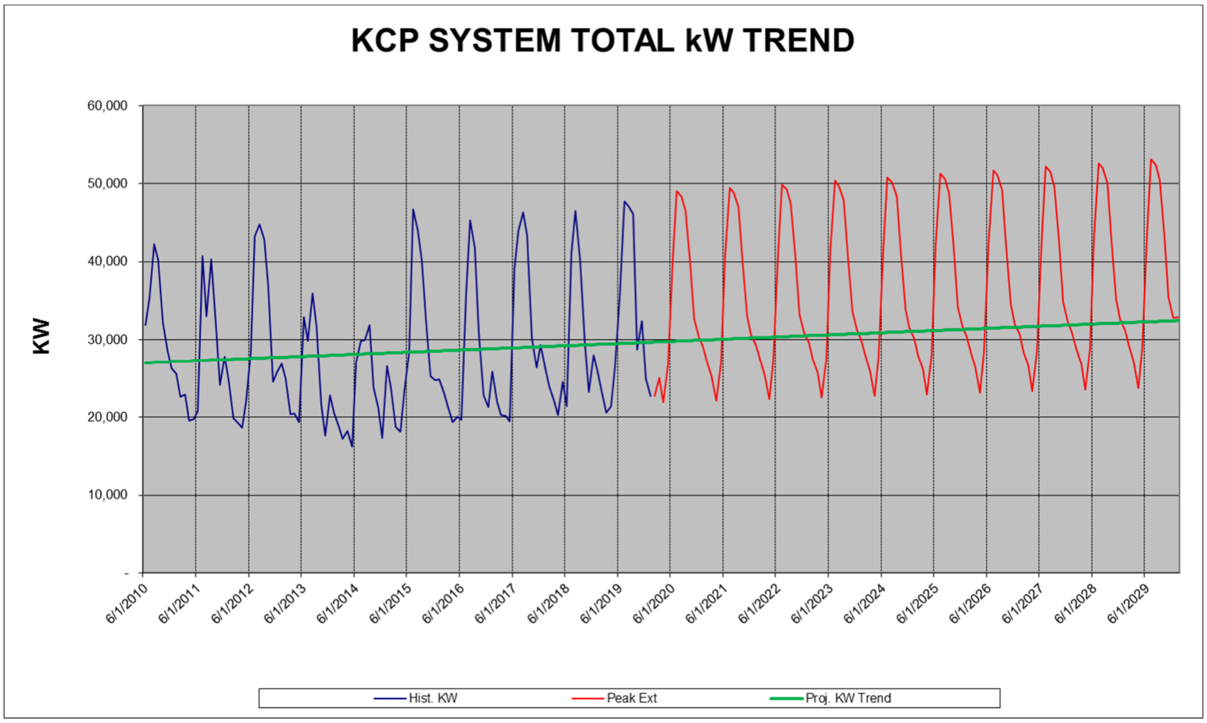


Figure 4-3-1

4.3 Historical Demand and Growth Patterns

Present substation capacity and peak demand are shown in the Feeder Summary. KCP provides distribution-level voltage through four (4) substations; Burton Lane, Main, Schick and West.

Figure 4-3-1 shows the growth characteristics of KCP's entire system for the period 2010 through 2019, as well as projected load growth through year 2029. *Figures 4-3-2* through *4-3-7* display information about past peak demand for each substation between 2010 and 2019.

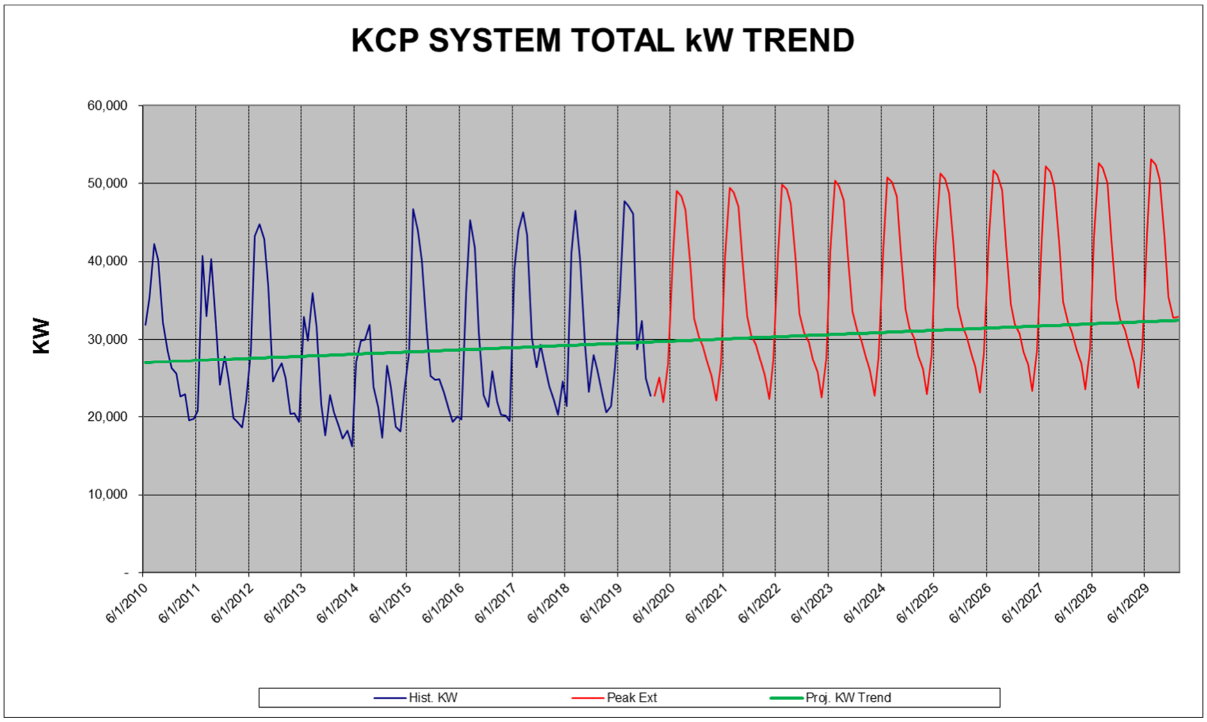


Figure 4-3-2

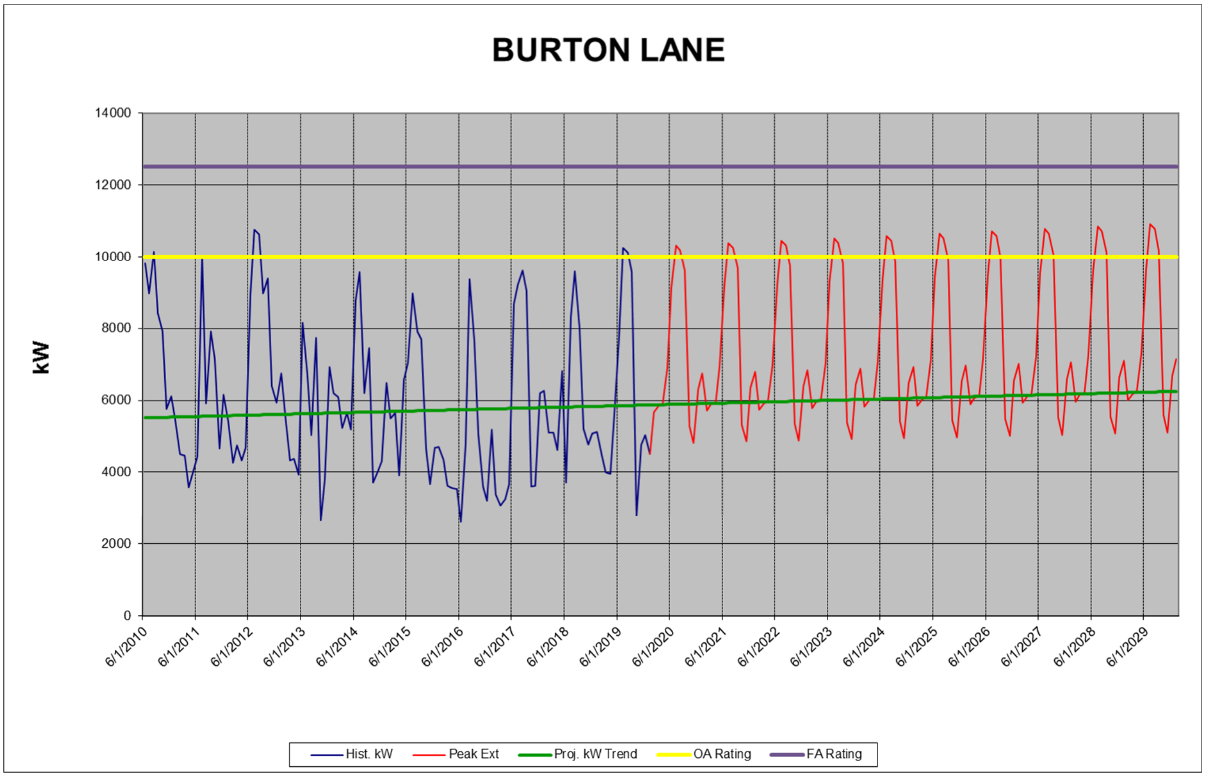


Figure 4-3-2

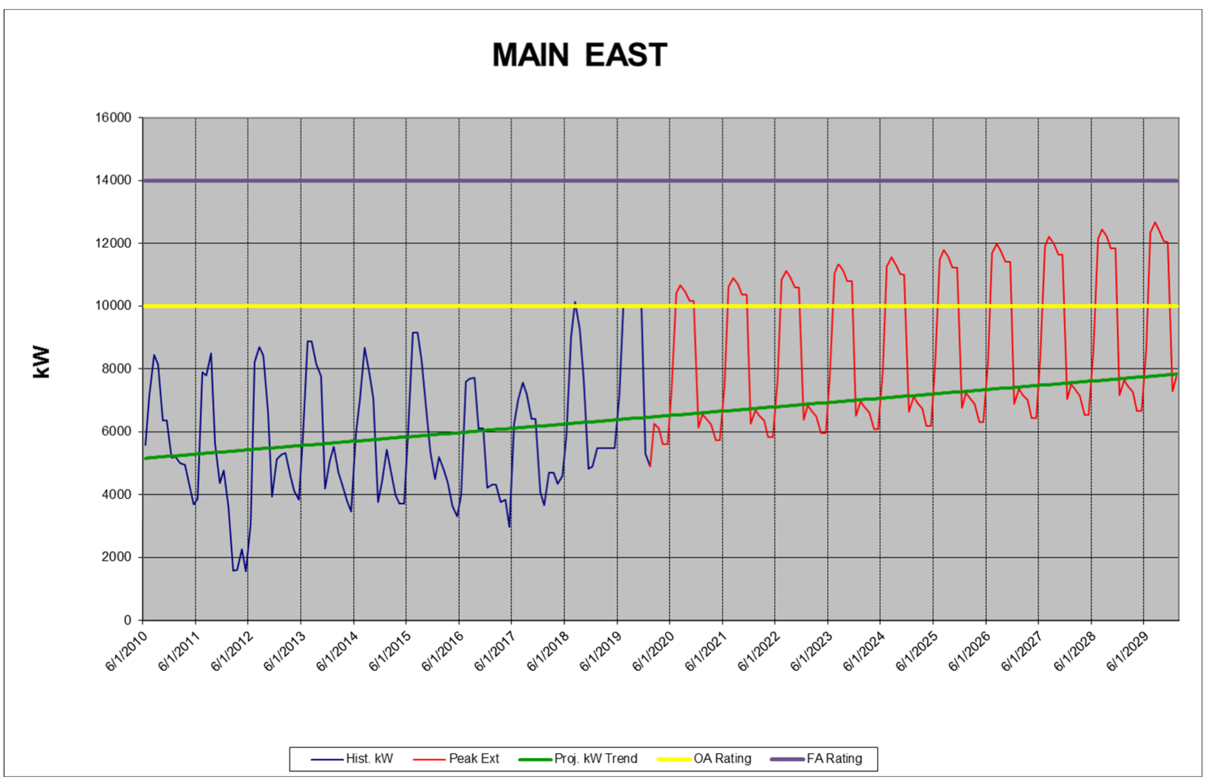


Figure 4-3-3

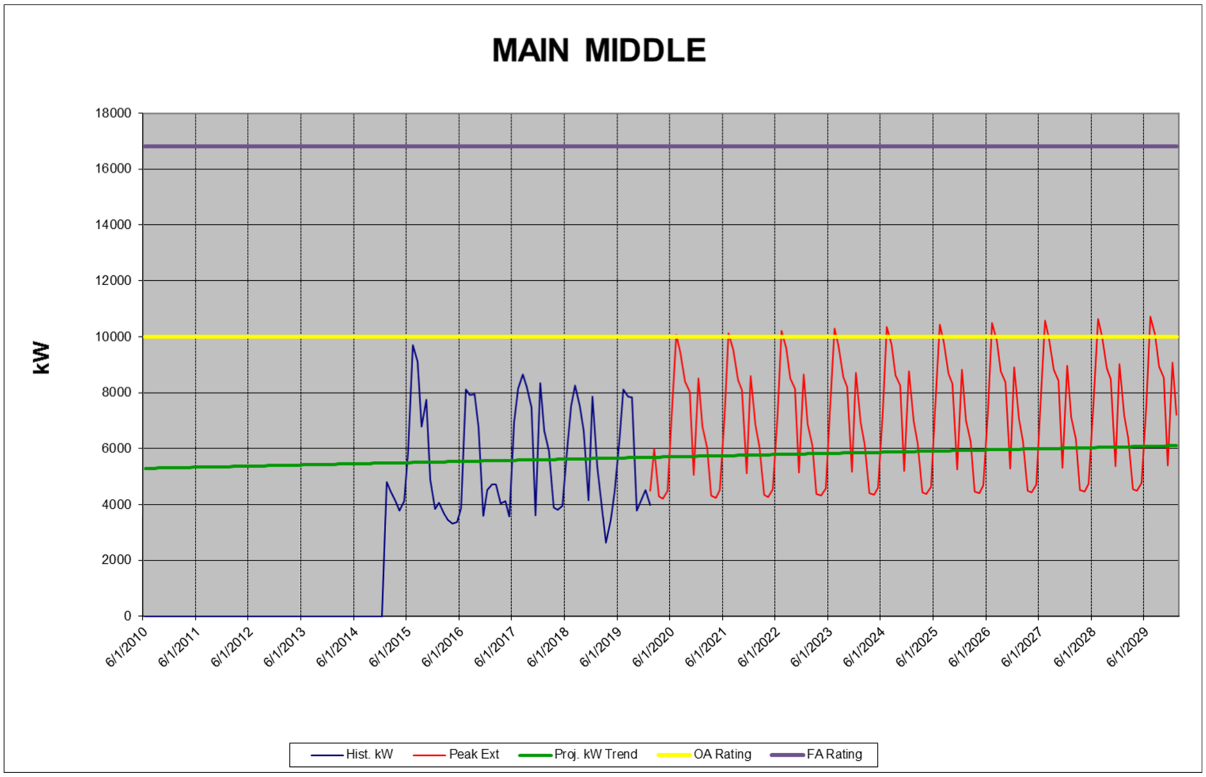


Figure 4-3-4

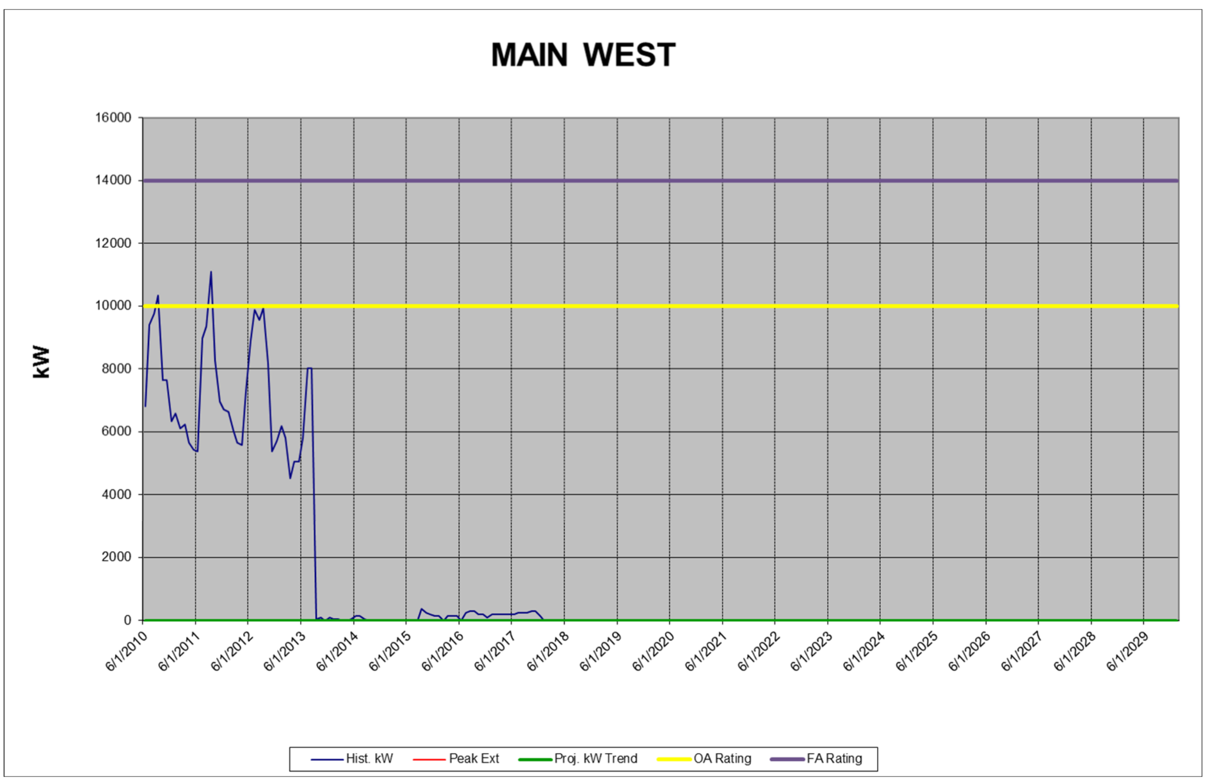


Figure 4-3-5

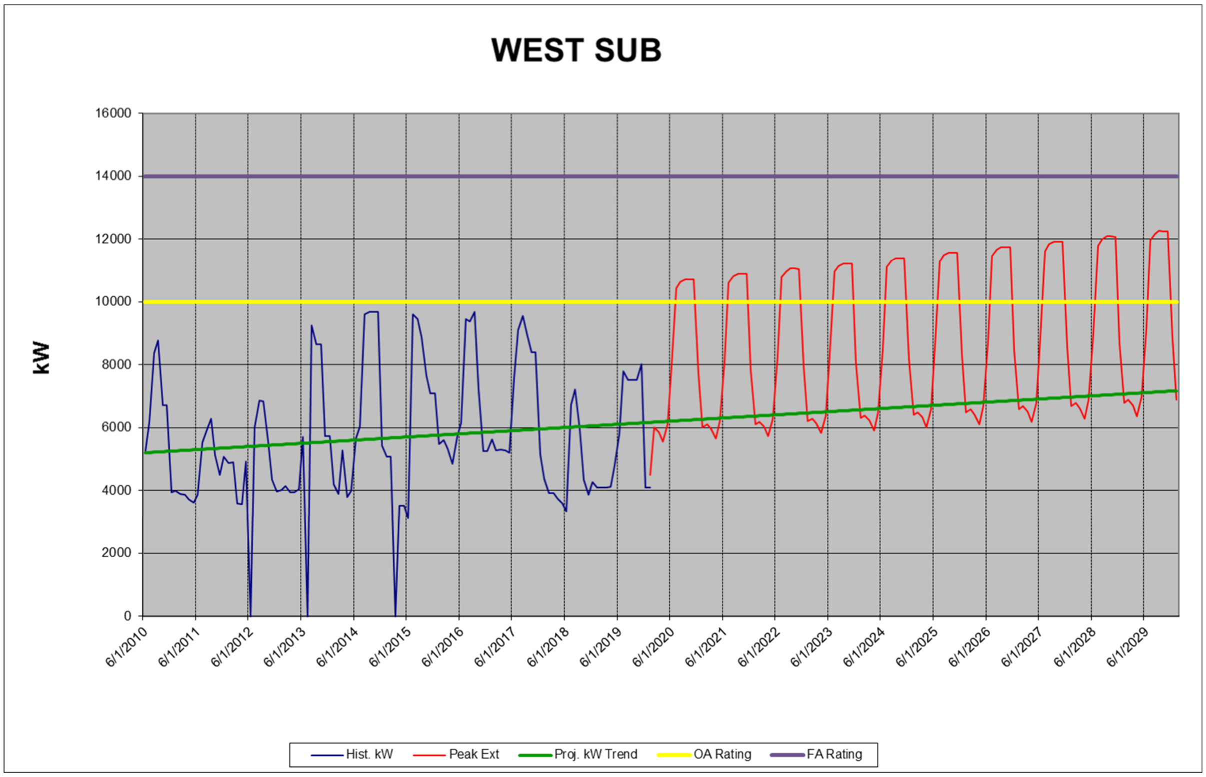


Figure 4-3-6

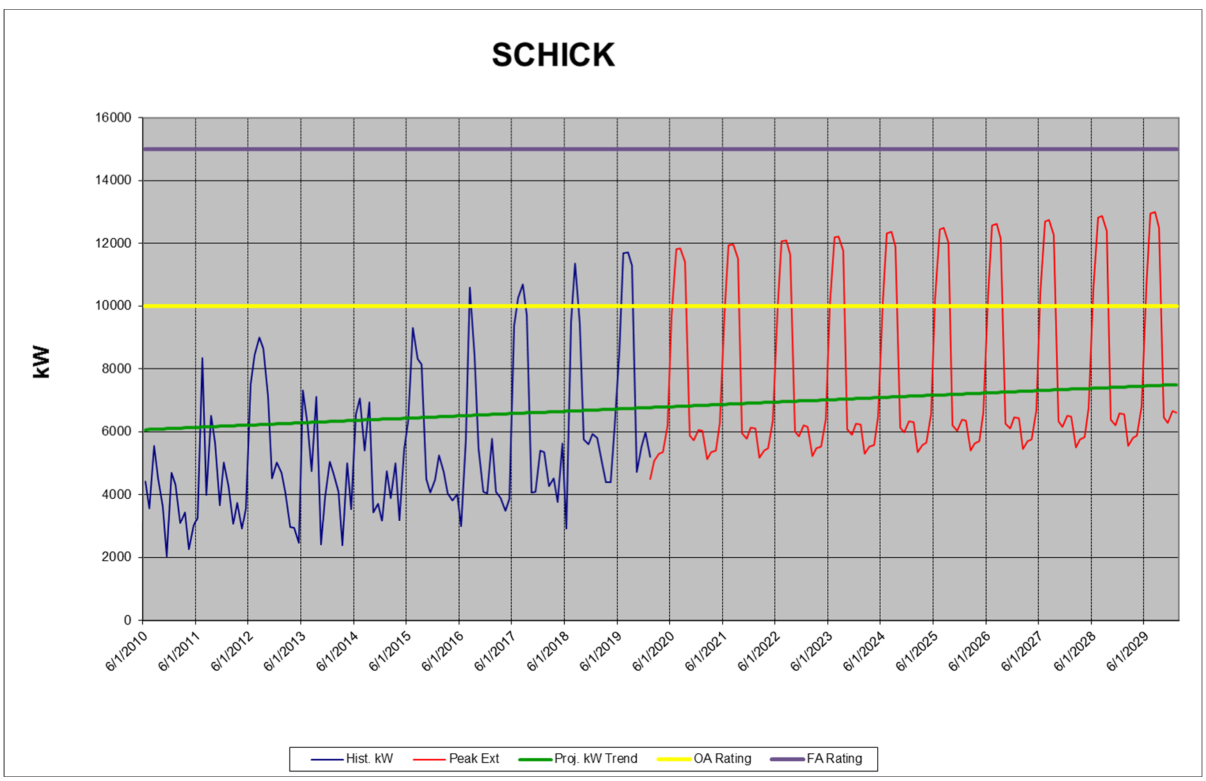


Figure 4-3-7

4.4 Annual System Demand

Demand is the number of kilowatts being used at an instantaneous point in time. Demand meter reads are usually averaged over 30-minute or 60-minute intervals. In 2019, the coincident peak demand was 48 MW.

5.0 CONSTRUCTION RECOMMENDATIONS

This section discusses the analysis of the existing distribution system by substation, projected loading on the existing system and substation changes and distribution system improvements required over the next 10-years. Voltage drop, loading and capacity, power factor, losses, conditions of plant, and service reliability are discussed for the present system with existing and projected loading. These results can also be found on the accompanying USB, along with the system model.

Section 5.0 of this report is arranged by substation and feeder. The written analysis follows a common pattern for each substation and feeder, and the report format is defined in the remaining parts of *Section 5.0*.

5.0.1 Loading and Capacity

This section details the substation, number of transformers, service bays, etc. Any equipment overloading is listed in this section.

5.0.2 Mechanical Condition of Plant

This section details each service area's unique electrical performance and characteristics, as well as any recommendations for system improvement. Improvements that are carry-over items from the previous work plan are denoted with an asterisk (*) before the project number.

5.0.3 Electrical Performance and Recommendations

This section details each service area's unique electrical performance and characteristics. Phase rebalancing recommendations are made and Mechanical condition concerns are noted.

5.0.4 Feeder Summary

This table provides existing system and projected system loads, power factor, and losses for each feeder by service area.

Peak line losses, excluding distribution transformer and secondary losses, are provided for the plan periods in kW and as a percent of feeder loading.

5.1 Burton Lane Service Area

Burton Lane Substation is located at the intersection of S. Burton Lane and Deseret Dr. with service to approximately 2,075 consumers and a total load of 10.24 MW. The projected growth rate is approximately 0.65% per year with losses, compounded annually for the planning period.

5.1.1 Loading and Capacity

Burton Lane Substation has one (1) three-phase, 10/14 MVA transformer with two (2) feeder bays in service and one (1) spare. At 5-year loading levels, the transformer is at 90.3% capacity and is at 92.3% capacity at 10-year loading levels.

5.1.2 Mechanical Condition of Plant

There are no mechanical or aging concerns during the 10-year planning period.

5.1.3 Electrical Performance and Recommendations

a. Feeder 1 – Burton East

Feeder 1 serves the area to the east and south of the Burton Lane Substation. Voltage does not fall below the Planning Criteria in the existing, 5-year, and 10-year models.

The conductor from the substation to the intersection of S 50 W and W Burton Ln S is loaded at 51% during existing loading levels and reaches 58% loading during 10-year loading levels.

b. Feeder 2 – Burton Lane Mid

Feeder 2 serves the area to the west of the Burton Lane Substation. Voltage does not fall below the Planning Criteria in the existing, 5-year, and 10-year models.

The conductor from the intersection of Sunset Drive and W Burton Ln S to the intersection of Sunset Drive and Paddock Ln is loaded at 58% during 10-year loading levels. The conductor from the intersection of Sunset Drive and Western Drive to the intersection of Western Drive and Sir Barton Dr. is loaded at over 50%, up to 77% on some sections during 10-year loading levels.

Contingency Analysis

Contingency analysis was completed for the transfer of the Burton Lane service area to Schick and Main.

The following steps were followed to transfer loads:

- Open feeders at substation
- Close the switch near the intersection of Sunset Drive and Brinley Ct. to connect to the Schick Substation
- Close the switch near the intersection of W 900 S and S 50 W to connect to the Main substation

Voltage does not fall below the Planning Criteria in the 5-year, and 10-year models.

Minimum Voltages On Burton Lane Service Area During Contingency			
	Existing	**5-year**	**10-year**
A	118.3	115.5	115.0
B	120.8	118.3	118.1
C	120.7	118.3	118.0
Schick Transformer Loading	95.1%	136.8%	138.2%
Schick Regulator Loading	116.6%	165.8%	167.5%
Main Center Transformer Loading	90.6%	99.4%	126.3%
Main Center Regulator Loading	107.5%	117.9%	147.8%

Table 5-1-3-1

5.1.3.1 Recommended Transition Projects

Phase Balancing Projects

There are no phase balancing recommendations for this service area.

Other Transition Projects

The following recommendations are included for the Burton Lane service area in order to improve load transfer and transformer loading.

BR-C1A In order to transfer Schick to Burton Lane substation during existing, 5-year and 10-year peak loading levels, it is recommended to upgrade the Burton Lane substation transformer to 15/20/25 MVA with an LTC.

Estimated Cost: $500,000

5.1.3.2 Recommended Long Range Projects

The following recommendations are included for the Burton Lane service area in order to improve load transfer.

BR-C6A This conductor is loaded 111% at 5-year and 10-year peak loading during the Schick contingency. In order to transfer Schick to Burton Lane substation during 10-year peak loading levels, it is recommended to rebuild 0.4 miles of #4/0 AWG ACSR to 477 kcmil ACSR from the W Burton Ln/Sunset Drive intersection to the Western Drive/Sunset Drive intersection.

Estimated Cost: $87,000

BR-C6B This conductor is loaded 120% at 5-year and 10-year peak loading during the Schick contingency. In order to transfer Schick to Burton Lane substation during 10-year peak loading levels, it is recommended to rebuild 0.1 miles of #4/0 AWG URD to 500 kcmil ACSR on the East side of the W Burton Ln and Sunset Drive intersection.

Estimated Cost: $31,000

5.1.3.3 Alternative and Exploratory Plans

BR-ALT1A As an alternative to BR-C1A, it is recommended to install and additional 10/12.5 MVA transformer at the Burton Lane substation.

Estimated Cost: $450,000

Existing Feeder Summary

Substation: BURTON LANE :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
BURTON LANE	10566.28	99.36	10498.19	99.36	1016.86	11.17	113.59	11.17
Total	**10566.28**	**99.36**	**10498.19**	**99.36**	**1016.86**	**11.17**	**113.59**	**11.17**
BURTON 1-EAST	6573.63	-100.00	6573.56	-100.00	109.23	35.22	38.47	35.22
BURTON 2-MID	3817.30	99.84	3811.05	99.84	54.42	44.30	24.11	44.30
Total	**10386.29**	**99.98**	**10384.61**	**99.98**	**163.47**	**38.28**	**62.58**	**38.28**

5-Year Feeder Summary

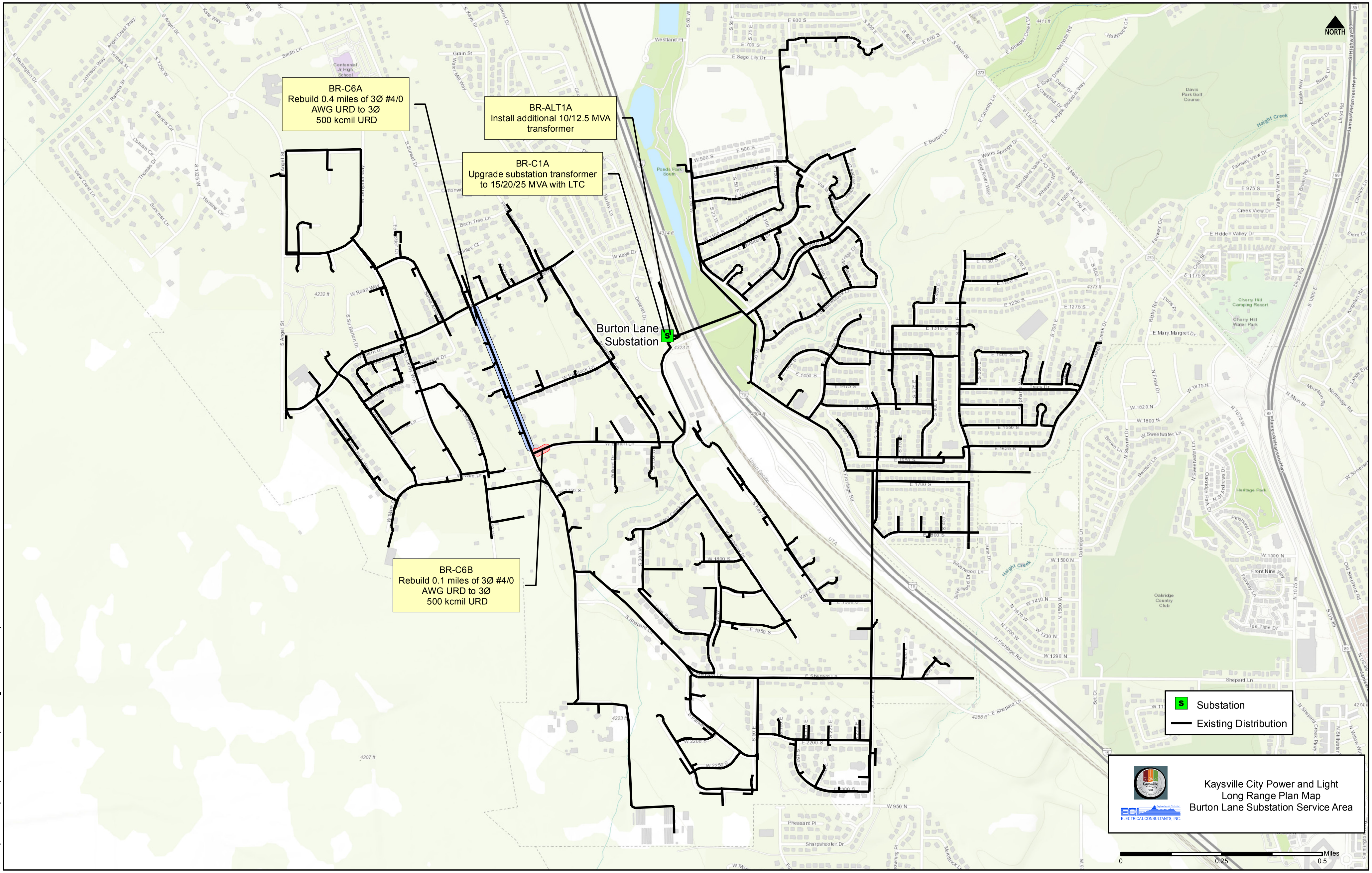
Substation: BURTON LANE :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
BURTON LANE	12734.26	98.77	12577.29	98.77	1477.16	10.69	157.83	10.69
Total	**12734.26**	**98.77**	**12577.29**	**98.77**	**1477.16**	**10.69**	**157.83**	**10.69**
BURTON 1-EAST	7238.92	99.99	7238.53	99.99	137.13	35.29	48.39	35.29
BURTON 2-MID	5200.38	99.63	5180.93	99.63	104.99	48.28	50.69	48.28
Total	**12430.53**	**99.91**	**12419.46**	**99.91**	**241.52**	**41.03**	**99.08**	**41.03**

10-Year Feeder Summary

Substation: BURTON LANE :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
BURTON LANE	13014.25	98.69	12843.69	98.69	1542.76	10.64	164.14	10.64
Total	**13014.25**	**98.69**	**12843.69**	**98.69**	**1542.76**	**10.64**	**164.14**	**10.64**
BURTON 1-EAST	7503.58	99.99	7502.66	99.99	140.82	35.58	50.10	35.58
BURTON 2-MID	5196.32	99.63	5176.89	99.63	105.00	48.27	50.68	48.27
Total	**12692.18**	**99.90**	**12679.55**	**99.90**	**245.23**	**41.10**	**100.78**	**41.10**



File: R:\Projects\KCP-002 Kaysville City Model\GIS\MXD\KaysvilleOverviews_20200317.mxd Last Saved: jihanson 6/26/2020 12:02:47 PM

Source:Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

5.2 Main Substation Service Area

Main Substation is located at the intersection of E 200 N and N 100 E with service to approximately 3,440 consumers and a total load of 14.7 MW. The projected growth rate is approximately 2.27% per year with losses, compounded annually for the planning period.

5.2.1 Loading and Capacity

Main Substation has two (2) three-phase, 10/14 MVA transformers and one (1) 10/14/16.8 MVA transformer with four (4) feeder bays in service. The Center regulators are 83% loaded at 10-year loading levels.

5.2.2 Mechanical Condition of Plant

There are no mechanical or aging concerns during the 10-year planning period.

5.2.3 Electrical Performance and Recommendations

a. Feeder 3 – South Main

Feeder 3 serves the area to the North and East of the Main Substation. Voltage falls below 118.0V at 10-year loading levels starting near the intersection of W Mutton Road and Meadow Lark Dr.

The conductor from the substation to the north side of the intersection of N 100 E and Crestwood Road is loaded at 56.8% during existing loading levels and reaches 141.7% loading during 10-year loading levels.

The conductor from Crestwood Road to its split south to serve N 900 E is loaded at 57.5% during existing loading levels and reaches 62.0% loading during 10-year loading levels.

b. Feeder 4 – 50 West

Feeder 4 serves the area to the South and West of the Main Substation. Voltage does not fall below the Planning Criteria in the existing, 5-year, and 10-year models.

c. Feeder 5 – Old 4kV Circuit

Feeder 5 serves the area to the South and East of the Main Substation. Voltage falls below 114.6V at existing levels, and falls to 113.7V at 10-year loading levels on the single phase service starting at the intersection of Green Road and S 900 E.

The 1/0 ACSR overhead conductor from substation east is loaded at 93.0% during existing loading levels and reaches 97.3% loading during 10-year loading levels.

The conductor from the N 500 E/E Center St. block south loaded at 192.1% on the B-phase during existing loading levels and reaches 203.4% loading during 10-year loading levels.

The single-phase conductor serving the Laurelwood Dr. customers is loaded at 67.8% on the B-phase during existing loading levels and reaches 96.5% loading during 10-year loading levels.

d. Feeder 6 – King Clarion

Feeder 6 serves the area to the south of the Main Substation. Voltage does not fall below the Planning Criteria in the existing, 5-year, and 10-year models.

The conductor from The Rock Chapel to the southern cul-de-sac on S 100 E is loaded at 114.1% during existing loading levels and reaches 114.7% loading during 10-year loading levels.

The conductor from the intersection of S Main Street and E 550 S to the intersection of E 550 S and S 300 E and is loaded at 56.1% during existing loading levels and reaches 56.1% loading during 10-year loading levels.

The conductor from the West side of the intersection of S Main St and E 200 S to the North side of the S 150 E Cul-de-sac is loaded at 55.4% at existing and 10-year loading levels.

Contingency Analysis

Contingency analysis was completed for the transfer of the Main Center transformer service area to Main East transformer, Burton and West. Contingency analysis would not converge in the model when performing an N-2 contingency at the Main Substation, where the East, West and Center transformers were taken out of service.

The following steps were followed to transfer loads:

- Open feeders fed by Center transformer
- Close the switch near the intersection of W 900 S and S 50 W to connect to the Burton substation
- Close the bus tie between the Main East transformer bus and Switchgear #4

- Close Switchgear #4 Way 2 switch
- Open the sectionalizer on the north side of the intersection of N 100 E and Crestwood road
- Close the switch on the East section of the intersection of W Mutton Hollow Road and N Main Street to connect to the Burton Substation

Voltage does not fall below planning criteria in the existing, 5-year, and 10-year models.

Minimum Voltages On Main Center Service Area During Contingency			
	Existing	**5-year**	**10-year**
A	121.4	120.4	116.3
B	123.9	123.3	118.9
C	120.8	120.0	116.8
Burton Transformer Loading	84.3%	97.8%	99.8%
Burton Regulator Loading	87.9%	76.9%	78.4%
Main East Transformer Loading	82.8%	88.7%	101.5%
Main East Regulator Loading	125.4%	132.2%	146.1%
West Transformer Loading	110.8%	148.4%	169.0%
West Regulator Loading	119.8%	156.9%	176.4%

Table 5-2-3-1

**NC = Did Not Converge*

Contingency analysis was completed for the transfer of the Main East transformer service area to Main Center transformer, Burton and West.

The following steps were followed to transfer loads:

- Open feeders fed by East transformer
- Open Recloser #9 at the Main substation
- Open Switchgear #4 Way 1 switch at the Main substation
- Close Switchgear #4 Way 4 switch at the Main Substation to transfer to the Main West transformer
- Close the switch at the intersection of S 50 W and E Mill Road S
- Close the fuse at the intersection of S 500 E and S Main Street
- Open the west fuse at the intersection of S 900 E and Green Road

- Close the fuse at the intersection of E 650 S and S Main St

Minimum Voltages On Main East Service Area During Contingency			
	Existing	**5-year**	**10-year**
A	124.6	124.6	124.6
B	114.7	114.7	114.9
C	124.0	124.0	124.0
Burton Transformer Loading	75.5%	89.2%	91.2%
Burton Regulator Loading	58.2%	68.6%	91.9%
Main Center Transformer Loading	47.4%	47.4%	47.9%
Main Center Regulator Loading	75.9%	76.0%	77.9%
Main West Transformer Loading	49.4%	54.9%	83.6%
Main West Regulator Loading	45.7%	58.1%	84.7%

Table 5-2-3-2

**NC = Did Not Converge*

5.2.3.1 Recommended Transition Projects

Phase Balancing Projects

There are no phase balancing recommendations for this service area.

Other Transition Projects

The following recommendations are included for the Burton Lane service area in order to improve load transfer, current balance, and transformer loading.

MN-1A It is recommended to install a switch on the East side of the Main substation in order to improve load transfer ability between feeders.

Estimated Cost: $10,000

MN-2A The conductor is loaded at 135% at 10-year loading, and 128.5% at 5-year and existing loading levels. It is recommended to rebuild 0.6 miles of 3-phase #6 HD cu to 3-phase #1/0 AWG ACSR from the Green Road/S 900 E intersection to the N 500 E/E Center St. block.

Estimated Cost: $128,000

MN-3A The conductor is loaded 166.9% at 10-year loading, and 101% at 5-year and existing loading levels. It is recommended to rebuild 0.6 miles of 3-phase #2 AWG ACSR to 3-phase #4/0 AWG ACSR from the north side of the Crestwood Rd/N 100 E intersection to the North side of the E 500 N/West side of the Kaysville City Cemetery. This project will improve voltage levels on the circuit to within planning criteria for all loading levels.

Estimated Cost: $129,000

MN-C3A In order to improve load transfer from the West substation to the Main substation, it is recommended to construct a 0.1 mile, 3-phase overhead tie across Crestwood road near the Crestwood road/N 100 E intersection.

Estimated Cost: $21,000

5.2.3.2 Recommended Long Range Projects

MN-4A The conductor is loaded 96% at 10-year loading levels. During Main Center contingency, the #4 AWG CU conductor is loaded 252% at 10-year, 188% at 5-year loading and 151.4% at existing loading. The #4 AWG CU conductor is loaded at 155% during 10-year loading West contingency. It is recommended to rebuild 0.5 miles of 3-phase #4 AWG CU to 3-phase #477 kcmil ACSR from the 300 W/N Main St. intersection to the W Mutton Hollow Rd./N Main St. intersection.

Estimated Cost: $108,000

MN-C6A The #1/0 AWG ACSR conductor is loaded at 123% during the 10-year loading Main Center contingency. It is recommended to rebuild 0.2 miles of 3-phase #1/0 AWG ACSR to 3-phase #477 kcmil ACSR from the W Mutton Hollow Rd./N Main St. intersection to the E Mutton Hollow Rd/Stonne Ln intersection.

Estimated Cost: $43,000

MN-9A The conductor is loaded 88% at 10-year loading and 82% during 5-year loading, it is recommended to rebuild 0.2 miles of 3-phase #6 HDC to 3-phase #4 AWG ACSR along Ward Rd ending near the Nard Rd./N800 E intersection.

Estimated Cost: $43,000

MN-10A The conductor is loaded at 92% during 10-year loading, it is recommended to rebuild 0.6 miles of 3-phase 477 kcmil ACSR to 3-phase 556 kcmil ACSR from East of the Main substation to the Crestwood Rd/N 400 E intersection.

Estimated Cost: $130,000

MN-10B The conductor is loaded at 85% during 10-year loading, it is recommended to rebuild 0.2 miles of 3-phase #4/0 AWG ACSR to 3-phase 477 kcmil ACSR along the west side of the Kaysville Memorial Cemetery.

Estimated Cost: $43,000

5.2.3.3 Alternative and Exploratory Plans

MN-ALT10A As an alternative to alleviate load transfer concerns in the Main and West service areas, transmission could be extended and substation could be constructed near Hods Hollow Park.

Estimated Cost: $3,500,000

Existing Feeder Summary

Substation: MAIN :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
MAIN	14819.34	99.34	14721.54	99.34	592.34	16.95	100.40	16.95
Total	**14819.34**	**99.34**	**14721.54**	**99.34**	**592.34**	**16.95**	**100.40**	**16.95**
MAIN 2-WEST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAIN 3-SOUTH MAIN	7128.99	99.82	7115.89	99.82	268.87	48.39	130.10	48.39
MAIN 4- 50 WEST	1152.78	-99.99	1152.65	-99.99	2.87	30.93	0.89	30.93
MAIN 4-KING CLARION	3179.98	99.97	3178.93	99.97	40.62	44.83	18.21	44.83
MAIN 5-OLD 4KV CIRCUIT	3233.66	98.14	3173.67	98.14	70.48	73.55	51.84	73.55
Total	**14663.70**	**99.71**	**14621.14**	**99.71**	**379.68**	**52.95**	**201.03**	**52.95**

5-Year Feeder Summary

Substation: MAIN :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
MAIN	15762.59	99.22	15639.46	99.22	676.64	15.85	107.26	15.85
Total	**15762.59**	**99.22**	**15639.46**	**99.22**	**676.64**	**15.85**	**107.26**	**15.85**
MAIN 2-WEST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAIN 3-SOUTH MAIN	8031.15	99.71	8007.80	99.71	320.99	45.48	145.98	45.48
MAIN 4- 50 WEST	1153.92	-99.99	1153.78	-99.99	2.86	30.96	0.89	30.96
MAIN 4-KING CLARION	3198.14	99.96	3197.01	99.96	41.02	44.70	18.34	44.70
MAIN 5-OLD 4KV CIRCUIT	3233.59	98.14	3173.60	98.14	70.49	73.55	51.84	73.55
Total	**15586.39**	**99.65**	**15532.20**	**99.65**	**431.60**	**50.29**	**217.04**	**50.29**

10-Year Feeder Summary

Substation: MAIN :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
MAIN	19889.95	98.47	19585.62	98.47	1154.88	12.65	146.11	12.65
Total	**19889.95**	**98.47**	**19585.62**	**98.47**	**1154.88**	**12.65**	**146.11**	**12.65**
MAIN 2-WEST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAIN 3-SOUTH MAIN	11990.61	99.18	11892.29	99.18	733.51	46.40	340.36	46.40
MAIN 4- 50 WEST	1155.75	-99.99	1155.58	-99.99	2.86	30.90	0.88	30.90
MAIN 4-KING CLARION	3196.24	99.96	3195.10	99.96	41.04	44.70	18.35	44.70
MAIN 5-OLD 4KV CIRCUIT	3277.19	97.54	3196.54	97.54	76.56	73.59	56.34	73.59
Total	**19577.56**	**99.29**	**19439.51**	**99.29**	**849.78**	**48.95**	**415.93**	**48.95**

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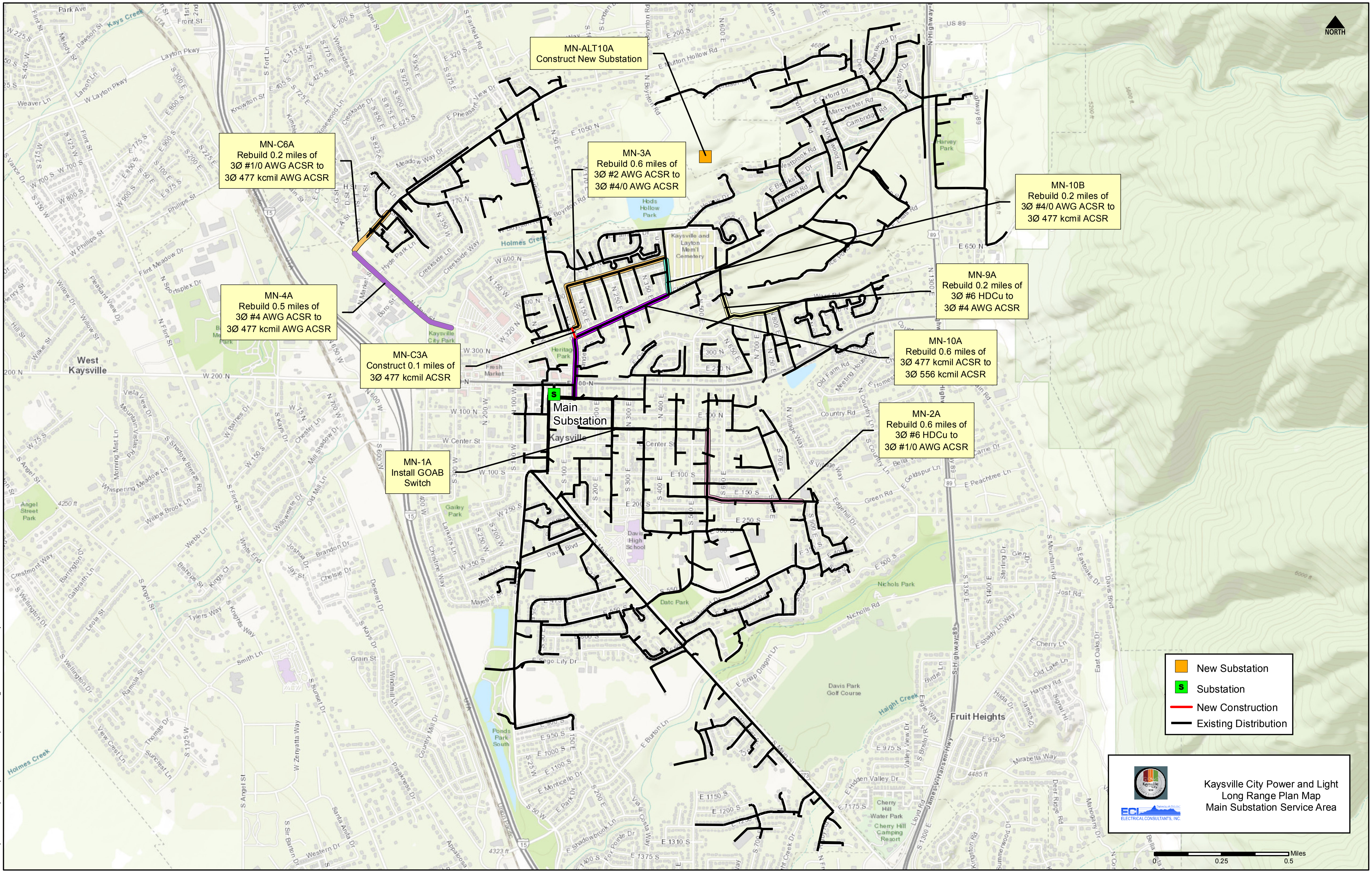

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5.3 Schick Substation Service Area

Schick Substation is located at the intersection of Schick Ln. and Wellington Dr. with service to approximately 2,059 consumers and a total load of 11.8 MW. The projected growth rate is approximately 1.12% per year with losses, compounded annually for the planning period.

5.3.1 Loading and Capacity

Schick Substation has one (1) three-phase, 10/14/16.8 MVA transformer with two (2) feeder bays in service and one (1) spare. The Schick regulators are 125.9% loaded at 10-year loading levels. The Schick transformer is 104.6% loaded at 10-year loading levels.

5.3.2 Mechanical Condition of Plant

There are no mechanical or aging concerns during the 10-year planning period.

5.3.3 Electrical Performance and Recommendations

a. Feeder 2 – Schick East

Feeder 2 serves the area to the South and East of the Schick Substation. Voltage does not fall below the Planning Criteria in the existing, 5-year, and 10-year models.

The conductor from the substation to the intersection of W 200 N and N Angel St. is loaded at 71.0% during existing loading levels and reaches 95.8% loading during 10-year loading levels.

b. Feeder 3 – Schick South

Feeder 3 serves the area to the south of the Schick Substation. Voltage does not fall below the Planning Criteria in the existing, 5-year, and 10-year models.

The conductor from the intersection of Schick Ln and Bonneville Ln to the intersection of Bonneville Ln and Wellington Dr is loaded at 73.4% during existing loading levels and reaches 81.3% loading during 10-year loading levels.

Contingency Analysis

Contingency analysis was completed for the transfer of the Schick service area to West and Burton Lane.

The following steps were followed to transfer loads:

- Open feeders at substation
- Open the south switch near the intersection of W 200 N and N Flint St.
- Close the east switch near the intersection of W 200 N and N Flint St. to connect to the West Substation
- Close the switch near the intersection of Sunset Drive and Brinley Ct. to connect to the Burton Substation
- Close the south switch near the intersection of N Angel St. and W 200 N
- Open the switch near the intersection of W 200 N and N 600 W
- Close Burton feeder recloser 3 and close the switch outside of the sub in order to transfer load from West substation to Burton Lane substation

Voltage does not fall below the Planning Criteria in the existing, 5-year and 10-year models.

Minimum Voltages On Schick Service Area During Contingency			
	Existing	**5-year**	**10-year**
A	121.6	119.6	119.4
B	123.3	120.1	119.4
C	123.4	122.1	121.9
West Transformer Loading	128.3%	189.4%	191.3%
West Regulator Loading	126.1%	184.6%	185.7%
Burton Transformer Loading	131.9%	163.3%	165.8%
Burton Regulator Loading	105.0%	129.6%	131.4%

Table 5-3-3-1

5.3.3.1 Recommended Transition Projects

Phase Balancing Projects

There are no phase balancing recommendations for this service area.

Other Transition Projects

SH-C2A In order to transfer Burton during contingency to Schick, it is recommended to rebuild 0.3 miles of 1-phase #6 HD cu to 3-phase 477 kcmil ACSR along S Angel St in order to create a three-phase tie between Schick Feeder 3 and Schick Feeder 2.

Estimated Cost: $65,000

SH-C2B In conjunction with SH-C1A, it is recommended to rebuild 0.1 miles of 3-phase #2 AWG ACSR to 3-phase 477 kcmil ACSR along S Angel St in order to create a three-phase tie between Schick Feeder 3 and Schick Feeder 2.

Estimated Cost: $65,000

SH-C3A During the West contingency, conductor is loaded 124% at 5-year loading and 126% at 10-year loading. During the Main Center contingency, conductor is loaded 112% at 10-year loading and 110% at 5-year loading. During normal operation conditions, it is loaded 112% at 10-year loading and 110% at 5-year loading levels. It is recommended to rebuild 0.2 miles of 3-phase 750 kcmil URD to parallel 3-phase 750 kcmil URD east out of the substation along Schick lane.

Estimated Cost: $121,000

SH-C4A In order to transfer Burton Lane or West to Schick substation during 5-year and 10-year peak loading levels, it is recommended to upgrade the Burton Lane substation transformer to 15/20/25 MVA with an LTC.

Estimated Cost: $500,000

5.3.3.2 Recommended Long Range Projects

SH-8A The conductor is loaded at 81% during 10-year loading, it is recommended to rebuild 0.1 miles of 3-phase 477 kcmil ACSR to 3-phase 556 kcmil ACSR along Schick lane.

Estimated Cost: $22,000

SH-C9A The conductor is loaded at 170% at 5 and 10-year loading and 145% at existing loading during Burton Substation's contingency, it is recommended to rebuild 0.4 miles of 3-phase #4/0 AWG URD to 3-phase 750 kcmil URD along Bonneville lane.

Estimated Cost: $123,000

5.3.3.3 Alternative and Exploratory Plans

SH-ALT3A For load transfer between West and Schick, an alternative recommendation would be to construct 1.25 miles of overhead 477 kcmil ACSR along Schick lane and W 200 N to create a new feeder out of the Schick substation. This would allow for load to be split between multiple feeders, and would be an alternative to SH-8A

Estimated Cost: $274,000

SH-ALT3B For load transfer between West and Schick, an alternative recommendation to SH-C3A in addition to the feeder circuit defined in SH-ALT3A would be to upgrade the Schick substation transformer bay and install a new recloser.

Estimated Cost: $500,000

Existing Feeder Summary

Substation: SCHICK :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
SHICK	11887.69	99.41	11817.92	99.41	893.20	6.17	55.13	6.17
Total	**11887.69**	**99.41**	**11817.92**	**99.41**	**893.20**	**6.17**	**55.13**	**6.17**
SHICK 2-EAST	7722.28	-99.97	7720.27	-99.97	201.18	39.83	80.14	39.83
SHICK 3-SOUTH	4082.65	99.02	4042.53	99.02	36.09	86.05	31.05	86.05
Total	**11769.41**	**99.94**	**11762.80**	**99.94**	**231.38**	**48.05**	**111.19**	**48.05**

5-Year Feeder Summary

Substation: SCHICK :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
SHICK	17247.41	98.36	16964.51	98.36	1878.94	5.23	98.34	5.23
Total	**17247.41**	**98.36**	**16964.51**	**98.36**	**1878.94**	**5.23**	**98.34**	**5.23**
SHICK 2-EAST	12243.57	99.89	12229.94	99.89	343.17	39.32	134.93	39.32
SHICK 3-SOUTH	4682.57	99.01	4636.23	99.01	44.73	85.85	38.40	85.85
Total	**16911.30**	**99.73**	**16866.17**	**99.73**	**380.27**	**45.58**	**173.33**	**45.58**

10-Year Feeder Summary

Substation: SCHICK :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
SHICK	17513.12	98.31	17216.64	98.31	1937.08	5.21	100.89	5.21
Total	**17513.12**	**98.31**	**17216.64**	**98.31**	**1937.08**	**5.21**	**100.89**	**5.21**
SHICK 2-EAST	12489.36	99.88	12474.12	99.88	352.42	39.18	138.08	39.18
SHICK 3-SOUTH	4687.97	99.01	4641.64	99.01	44.71	85.85	38.38	85.85
Total	**17163.13**	**99.72**	**17115.75**	**99.72**	**389.44**	**45.31**	**176.46**	**45.31**

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5.4 West Substation Service Area

West Substation is located at the intersection of W 200 N and the railroad tracks, with service to approximately 1,617 consumers and a total load of 10.3 MW. The projected growth rate is approximately 1.7% per year with losses, compounded annually for the planning period.

5.4.1 Loading and Capacity

West Substation has one (1) three-phase, 10/14 MVA transformer with two (2) feeder bays in service and one (1) spare. The substation regulator is 131.2% loaded at 10-year loading levels. The Substation transformer is 131.8% loaded at 10-year loading levels.

5.4.2 Mechanical Condition of Plant

There are no mechanical or aging concerns during the 10-year planning period.

5.4.3 Electrical Performance and Recommendations

a. Feeder 1 – East

Feeder 1 serves the area to the north of the West Substation. Voltage does not fall below the Planning Criteria in the existing, 5-year, and 10-year models.

The conductor from substation to the W 200 N is loaded at 81.7% during existing loading levels and reaches 118.4% loading during 10-year loading levels.

The conductor from the intersection of W 200 N and N 600 W to the intersection of S Kays Dr. W and Grain St. is loaded at 86.3% during existing loading levels and reaches 124.9% loading during 10-year loading levels.

The conductor from the intersection of W 100 N and N 300 W to the intersection of W Center St. and N 300 W is loaded at 64.3% during existing loading levels and reaches 66.8% loading during 10-year loading levels.

The conductor in the N 200 W/W100 N block is loaded at 83.1% during all loading levels.

The conductor from the intersection of N Main St. and N 300 W to the intersection of Creekside Way and N Man St. is loaded at 61.6% during existing loading levels and reaches 96.8% loading during 10-year loading levels.

b. Feeder 3 – North

Feeder 3 serves the area to the south and east of the West Substation. Voltage does not fall below the Planning Criteria in the existing, 5-year, and 10-year models.

The conductor from substation to the end of the north cul-de-sac is loaded at 70.6% during existing loading levels.

Contingency Analysis

Contingency analysis was completed for the transfer of the West service area to Schick, Burton Lane and Main.

The following steps were followed to transfer loads:

- Open feeders at substation
- Open Switchgear #4 Way 1 switch in the Main substation
- Close Switchgear #4 Way 4 switch to transfer Main 3 – South Main Feeder to the Main West transformer
- Open Recloser #8, the Main 2 – West feeder recloser
- Close Switchgear #5 Way 3 switch and Switchgear #5 Way 1switch
- Close Recloser #7
- Open the switch at the intersection of W 200 N and N 400 W
- Open the switch at the intersection of W 200 N and N 600 W
- Close the east switch on the intersection of W 200 N and N Flint St. to transfer to Schick
- Close Burton 3-West tie switch
- Close Burton 3-West feeder recloser to transfer to Burton Lane
- Close the switch at the intersection of W 200 N and N 100 W to transfer to Main
- Feeder 3 has no three-phase ties to other service areas

Voltage does not fall below the Planning Criteria in the existing, 5-year, and 10-year models.

Minimum Voltages On West Service Area During Contingency			
	Existing	**5-year**	**10-year**
A	1237	117.2	117.0
B	125.0	118.6	118.4
C	124.3	117.9	117.8
Main Center Transformer Loading	43.9%	56.0%	56.3%
Main Center Regulator Loading	50.5%	63.8%	63.8%
Main West Transformer Loading	49.4%	55.7%	85.9%
Main West Regulator Loading	52.6%	58.9%	77.3%
Burton Transformer Loading	103.9%	127.9%	130.2%
Burton Regulator Loading	82.7%	100.4%	102.3%
Schick Transformer Loading	74.1%	102.8%	104.2%
Schick Regulator Loading	91.0%	124.7%	126.2%

Table 5-4-3-1

**NC = Did Not Converge*

5.4.3.1 Recommended Transition Projects

Phase Balancing Projects

There are no phase balancing recommendations for this service area.

Other Transition Projects

The following recommendations are included for the West service area in order to improve load transfer, conductor loading and transformer loading.

WE-2A The conductor is 110% loaded at 5 and 10-year loading. During the Schick contingency, the conductor is loaded 166% at 10-year loading and 164% at 5-year loading. During the Main Center contingency, the conductor is loaded 154% at 10-year loading, 136% at 5-year loading and 107% at existing loading. It is recommended to rebuild 0.1 miles of 3-phase 477 kcmil ACSR to 3-phase 954 kcmil ACSR southeast out of the substation.

Estimated Cost: $26,000

WE-C3A In order to transfer Schick or Main Center to West substation during peak loading levels, it is recommended to upgrade the West Lane substation equipment to accommodate a larger transformer.

Estimated Cost: $500,000

WE-C3B In order to transfer Schick or Main Center to West substation during all peak loading levels, it is recommended to upgrade the West Lane substation transformer to 15/20/25 MVA with an LTC.

Estimated Cost: $500,000

WE-4A The conductor is loaded at 124% during 5 and 10-year loading, it is recommended to rebuild 0.3 miles of 3-phase #1/0 AWG ACSR to 3-phase 477 kcmil ACSR along N 600 W.

Estimated Cost: $65,000

WE-5A The conductor is loaded 83% at 5 and 10-year loading. It is recommended to rebuild 0.1 miles of 3-phase #6 HDC to 3-phase #4 AWG ACSR on the east side of N 200 W.

Estimated Cost: $21,000

5.4.3.2 Recommended Long Range Projects

WE-9A The conductor is loaded at 83% during 10-year loading and 83% at 5-year loading levels. It is recommended to rebuild 0.3 miles of 3-phase #4/0 AWG ACSR to 3-phase 477 kcmil ACSR along Old Mill Ln.

Estimated Cost: $65,000

WE-9B The conductor is loaded at 87% during 10-year loading and 86% during 5-year loading. It is recommended to rebuild 0.4 miles of 3-phase #4/0 AWG URD to 3-phase 350 kcmil URD along S Kays Dr.

Estimated Cost: $123,000

WE-C10A The conductor is loaded 108% at 10-year loading and 107% during 5-year loading during the Schick contingency, it is recommended to rebuild 0.5 miles of 3-phase #4/0 AWG URD to 3-phase 350 kcmil URD along County Mill Dr.

Estimated Cost: $154,000

WE-C10B The conductor is loaded 104% at 10-year loading and 103% at 5-year loading during the Schick contingency, it is recommended to rebuild 0.5 miles of 3-phase 477 kcmil ACSR to 3-phase 556 kcmil ACSR along W 200 N south of Barnes Memorial Park.

Estimated Cost: $108,000

WE-C10C The conductor is loaded 122% at 10-year loading during the Schick contingency, it is recommended to rebuild 0.3 miles of 3-phase 750 kcmil URD to 3-phase 1100 kcmil URD along W 200 N south of the West substation.

Estimated Cost: $118,000

WE-C10D The conductor is loaded 105% at 10-year loading during the Main Center contingency. It is recommended to rebuild 0.3 miles of 3-phase 477 kcmil ACSR to 3-phase 556 kcmil ACSR along W 200 N southeast of the West substation.

Estimated Cost: $65,000

WE-C10E The conductor is loaded 104% at 10-year loading and 103% at 5-year loading during the Schick contingency, it is recommended to rebuild 0.1 miles of 3-phase 477 kcmil ACSR to 3-phase 556 kcmil south of the West substation near the W 200 N/N 600 W intersection.

Estimated Cost: $22,000

5.4.3.3 Alternative and Exploratory Plans

WE-ALT7A As an alternative to WE-C8A, a new feeder could be built out of the West substation to transfer some of the load seen during contingency to another conductor. It is recommended to construct 0.1 miles of 3-phase #477 kcmil ACSR from the substation south.

Estimated Cost: $21,000

Existing Feeder Summary

Substation: WEST SUB :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
WEST SUB	12046.99	98.84	11906.97	98.84	1111.08	5.82	64.66	5.82
Total	**12046.99**	**98.84**	**11906.97**	**98.84**	**1111.08**	**5.82**	**64.66**	**5.82**
WEST SUB 1-EAST	9975.41	99.86	9961.86	99.86	233.43	53.08	123.91	53.08
WEST SUB 2-WEST	384.82	-99.49	382.87	-99.49	0.53	61.71	0.33	61.71
WEST SUB 3-NORTH	1516.86	98.73	1497.59	98.73	5.57	85.72	4.78	85.72
Total	**11864.32**	**99.81**	**11842.32**	**99.81**	**238.94**	**54.00**	**129.02**	**54.00**

5-Year Feeder Summary

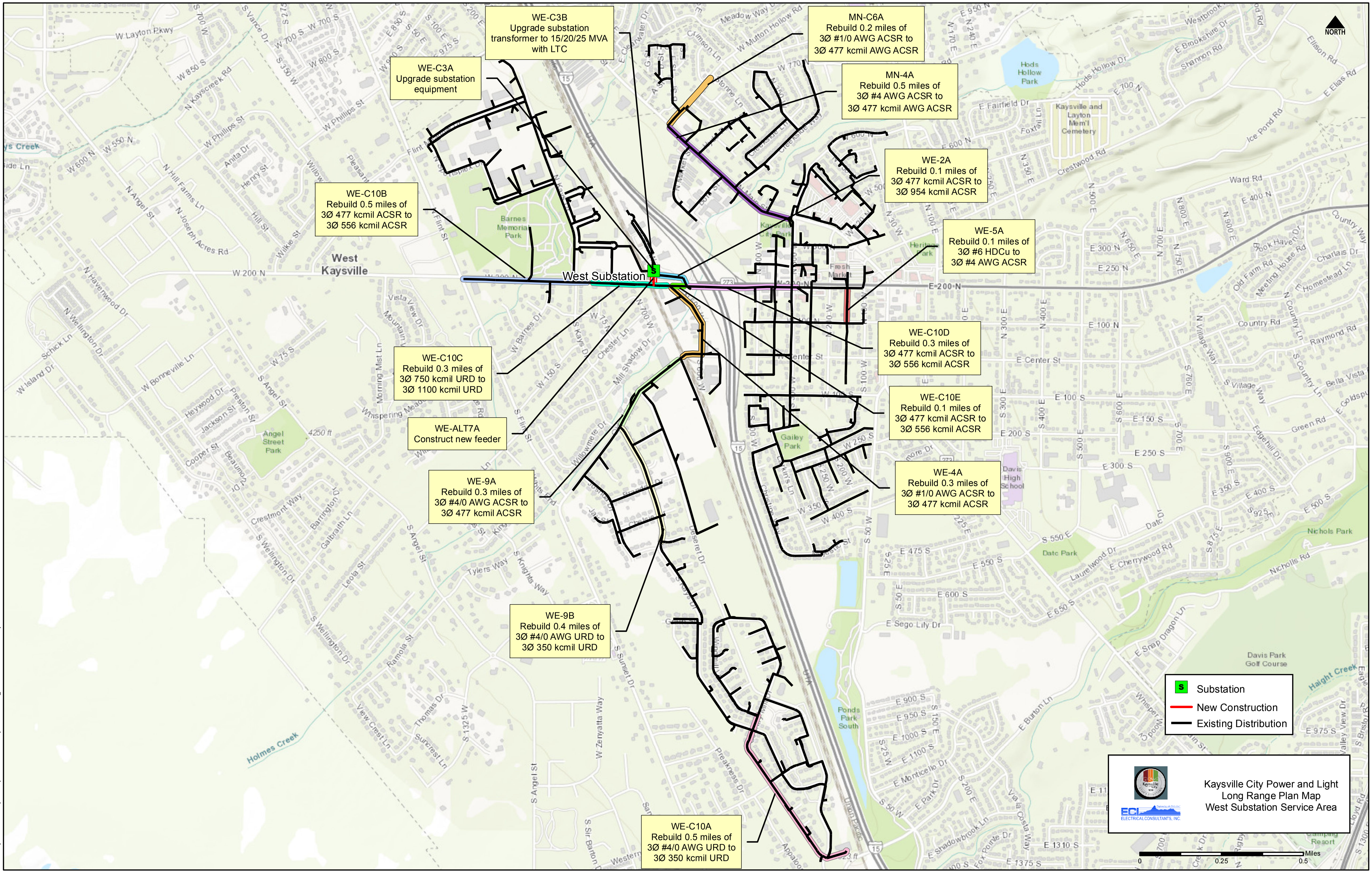
Substation: WEST SUB :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
WEST SUB	17486.34	96.08	16800.80	96.08	2340.20	5.06	118.51	5.06
Total	**17486.34**	**96.08**	**16800.80**	**96.08**	**2340.20**	**5.06**	**118.51**	**5.06**
WEST SUB 1-EAST	14049.54	98.79	13879.71	98.79	422.26	53.61	226.39	53.61
WEST SUB 2-WEST	1297.97	99.76	1294.80	99.76	3.61	89.62	3.23	89.62
WEST SUB 3-NORTH	1527.15	98.73	1507.78	98.73	5.56	85.72	4.76	85.72
Total	**16870.21**	**98.89**	**16682.29**	**98.89**	**430.34**	**54.47**	**234.38**	**54.47**

10-Year Feeder Summary

Substation: WEST SUB :

	Total Load		Total Load		Total Losses		Total Losses	
Network ID	kVA	PF (%)	kW	PF (%)	kVA	PF (%)	kW	PF (%)
WEST SUB	17533.11	96.07	16843.46	96.07	2352.73	5.06	119.06	5.06
Total	**17533.11**	**96.07**	**16843.46**	**96.07**	**2352.73**	**5.06**	**119.06**	**5.06**
WEST SUB 1-EAST	14092.74	98.79	13922.13	98.79	425.73	53.76	228.87	53.76
WEST SUB 2-WEST	1297.83	99.76	1294.66	99.76	3.61	89.62	3.23	89.62
WEST SUB 3-NORTH	1526.98	98.73	1507.61	98.73	5.56	85.72	4.76	85.72
Total	**16913.09**	**98.88**	**16724.40**	**98.88**	**433.81**	**54.60**	**236.87**	**54.60**



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Construction Costs

Conductor	ConsType	ExistingPhase	New Phase	Comments	Construction Cost
	Retire	1	2	Retire 1 phase Line	$4,500.00
	Retire	2	2	Retire 2 phase Line	$5,250.00
	Retire	3	2	Retire 3 phase Line	$6,000.00
#1/0 220 MIL EPR	Rebuild	1	3		$302,484.00
#1/0 220 MIL EPR	Rebuild	3	3		$302,484.00
#1/0 ACSR	Construct		1		$197,718.00
#1/0 ACSR	Construct		3		$207,378.00
#1/0 ACSR	Rebuild	1	3		$207,378.00
#1/0 CU	Construct		1		$197,718.00
#1/0 CU	Construct		3		$207,378.00
#1/0 CU	Rebuild	1	3		$207,378.00
#2 AWG ACSR	Construct		1		$197,507.00
#2 AWG ACSR	Construct		3		$207,166.00
#2 AWG ACSR	Rebuild	1	3		$207,166.00
#4 AWG ACSR	Construct		1		$197,507.00
#4 AWG ACSR	Construct		3		$207,166.00
#4 AWG ACSR	Rebuild	1	3		$207,166.00
#4/0 AWG ACSR	Construct		1		$200,992.00
#4/0 AWG ACSR	Construct		1		$198,510.00
#4/0 AWG ACSR	Construct		3		$208,170.00
#4/0 AWG ACSR	Construct		3		$210,652.00
#4/0 AWG ACSR	Rebuild	1	3		$208,170.00
#4/0 AWG AL 15KV	Construct		3		$388,839.00

Conductor	ConsType	ExistingPhase	New Phase	Comments	Construction Cost
#4/0 AWG AL 15KV	Rebuild	3	3		$388,839.00
1000 kcmil 260 MIL EPR	Construct		3		$302,484.00
1100 kcmil	Construct		3		$388,839.00
1100 kcmil	Rebuild	3	3		$388,839.00
1250 kcmil	Construct		3		$388,839.00
1250 kcmil	Rebuild	3	3		$388,839.00
1272 kcmil ACSR	Construct-H		3		$250,000.00
350 kcmil	Rebuild	3	3		$302,484.00
4 CU	Construct		1		$199,619.00
4 CU	Construct		3		$209,279.00
4 CU	Rebuild	1	3		$209,279.00
477 kcmil ACSR	Construct	1	3		$210,652.00
477 kcmil ACSR	Rebuild	1	3		$210,652.00
500 kcmil	Rebuild	3	3		$302,484.00
556 kcmil ACSR	Rebuild	1	3		$210,652.00
6 CU	Construct		1		$198,404.00
6 CU	Construct		3		$208,064.00
6 CU	Rebuild	1	3		$208,064.00
750 kcmil	Construct		3		$302,484.00
750 kcmil	Rebuild	1	3		$302,484.00
750 kcmil	Rebuild	3	3		$302,484.00
954 kcmil ACSR	Construct	1	3		$250,000.00

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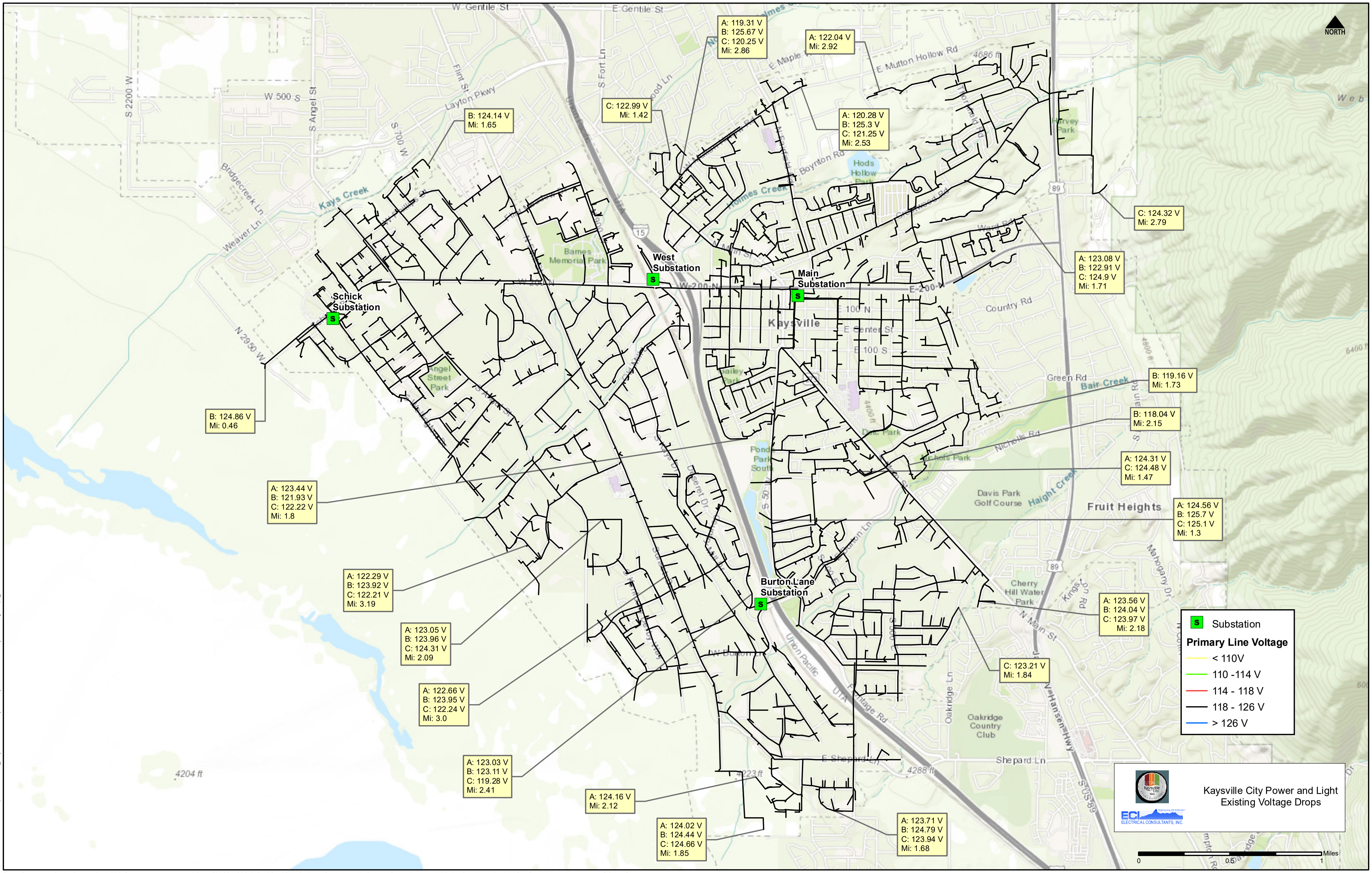

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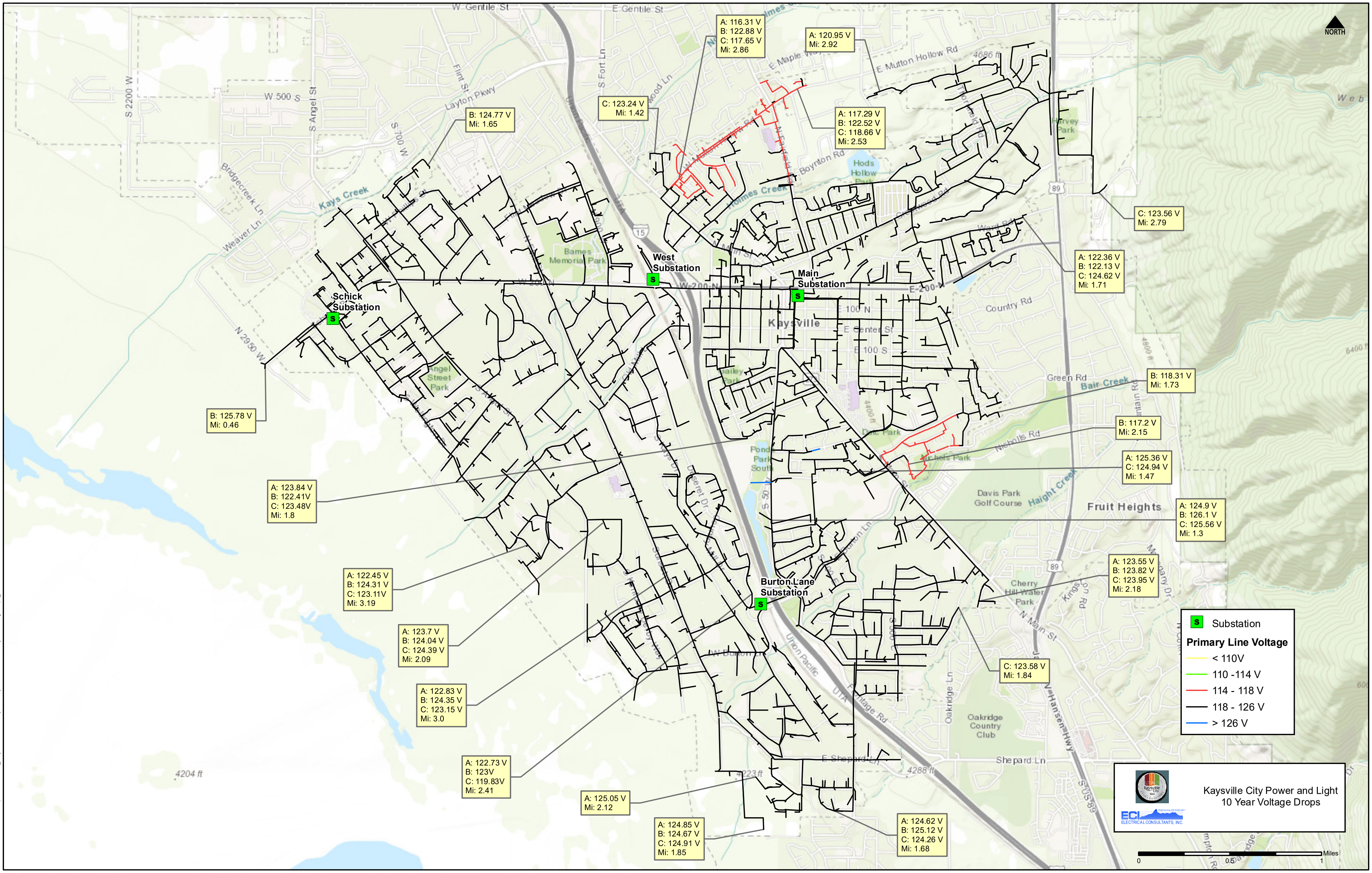
Kaysville City Power and Light
10 Year Voltage Drops
ECI ELECTRICAL CONSULTANTS, INC.
Substation
Primary Line Voltage
< 110V
110 -114 V
114 - 118 V
118 - 126 V
> 126 V
NORTH
0
0.5
1 Miles
Schick Substation
West Substation
Main Substation
Burton Lane Substation
Kaysville
Fruit Heights
A: 116.31 V
B: 122.88 V
C: 117.65 V
Mi: 2.86
A: 120.95 V
Mi: 2.92
C: 123.24 V
Mi: 1.42
A: 117.29 V
B: 122.52 V
C: 118.66 V
Mi: 2.53
B: 124.77 V
Mi: 1.65
C: 123.56 V
Mi: 2.79
A: 122.36 V
B: 122.13 V
C: 124.62 V
Mi: 1.71
B: 118.31 V
Mi: 1.73
B: 117.2 V
Mi: 2.15
A: 125.36 V
C: 124.94 V
Mi: 1.47
A: 124.9 V
B: 126.1 V
C: 125.56 V
Mi: 1.3
A: 123.55 V
B: 123.82 V
C: 123.95 V
Mi: 2.18
C: 123.58 V
Mi: 1.84
B: 125.78 V
Mi: 0.46
A: 123.84 V
B: 122.41V
C: 123.48V
Mi: 1.8
A: 122.45 V
B: 124.31 V
C: 123.11V
Mi: 3.19
A: 123.7 V
B: 124.04 V
C: 124.39 V
Mi: 2.09
A: 122.83 V
B: 124.35 V
C: 123.15 V
Mi: 3.0
A: 122.73 V
B: 123V
C: 119.83V
Mi: 2.41
A: 125.05 V
Mi: 2.12
A: 124.85 V
B: 124.67 V
C: 124.91 V
Mi: 1.85
A: 124.62 V
B: 125.12 V
C: 124.26 V
Mi: 1.68

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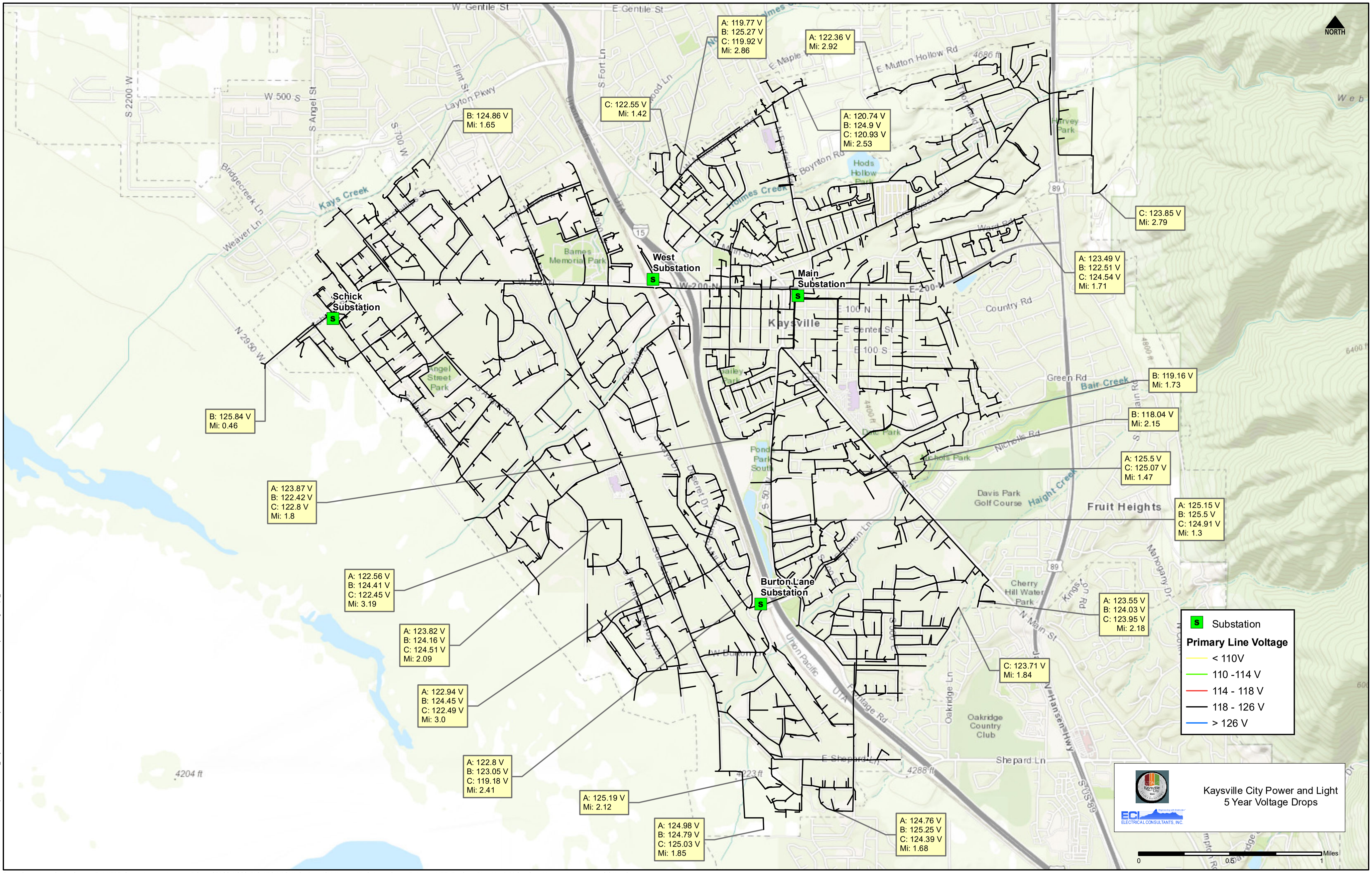

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