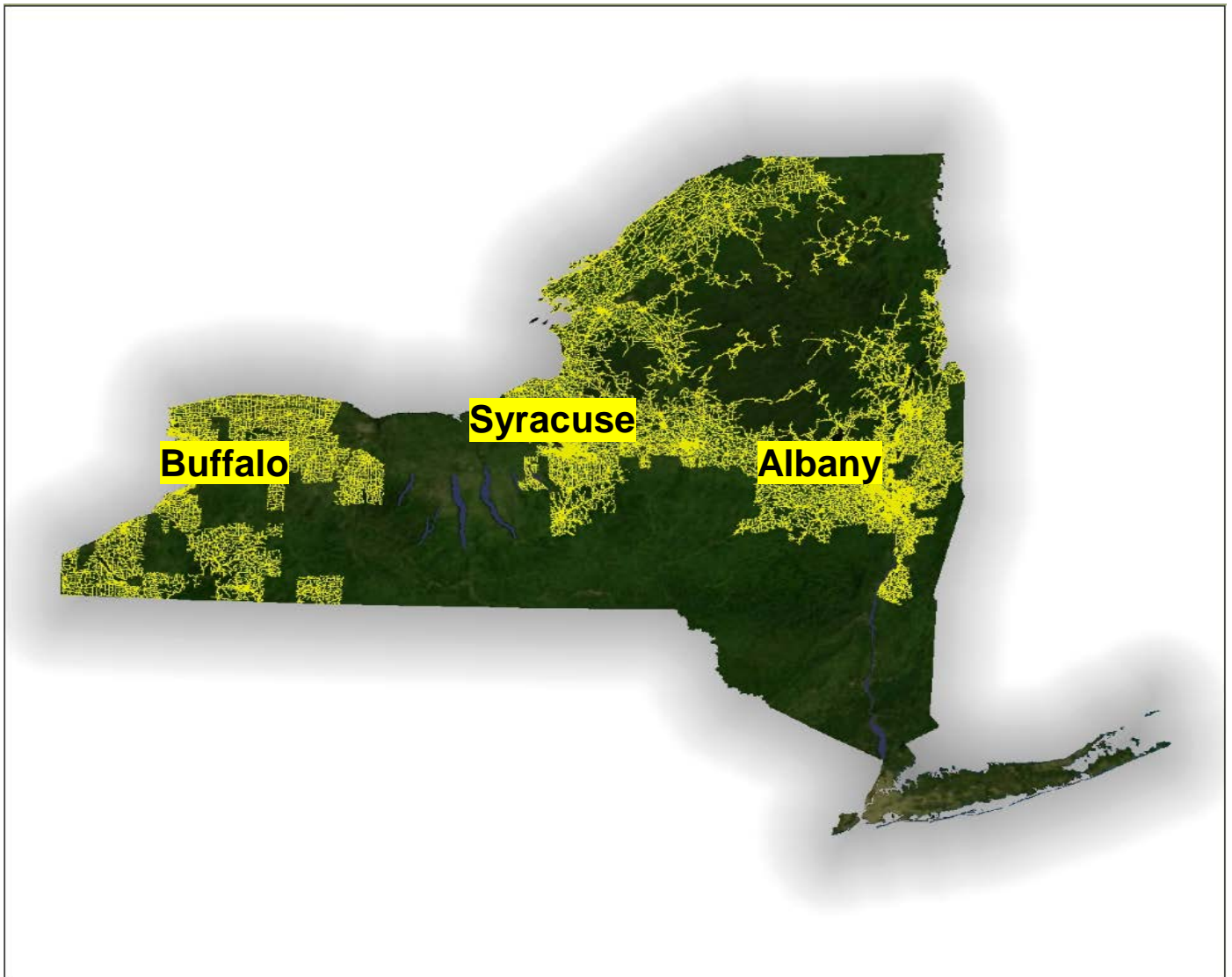


# nationalgrid

## ANNUAL ELECTRIC RELIABILITY REPORT



ANNUAL ELECTRIC RELIABILITY REPORT FOR 2018  
PSC CASE #19-E-0169



# **ANNUAL ELECTRIC RELIABILITY REPORT for 2018**

**Required By:**

**PSC CASES 02-E-1240, 15-E-0179, 17-E-0164, 18-E-0153, 19-E-0169**

**Prepared By:**

**Customer Reliability and  
Electric Distribution Planning & Engineering  
MARCH 2019**

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# ANNUAL ELECTRIC RELIABILITY REPORT for 2018

## Introduction

Enclosed is the Niagara Mohawk Power Corporation d/b/a National Grid (“National Grid” or “Company”) Annual Electric Reliability Report for 2018. This report has been prepared based on National Grid’s electric service to New York customers for the year ended December 31, 2018, in compliance with New York State Public Service Commission (“PSC”) Cases 02-E-1240, 15-E-0179, 17-E-0164, 18-E-0153, and 19-E-0169.

National Grid met both reliability targets System Average Interruption Frequency Index (“SAIFI”) and Customer Average Interruption Duration Index (“CAIDI”) in 2018, and as a result, no penalties were incurred.

This report reviews the reliability metrics at both the system-wide and regional levels, with analyses broken down by causes and circuits. The report includes a detailed analysis for any circuit that was among the top 5% worst performing distribution circuits in 2018. For any region where the SAIFI or CAIDI reliability metric did not meet the PSC target, we also include a detailed analysis of the factors that contributed to the below-target performance and a description of our plan to improve performance. Information on the major storms of 2018 is also included in the report.

National Grid continues its efforts to maintain reliability. This report includes a description of the Company’s Reliability Programs, Inspection and Maintenance, and Vegetation Management Programs. We have included a summary of expenditures and information regarding the composition of our work force as requested by Department of Public Service (“DPS”) Staff.



## A. SUMMARY OF PERFORMANCE AND COMMENTS

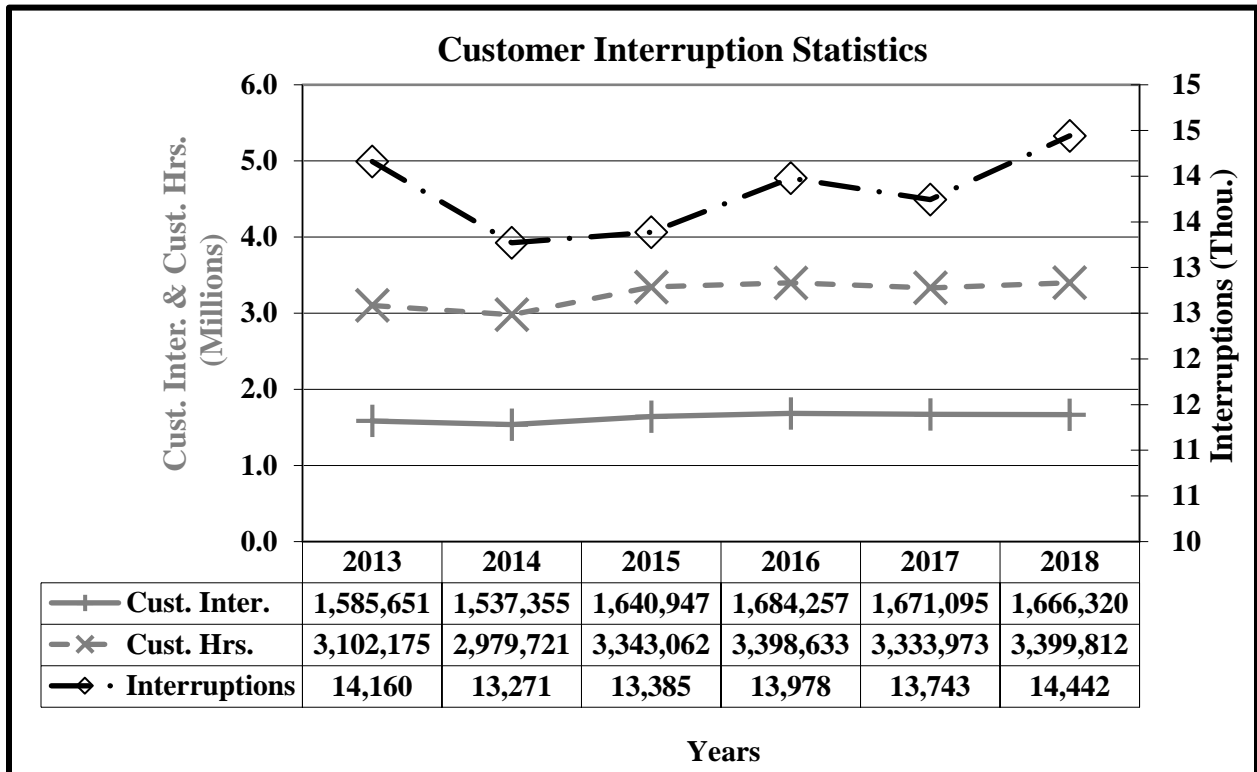
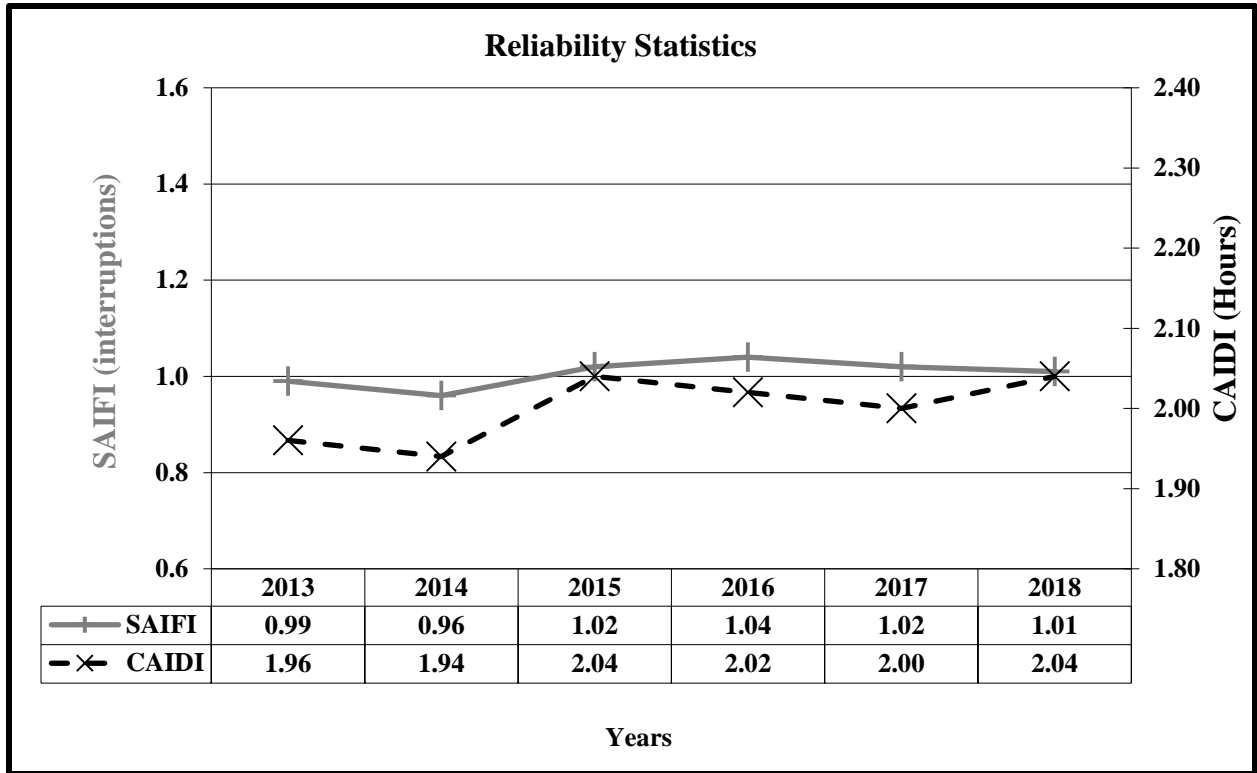
### 1. CORPORATE SAIFI AND CAIDI

The Company successfully met the Customer Average Interruption Duration Index (CAIDI) metric for the thirteenth consecutive year, with a value 2.04 hours. This is 3% below the target of 2.10 hours and is the 3% above the 5-year average.

The Company also successfully met the System Average Interruption Frequency Index (SAIFI) target for the eleventh consecutive year, with a value of 1.01. This is 6% below the target of 1.08 and the same as the 5-year average.

The number of interruptions excluding major storms was 5% above the 2017 result and was 5% above the 5-year average. The number of customers interrupted was 0.3% below the 2017 result and 3% above the 5-year average. The duration of customers interrupted (Customer-Hours Interrupted) was 2% above the 2017 result and was 5% above the 5-year average.

	2018	2017	2016	2015	2014	2013
<b>CAIDI Target: 2.10</b>	2.04	2.00	2.02	2.04	1.94	1.96
<b>SAIFI Target: 1.08</b>	1.01	1.02	1.04	1.02	0.96	0.99
<b>SAIDI</b>	2.07	2.04	2.11	2.08	1.86	1.93
<b>Interruptions</b>	14,442	13,743	13,978	13,385	13,271	14,160
<b>Customers Interrupted</b>	1,666,320	1,671,095	1,684,257	1,640,947	1,537,355	1,585,651
<b>Customer-Hours Interrupted</b>	3,399,812	3,333,973	3,398,633	3,343,062	2,979,721	3,102,175
<b>Customers Served</b>	1,643,812	1,630,719	1,614,496	1,605,794	1,604,865	1,605,502
<b>Customers per Interruption</b>	115.38	121.60	120.49	122.60	115.84	111.98
<b>Availability Index</b>	99.9764	99.9767	99.9760	99.9762	99.9788	99.9779
<b>Interruptions/1000 Customers</b>	8.79	8.43	8.66	8.34	8.27	8.82





## 2. CAIDI AND SAIFI BY REGION

The tables below illustrate CAIDI and SAIFI performance for each region. Data from 2013 through 2018 is derived from the Interruption and Disturbance System (IDS).

CAIDI performance met PSC targets in 5 of 8 regions. Customers in the Northern region experienced the most improvement with a 21% decrease as compared to 2017. Customers in the Frontier and Southwest regions also showed improvement in CAIDI from 2017.

Customers in the Capital, Genesee, and Mohawk Valley regions experienced CAIDI performances that did not meet the PSC targets.

SAIFI performance met PSC targets in 7 of 8 regions. Customers in the Mohawk Valley region experienced the most improvement with a 15% decrease from 2017. Customers in the Northeast, Northern, and Southwest regions also showed improvement in SAIFI from 2017.

Customers in the Genesee region experienced SAIFI performance that did not meet the PSC targets.

CAIDI (IDS data)

Region	2018 Target	2018 Actual	2017 Actual	2016 Actual	2015 Actual	2014 Actual	2013 Actual
Capital	2.025	2.20*	2.09*	1.86	1.90	2.04*	2.01*
Central	1.899	1.80	1.70	1.86	1.83	1.62	1.84
Frontier	1.869	1.61	1.79*	1.85*	1.73	1.74	1.74
Genesee	2.049	2.06*	1.76	1.62	1.98	1.96	1.96
Mohawk Valley	2.150	2.29*	1.57	1.94	1.87	2.21	1.93
Northeast	2.578	2.42	2.42	2.83*	3.00*	2.10	2.23
Northern	2.111	1.84	2.34*	1.87	1.51	2.13	1.78
Southwest	1.950	1.86	2.04*	1.91*	2.47*	1.91*	2.02*

SAIFI (IDS data)

Region	2018 Target	2018 Actual	2017 Actual	2016 Actual	2015 Actual	2014 Actual	2013 Actual
Capital	1.024	0.95	0.92*	1.01*	0.99*	0.83	1.02*
Central	1.226	1.17	1.16*	1.12*	1.19*	1.26*	0.90
Frontier	0.480	0.48	0.43	0.47	0.46	0.44	0.45
Genesee	1.037	1.23*	0.76	0.70	1.11*	0.96	1.01*
Mohawk Valley	1.483	1.29	1.52*	2.03*	1.24*	1.12	1.24*
Northeast	1.372	1.22	1.36*	1.21*	1.25*	1.36*	1.28*
Northern	1.412	1.34	1.48*	1.35*	1.50*	1.06*	1.47*
Southwest	1.181	1.02	1.13*	1.01*	0.94	0.96	1.21*

Note: The numbers in these tables are based on data that excludes major storm events. An asterisk (\*) indicates that the region fell short of the PSC target for the region.

### 3. PSC CAUSE CODE ANALYSIS

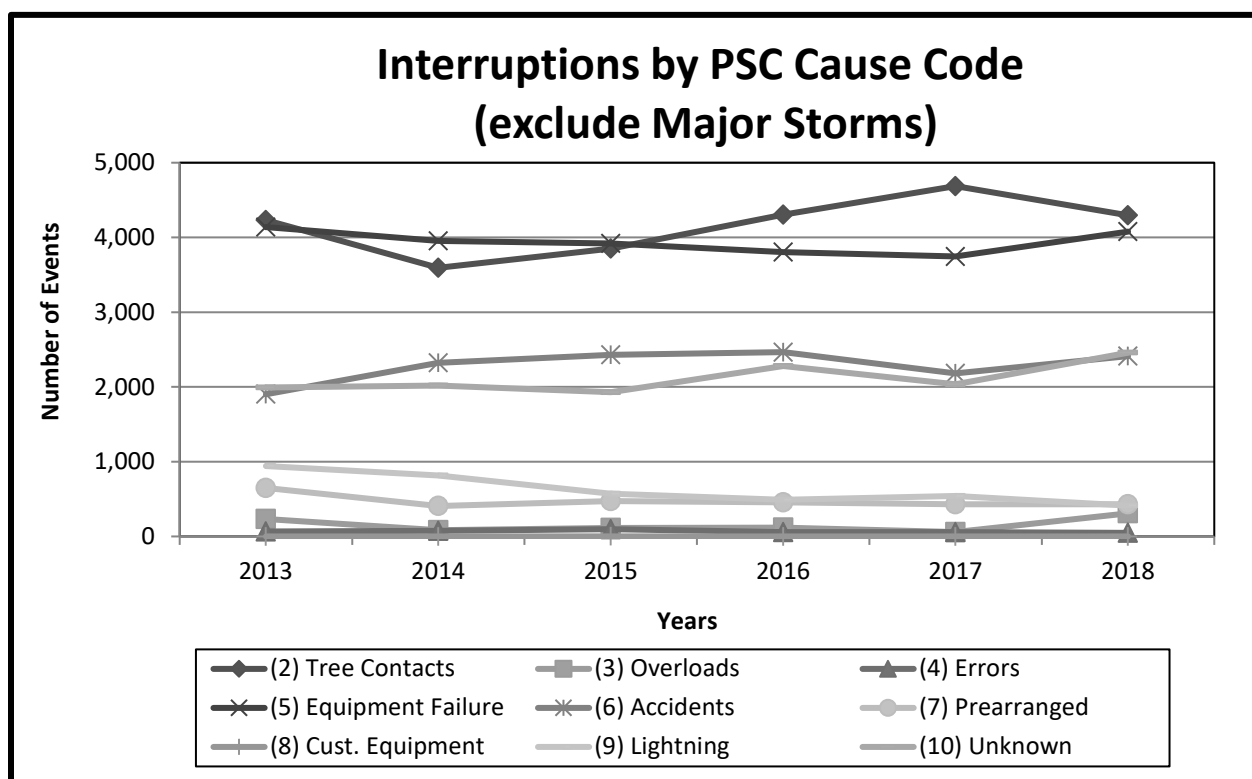
As illustrated in the table below, overall interruptions including major storms increased 20% in 2018 as compared to 2017. There was a moderate decrease in Tree Contacts and an increase in Major Storm Events and Overloads. Overall, the 20% increase can be attributed to a moderate increase in Major Storm events from 2017 to 2018.

Excluding Cause Code (1) Major Storms, the number of interruptions increased 5% from 2017. The top three contributors were (2) Tree Contacts at 30%, (5) Equipment Failure at 28%, and (6) Accidents at 17%.

During the past several years, National Grid has worked with DPS staff to enhance its vegetation management program. In 2018, (2) Tree Contacts decreased by 8% from 2017, the number of customers interrupted (CI) decreased by 18%, and customer-hours decreased by 18%. CAIDI, due to tree contacts, increased 1% in 2018 as compared to 2017, while SAIFI, due to tree contacts, decreased 19%. The results this year can be attributed to minor storm events that did not result in Major Storm Exclusions and also an increase in adverse weather.

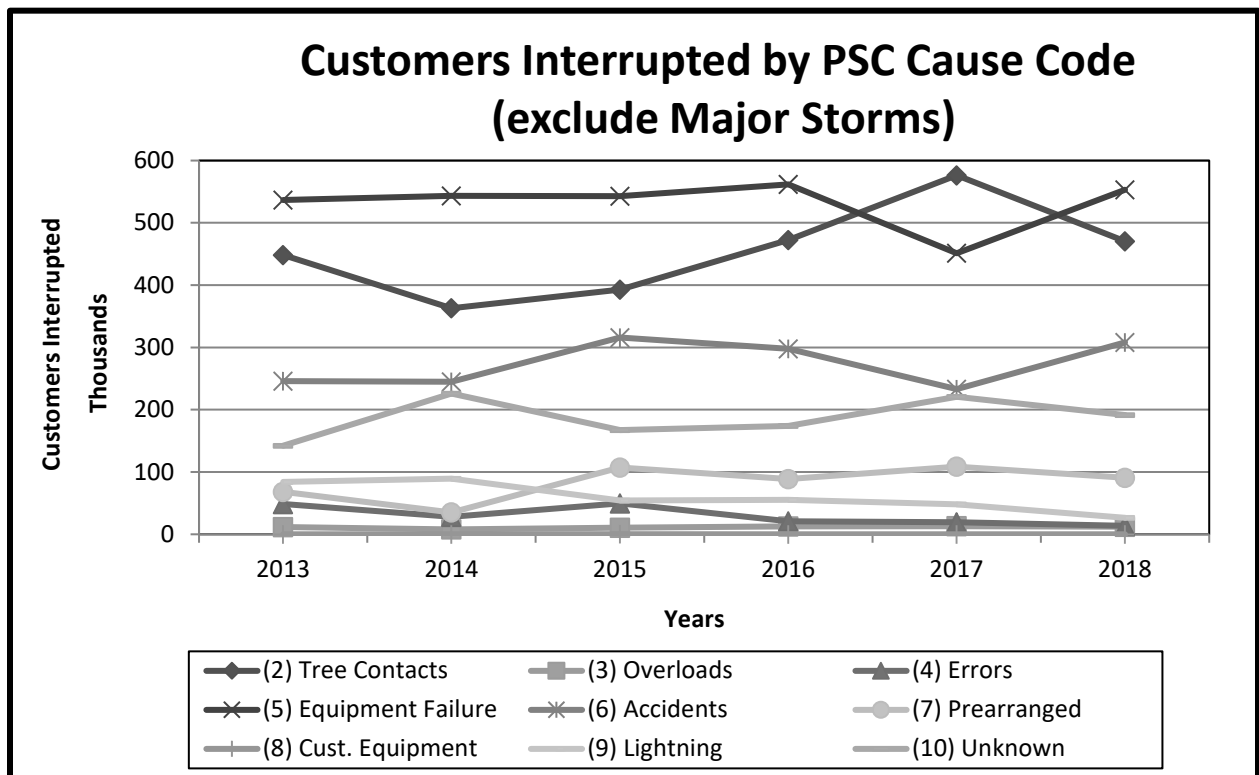
**NUMBER OF INTERRUPTIONS BY CAUSE CODE**

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	8,206	5,053	2,126	404	3,106	4,909
<b>02</b> Tree Contacts	4,296	4,687	4,306	3,850	3,594	4,234
<b>03</b> Overloads	309	59	118	113	85	233
<b>04</b> Errors	48	59	60	97	74	68
<b>05</b> Equipment Failure	4,078	3,746	3,802	3,918	3,955	4,139
<b>06</b> Accidents	2,411	2,183	2,466	2,431	2,322	1,902
<b>07</b> Prearranged	429	430	457	475	407	649
<b>08</b> Customer Equipment	0	0	0	1	0	0
<b>09</b> Lightning	413	542	491	570	814	942
<b>10</b> Unknown	2,458	2,037	2,278	1,930	2,020	1,993
<b>Totals</b>	<b>22,648</b>	<b>18,796</b>	<b>16,104</b>	<b>13,789</b>	<b>16,377</b>	<b>19,069</b>



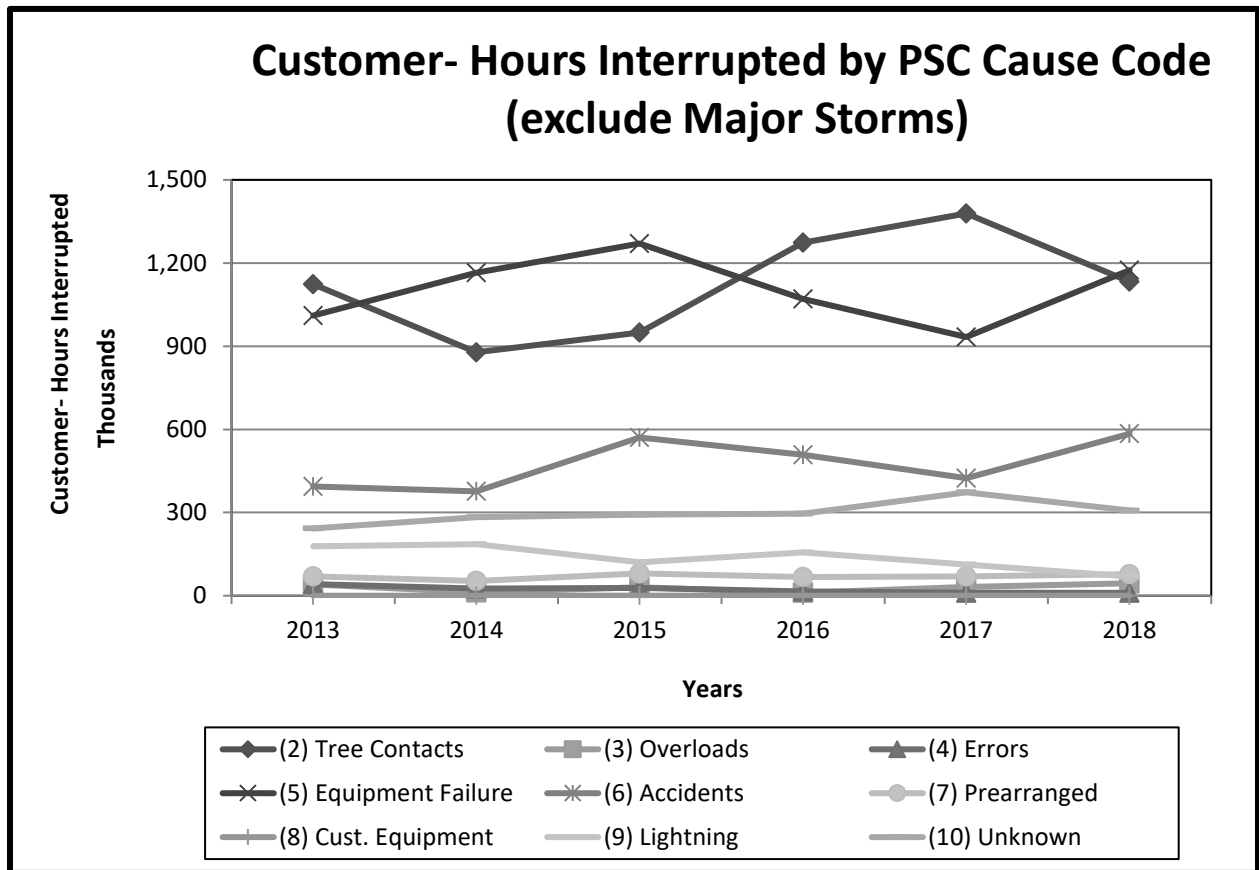
**CUSTOMERS INTERRUPTED BY CAUSE CODE**

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	839,762	570,641	222,113	70,903	336,656	646,535
<b>02</b> Tree Contacts	470,432	576,371	472,561	392,737	362,901	448,579
<b>03</b> Overloads	12,379	12,998	12,860	10,406	7,871	11,793
<b>04</b> Errors	13,633	19,595	20,956	49,657	27,847	48,528
<b>05</b> Equipment Failure	553,325	451,180	561,756	543,094	543,381	536,549
<b>06</b> Accidents	308,087	233,085	297,890	315,907	244,993	245,767
<b>07</b> Prearranged	90,590	108,583	88,530	107,376	35,090	68,129
<b>08</b> Customer Equipment	0	0	0	158	0	0
<b>09</b> Lightning	26,491	48,381	55,528	54,147	89,324	84,019
<b>10</b> Unknown	191,383	220,902	174,176	167,465	225,948	142,287
<b>Totals</b>	<b>2,506,082</b>	<b>2,241,736</b>	<b>1,906,370</b>	<b>1,711,850</b>	<b>1,874,011</b>	<b>2,232,186</b>



**CUSTOMER-HOURS INTERRUPTED BY CAUSE CODE**

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	7,433,501	5,037,211	1,198,909	200,832	2,394,591	4,944,875
<b>02</b> Tree Contacts	1,132,720	1,378,786	1,273,075	949,736	878,094	1,123,530
<b>03</b> Overloads	44,767	31,352	10,750	30,674	11,928	41,126
<b>04</b> Errors	10,263	11,179	15,743	28,256	25,540	41,802
<b>05</b> Equipment Failure	1,174,011	933,171	1,070,578	1,270,439	1,165,638	1,010,849
<b>06</b> Accidents	584,050	424,588	508,509	570,747	376,340	394,051
<b>07</b> Prearranged	77,269	69,184	67,864	80,449	53,058	70,087
<b>08</b> Cust. Equipment	0	0	0	137	0	0
<b>09</b> Lightning	69,490	112,784	156,706	120,030	185,844	178,068
<b>10</b> Unknown	307,243	372,929	295,409	292,595	283,280	242,662
<b>Totals</b>	<b>10,833,312</b>	<b>8,371,184</b>	<b>4,597,543</b>	<b>3,543,894</b>	<b>5,374,313</b>	<b>8,047,050</b>



CUSTOMERS INTERRUPTED AND CUSTOMER-HOURS  
INTERRUPTED BY CAUSE CODE INCLUDING MAJOR STORMS

Code	Category	Interruptions		Customers Interrupted		Customer-Hours	
		Number	% Total	Number	% Total	Number	% Total
01	Major Storms	8,206	36.2%	839,762	33.5%	7,433,501	68.6%
02	Tree	4,296	19.0%	470,432	18.8%	1,132,720	10.5%
03	Overload	309	1.4%	12,379	0.5%	44,767	0.4%
04	Errors	48	0.2%	13,633	0.5%	10,263	0.1%
05	Equipment	4,078	18.0%	553,325	22.1%	1,174,011	10.8%
06	Accidents	2,411	10.6%	308,087	12.3%	584,050	5.4%
07	Prearranged	429	1.9%	90,590	3.6%	77,269	0.7%
08	Customers	0	0.0%	0	0.0%	0	0.0%
09	Lightning	413	1.8%	26,491	1.1%	69,490	0.6%
10	Unknown	2,458	10.9%	191,383	7.6%	307,243	2.8%
	Totals	22,648	100.0%	2,506,082	100.0%	10,833,314	100.0%

CUSTOMERS INTERRUPTED AND CUSTOMER-HOURS  
INTERRUPTED BY CAUSE CODE EXCLUDING MAJOR STORMS

Code	Category	Interruptions		Customers Interrupted		Customer-Hours	
		Number	% Total	Number	% Total	Number	% Total
02	Tree	4,296	29.7%	470,432	28.2%	1,132,720	33.3%
03	Overload	309	2.1%	12,379	0.7%	44,767	1.3%
04	Errors	48	0.3%	13,633	0.8%	10,263	0.3%
05	Equipment	4,078	28.2%	553,325	33.2%	1,174,011	34.5%
06	Accidents	2,411	16.7%	308,087	18.5%	584,050	17.2%
07	Prearranged	429	3.0%	90,590	5.4%	77,269	2.3%
08	Customers	0	0.0%	0	0.0%	0	0.0%
09	Lightning	413	2.9%	26,491	1.6%	69,490	2.0%
10	Unknown	2,458	17.0%	191,383	11.5%	307,243	9.0%
	Totals	14,442	100.0%	1,666,320	100.0%	3,399,813	100.0%

### **Cause Code 01 - Major Storms**

In 2018, Major Storms accounted for 36% of interruptions, 34% of customers interrupted, and 69% of Customer-Hours Interrupted.

Interruptions due to Major Storm were up 62% from 2017, and up 163% over the 5 year average. Customers interrupted due to Major Storms were up 47% from 2017, and up 127% over the 5 year average. Customer-Hours interrupted were up 48% from 2017 and up 170% over the 5 year average.

The remaining PSC code descriptions do not include Major Storms in the percentages.

### **Cause Code 02 - Tree Contacts**

In 2018, Tree Contacts accounted for 30% of interruptions, 28% of customers interrupted, and 33% of Customer-Hours Interrupted.

Interruptions due to Tree Contacts were down 8% from 2017, and up 4% over the 5 year average. Customers interrupted due to Tree Contacts were down 18% from 2017, and up 4% over the 5 year average. Customer-Hours interrupted were down 18% from 2017 and up 1% over the 5 year average.

Tree Contacts were the largest cause of interruptions in 2018.

### **Cause Code 03 - Overloads**

In 2018, Overloads accounted for 2% of interruptions, 1% of customers interrupted, and 1% of Customer-Hours Interrupted.

Interruptions due to Overloads were up 424% from 2017, and up 153% over the 5 year average. Customers interrupted due to Overloads were down 5% from 2017, and up 11% over the 5 year average. Customer-Hours interrupted were up 43% from 2017 and up 78% over the 5 year average.

Overloads were the 7th largest cause of interruptions in 2018.

### **Cause Code 04 - Operator Error**

In 2018, Operator Error accounted for 0.3% of interruptions, 0.8% of customers interrupted, and 0.3% of Customer-Hours Interrupted.

Interruptions due to Operator Error were down 19% from 2017, and down 33% over the 5 year average. Customers interrupted due to Operator Error were down 30% from 2017, and down 59% over the 5 year average. Customer-Hours interrupted were down 8% from 2017 and down 58% over the 5 year average.

Operator Error was the 8th largest cause of interruptions in 2018.



### **Cause Code 05 - Equipment Failure**

In 2018, Equipment Failures accounted for 28% of interruptions, 33% of customers interrupted, and 35% of Customer-Hours Interrupted.

Interruptions due to Equipment Failure were up 9% from 2017, and up 4% over the 5 year average. Customers interrupted due to Equipment Failure were up 23% from 2017, and up 5% over the 5 year average. Customer-Hours interrupted were up 26% from 2017 and up 8% over the 5 year average.

Equipment Failures were the 2nd largest cause of interruptions in 2018.

### **Cause Code 06 - Accidents**

In 2018, Accidents accounted for 17% of interruptions, 18% of customers interrupted, and 17% of Customer-Hours Interrupted.

Interruptions due to Accidents were up 10% from 2017, and up 7% over the 5 year average. Customers interrupted due to Accidents were up 32% from 2017, and up 15% over the 5 year average. Customer-Hours interrupted were up 38% from 2017 and up 28% over the 5 year average.

Accidents were the 4th largest cause of interruptions in 2018.

### **Cause Code 07 - Prearranged**

In 2018, Prearranged outages accounted for 3% of interruptions, 5% of customers interrupted, and 2% of Customer-Hours Interrupted.

Interruptions due to Prearranged outages were down 0% from 2017, and down 11% over the 5 year average. Customers interrupted due to Prearranged outages were down 17% from 2017, and up 11% over the 5 year average. Customer-Hours interrupted were up 12% from 2017 and up 13% over the 5 year average.

Prearranged outages were the 5th largest cause of interruptions in 2018.

### **Cause Code 08 - Customer Equipment**

In 2018, Customer Equipment accounted for 0% of interruptions, 0% of customers interrupted, and 0% of Customer-Hours Interrupted.

Customer Equipment was the 9th largest cause of interruptions in 2018.

### **Cause Code 09 – Lightning**

In 2018, Lightning accounted for 3% of interruptions, 2% of customers interrupted, and 2% of Customer-Hours Interrupted.

Interruptions due to Lightning were down 24% from 2017, and down 39% over the 5 year average. Customers interrupted due to Lightning were down 45% from 2017, and down 60% over the 5 year average. Customer-Hours interrupted were down 38% from 2017 and down 54% over the 5 year average.

Lightning was the 6th largest cause of interruptions in 2018.

### **Cause Code 10 - Unknown**

In 2018, Unknown causes accounted for 17% of interruptions, 11% of customers interrupted, and 9% of Customer-Hours Interrupted.

Interruptions due to Unknown causes were up 21% from 2017, and up 20% over the 5 year average. Customers interrupted due to Unknown causes were down 13% from 2017, and up 3% over the 5 year average. Customer-Hours interrupted were down 18% from 2017 and up 3% over the 5 year average.

Unknown causes were the 3rd largest cause of interruptions in 2018.

#### 4. MAJOR STORMS

National Grid’s electric system experienced 34 severe weather incidents in 2018 that qualified as major storms; a 6% increase from the number of major storms reported in 2017 (32). Of the 34 events in 2018, 11 impacted the Central Division (Central – 3; Mohawk Valley – 5; Northern – 3), 15 impacted the Eastern Division (Capital – 7; Northeast – 8), and 8 impacted the Western Division (Frontier – 2; Genesee – 3; Southwest – 3). In order to qualify as a major storm, a storm event period must affect at least ten percent of the customers in an operating region or have at least one customer out of service for 24 hours or more. The Company excludes all interruptions caused by major storms from the CAIDI and SAIFI indices. The storms occurred during 14 distinct time periods, affecting multiple regions and in many cases, lasting for more than one day.

#### Major Interruptions Due to Major Storms

As shown in the table below, the number of major storm interruptions in 2018 was 163% higher than the 2013 to 2017, (5-year average). All regions with major storm events experienced a higher number of interruptions in 2018 relative to the 5-year average. There was a 62% increase in the number of 2018 interruptions as compared to 2017.

#### Major Storm Interruptions by Region

					(a)	(b)	(c)	(d) = (b-c)/c	(e) =(b-a)/a
Regions	2013	2014	2015	2016	2017	2018	13 - 17 Average	2018 vs. 5-year average	2018 vs. 2017
Capital	578	607	223	546	1,037	1,433	737	94.35%	38.19%
Central	380	409	33	142	419	635	336	88.80%	51.55%
Frontier	984	0	0	0	263	413	277	49.28%	57.03%
Genesee	361	52	0	0	1,033	503	325	54.85%	-51.31%
Mohawk	362	386	57	360	442	965	429	125.12%	118.33%
Northeast	564	1333	0	917	1,332	2,304	1,075	114.33%	72.97%
Northern	1680	271	0	109	180	1,144	564	102.84%	535.56%
Southwest	0	48	91	52	347	809	225	260.36%	133.14%
<b>Total</b>	<b>4,909</b>	<b>3,106</b>	<b>404</b>	<b>2,126</b>	<b>5,053</b>	<b>8,206</b>	<b>3,120</b>	<b>163.05%</b>	<b>62.40%</b>

## Major Storms – 2018

Date	Region	Storm Conditions	CI	CHI	Interruptions	Storm Duration	24 Hour Events	24 Hour Customers Interrupted	Qualification
03/01/2018	Southwest	Wind, Snow, Ice	38,167	824,675	590	4D 22H 41M	304	14,260	10%/24Hr
03/02/2018	Northeast	Wind, Snow, Ice	24,486	182,143	295	2D 16H 1M	55	654	10%/24Hr
03/02/2018	Capital	Wind, Snow, Ice	26,219	284,722	410	3D 13H 51M	127	3,074	24Hr
03/02/2018	Mohawk	Wind, Snow, Ice	52,758	457,745	337	2D 17H 34M	119	3,944	10%/24Hr
03/07/2018	Capital	Wind, Snow	14,065	63,328	261	1D 20H 46M	3	45	24Hr
04/04/2018	Northeast	Wind	49,225	622,773	620	3D 11H 30M	175	7,666	10%/24Hr
04/04/2018	Central	Wind	28,819	193,177	279	2D 8H 22M	37	931	10%/24Hr
04/04/2018	Northern	Wind	37,589	293,087	493	3D 7H 22M	109	3,132	10%/24Hr
04/04/2018	Southwest	Wind	7,403	44,838	177	1D 10H 41M	3	26	24Hr
04/04/2018	Frontier	Wind	19,434	65,504	246	1D 11H 57M	10	19	24Hr
04/04/2018	Mohawk	Wind	29,159	108,942	193	2D 15H 50M	37	488	10%/24Hr
04/04/2018	Capital	Wind	13,127	50,372	124	2D 20H 11M	4	40	24Hr
04/04/2018	Genesee	Wind	32,495	336,192	449	2D 19H 20M	116	4,919	10%/24Hr
04/15/2018	Mohawk	Wind	32,501	170,382	225	2D 10H 52M	46	1,001	10%/24Hr
04/15/2018	Central	Wind	46,445	214,273	201	2D 10H 40M	8	838	10%/24Hr
05/03/2018	Northeast	Wind, Rain	80,839	1,612,969	698	3D 22H 22M	312	23,000	10%/24Hr
05/04/2018	Capital	Wind, Rain	14,884	169,255	130	2D 15H 57M	24	1,181	24Hr
05/04/2018	Northern	Wind, Rain	41,023	379,716	486	3D 4H 34M	204	4,062	10%/24Hr
05/04/2018	Mohawk	Wind, Rain	12,914	77,946	93	1D 18H 36M	11	41	24Hr
05/04/2018	Frontier	Wind, Rain	41,018	240,246	167	1D 6H 5M	0	0	10%
05/04/2018	Genesee	Wind, Rain	2,478	8,673	47	2D 3H 52M	3	19	24Hr
06/14/2018	Genesee	Wind	12,240	19,054	7	0D 10H 40M	0	0	10%
06/18/2018	Northeast	Thunderstorm, Wind	12,745	88,314	135	1D 15H 43M	2	190	24Hr
07/27/2018	Capital	Thunderstorm, Wind	24,943	125,289	286	1D 23H 21M	10	102	24Hr
08/03/2018	Capital	Thunderstorm, Wind	26,801	121,567	143	3D 5H 27M	9	930	24Hr
08/04/2018	Northeast	Thunderstorm, Wind	5,121	31,600	64	1D 22H 52M	2	105	24Hr
09/21/2018	Southwest	Thunderstorm, Wind	13,276	20,649	42	0D 15H 16M	0	0	10%
10/15/2018	Northeast	Wind, Rain	7,724	82,248	138	1D 16H 29M	1	80	24Hr
11/02/2018	Capital	Wind, Rain	10,315	33,574	79	2D 3H 19M	1	14	24Hr
11/09/2018	Northeast	Wind	25,313	247,302	233	3D 20H 36M	18	1,239	10%/24Hr
11/26/2018	Central	Wind, Snow	21,176	100,827	155	3D 0H 57M	1	138	24Hr
11/27/2018	Northeast	Wind, Snow	20,192	117,455	121	1D 13H 14M	6	299	24Hr
11/27/2018	Mohawk	Wind, Snow	8,717	23,436	117	2D 13H 50M	2	33	24Hr
11/28/2018	Northern	Wind, Snow	6,151	21,226	165	1D 22H 3M	1	20	24Hr

## 5. CIRCUIT RELIABILITY

In order to identify action plans to maintain reliability, the Company ranks each circuit system-wide on the following four reliability metrics and generates an overall ranking by summing the four rankings for each feeder. This method helps to ensure that National Grid focuses on the worst performing feeders from the view point of customers regardless of physical location, voltage, or configuration.

- 1) Number of Interruptions
- 2) Number of Customer-Hours Interrupted (CHI)
- 3) SAIFI (Customers Interrupted/Customers Served)
- 4) SAIDI (Customer Hours/Customers Served)

The Company performs a detailed analysis of the reliability issues for the top 5% of circuits on this list. The location, duration of the interruptions, number of customers affected, cause(s), and physical environmental characteristics of the circuits are all analyzed to develop appropriate action plans that will address the issues.

For this report, the maximum number of feeders analyzed and evaluated in any one operating region is capped at twenty feeders. If any operating region has more than twenty feeders that rank among the top 5% worst performing, the performance for a commensurate number of next highly ranked feeders in other regions are analyzed. The following table shows the number of circuits in each operating region that were among the top 5% of feeders in terms of reliability issues. More detailed information can be found in Section L.1.

Company Operating Region	Total Number of Distribution Circuits	Company Criteria	
		Worst 5% For System	Circuits Analyzed
Capital	331	19	20
Central	302	19	20
Frontier	679	0	0
Genesee	133	6	6
Mohawk	137	16	17
Northeast	198	26	20
Northern	158	16	18
Southwest	152	3	4
<b>Grand Total</b>	<b>2,090</b>	<b>105</b>	<b>105</b>

## 6. RELIABILITY AND OTHER PROGRAMS

The Company has made significant investments for capital improvements and maintenance activities in recent years to develop and implement programs that will maintain the long-term performance and health of network assets.

The Reliability Program is designed to significantly improve and maintain reliability through four initiatives:

- 1) Engineering Reliability Reviews (“ERRs”)
- 2) Sub-Transmission Automation
- 3) Vegetation Management
- 4) Inspection and Maintenance Program (“I&M”)
- 5) Trip Saver Installation Program

The Inspection and Maintenance Program (“I&M”) has substantially replaced some of the strategy’s program work such as feeder hardening, potted porcelain cutout replacement, recloser installation, targeted pole replacement, manhole, and vaults. Section B of this report describes the Company’s reliability programs in more detail.

New York’s Broadband Expansion Program represented a significant increase in pole attachment activity in 2018. This unprecedented growth and speed of fiber expansion also, at times, created the need for National Grid to assist in the correction of non-compliant attachments. The total reliability impact of this corrective work has not been quantified within this report as most corrections were completed without the interruption of power to customers. These issues are noted within this report primarily for awareness as there were, in fact, multiple instances of unplanned interruptions and/or the need to proactively de-energize sections of lines to facilitate corrections to attachments which resulted in interruption of service to a limited number of customers.

## 7. TRANSMISSION AND DISTRIBUTION INSPECTION AND MAINTENANCE PROGRAM

The Company takes a very proactive approach to the management of its assets. First, the Inspection and Maintenance program is designed to find and fix issues before they become problems. Also, the inspections provide detailed information about our assets for further analysis of trends. In addition, planning of the transmission and distribution system assesses capacity, reliability and asset replacement issues in the future. The overarching objective of the initiatives is to get ahead of reliability concerns before they become events. Inspection of the transmission and distribution system is performed on a comprehensive system-wide basis using four basic methods:

- 1) A comprehensive helicopter inspection is performed to determine the condition of select lines (mainly transmission) and to help establish a repair schedule. These inspections are used to gather information to evaluate the need for maintenance or capital improvement on poorly performing circuits. The inspections provide detailed information about conductors, hardware, and structures.
- 2) Infrared testing is performed to sense heat dissipation from sub-transmission and transmission lines. Infrared testing detects faulty splices and loop sleeves so that the Company can take a short prearranged interruption to repair the problems proactively and thereby avoid a potentially lengthy uncontrolled emergency interruption.
- 3) Distribution and transmission lines are manually patrolled.
- 4) Mobile surveys of underground electric distribution systems are performed in select areas (cities with a population of >50,000) to detect elevated voltage.

Pursuant to the Electric Safety Standards, the performance target for inspections for 2018 was 19% (i.e., 95% of the annual 20% target). Defects that required immediate attention were addressed. Others problems were prioritized so they could be addressed in future work plans. National Grid has achieved 21% inspections of its electric facilities for the period ending December 31, 2018.

The results are summarized in the following tables.

**2018 Facility Inspection Program Results**

Category	Total System Units	2018 Units Completed	2018 Actual Inspected
Overhead Distribution	1,264,189	251,012	19.9%
Overhead Transmission	104,507	22,310	21.3%
Underground	99,358	25,046	25.2%
Pad-mounted Transformers	70,843	17,161	24.2%
Streetlight	65,523	14,532	22.2%
Totals	1,604,420	330,061	20.6%

**Inspection Performance Summary**

*Overhead Distribution Facilities*

Inspection Year	Number of Overhead Distribution Structures Inspected	% of Overall System Inspected
2018	251,012	20%
2017	260,764	21%
2016	258,385	21%
2015	255,736	21%
2014	229,300	19%
2013	265,168	21%

*Overhead Transmission Facilities*

Inspection Year	Number of Overhead Transmission Facilities Inspected	% of Overall System Inspected
2018	22,310	21%
2017	24,012	23%
2016	22,303	22%
2015	22,679	22%
2014	18,889	18%
2013	21,457	20%



Underground Facilities

Inspection Year	Number of Underground Facilities Inspected	% of Overall System Inspected
2018	25,046	25%
2017	19,460	20%
2016	17,582	19%
2015	17,254	18%
2014	19,124	21%
2013	24,845	26%

Pad-mount Transformers

Inspection Year	Number of Pad-mounted Transformers Inspected	% of Overall System Inspected
2018	17,161	24%
2017	13,793	20%
2016	13,985	21%
2015	12,268	19%
2014	12,308	19%
2013	17,190	26%

Streetlights

Inspection Year	Number of Streetlights Inspected	% of Overall System Inspected
2018	14,532	22%
2017	13,198	20%
2016	13,264	20%
2015	12,664	19%
2014	13,623	21%
2013	12,688	19%

In accordance with the Safety Standards, set forth in the PSC’s orders in Case 04-M-0159 National Grid uses the following severity levels to establish priority for repairs and scheduling:

**Level I** – Repair as soon as possible but not longer than one week. A Level I classification represents an actual or imminent safety hazard to the public or a serious and immediate threat to the delivery of power. Critical safety hazards present at the time of the inspection shall be guarded until the hazard is mitigated.

**Level II** – Repair within one year. A Level II classification represents conditions that are likely to fail prior to the next inspection cycle and represent a threat to safety and/or reliability should a failure occur prior to repair.

**Level III** – Repair within three years. A Level III classification represents conditions that do not present immediate safety or operational concerns and would likely have a minimal impact on the safe and reliable delivery of power should a failure occur prior to repair.

**Level IV** – A Level IV classification represents conditions found but repairs are not needed at this time. Level IV is used to track atypical conditions that do not require repair within a five year timeframe. This level is used for future monitoring purposes and planning proactive maintenance activities.

The following table summarizes the deficiencies identified by the inspection program in 2017 for the transmission and distribution system in each category. The specific issues that were identified for each asset grouping are described in the Company’s 2017 Annual Stray Voltage Testing and Facility Inspection Report in Case 04-M-0159 filed on February 13, 2018. All Level I issues and most Level II issues have already been addressed. The remaining issues will be addressed consistent with the timeframes as discussed above.

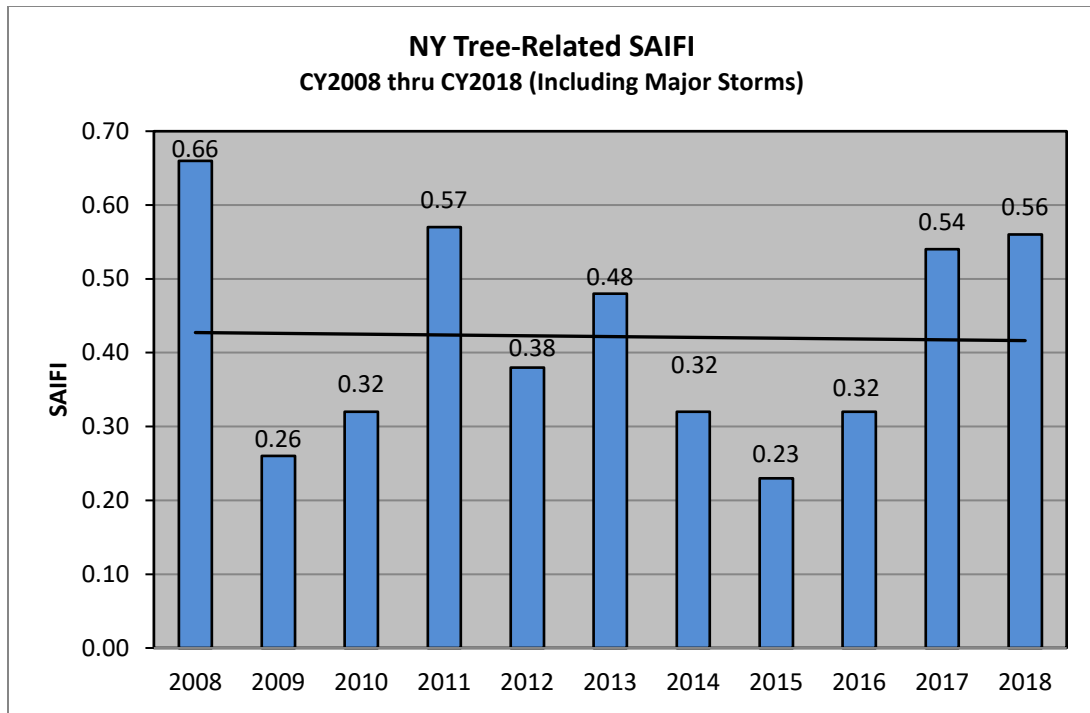
<b>Program</b>	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>
<b>Distribution</b>	1,896	456	41,447
<b>Underground</b>	295	896	130
<b>Transmission</b>	10	193	2,474

## 8. VEGETATION MANAGEMENT PROGRAM

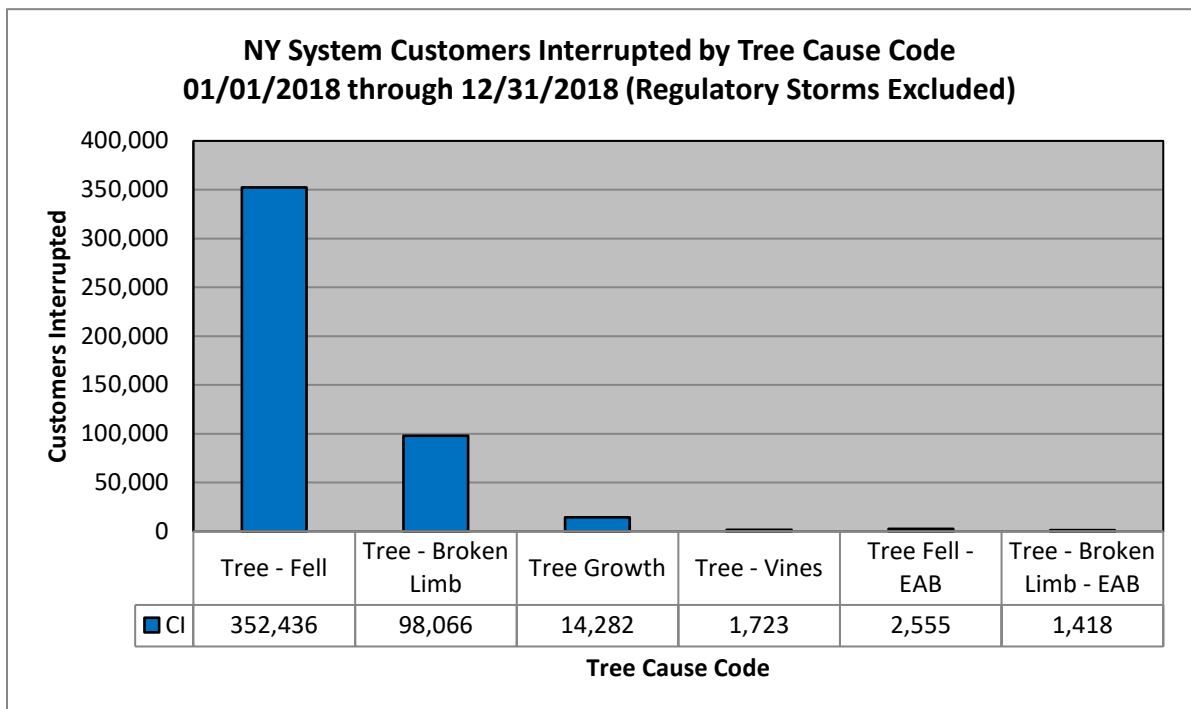
The Company's vegetation management program is divided into two sub-programs, one for the distribution system and another for the transmission system. Both programs include a cycle-based component and a reliability improvement component to minimize tree-related interruptions from trees and limbs falling into the infrastructure as well as provide a measure of public and worker safety. For the transmission system, the cycle-based program is an integrated vegetation management ("IVM") program used to manage vegetation along the floor of the rights-of-way. The details regarding the transmission program performance are reported annually in a separate report to the PSC.

The Company's distribution cycle-based component is circuit pruning, a comprehensive program that provides for the pruning of vegetation along all distribution circuit miles on an average five and one half year interval or cycle. An optimal cycle length is set for each circuit based on growing season, growth characteristics of predominant tree species in that area, and the appropriate clearance to be created at the time of pruning. The Company has maintained the appropriate level of funding necessary to operate the program for many years allowing the completion of six full cycles of pruning. In addition to the routine pruning, hazard tree removals are performed on prioritized distribution feeders. The Company identifies feeders for the inspection and removal of hazard trees based on field inspections, tree exposure, historical interruption data, number of customers served and circuit configuration.

Shown in the chart on the next page is the New York system tree-related SAIFI including major storms for the past ten years. Although tree-related interruptions are strongly correlated with wind and weather patterns; that variability and its effect on tree interruption data is mitigated when viewed over a longer period of years. As shown by the chart, SAIFI has been trending downward over the last ten years.



The distribution of tree interruptions between the six tree cause codes points to the importance of a hazard tree program. As demonstrated in the chart below, tree fell interruptions accounted for 75% of all tree interruptions in 2018, followed by 21% caused by limb failures, 3% caused by tree growth, and lastly tree vine growth, tree fell and limb failures accounted for only 1% combined. The minimal number of tree and vine growth interruptions is an indication that the current pruning cycle and pruning specifications are effective in minimizing interruptions related to vegetation growth.



The Company implemented a formal Ash tree removal program to mitigate the decline of Ash trees due to Emerald Ash Borer (EAB). Based on incremental funding, approximately 33,000 are targeted for removal in FY19. As part of the mitigation plan, an outage follow-up program was implemented to monitor the number of outage events caused by Ash trees. Below is a summary of the outage follow-up. Approximately 9.7% of the forest along the utility lines in New York State are comprised of Ash trees. In 2018, approximately 3% of all vegetation related outages were caused by Ash trees. Continuing to monitor the program to observe if Ash tree failures remain stable or if they begin to escalate due to EAB infestations will help to distribute resources appropriately.

**Ash Tree Interruptions by Division (Excluding major storms)**

<b>Division</b>	<b>Total Tree Events</b>	<b>Ash Tree Events</b>	<b>EAB Ash Tree Events</b>	<b>% Ash Tree Failures</b>	<b>%Ash Tree with EAB Failures</b>
East	1,700	32	15	1.9%	46.9%
Central	1,655	52	1	3.1%	1.9%
West	941	48	26	5.1%	54.2%
<b>Total</b>	<b>4,296</b>	<b>132</b>	<b>42</b>	<b>3.1%</b>	<b>31.8%</b>

In the table below the NY Operating Regions are ranked based on 2018 tree-related SAIFI performance. As one would expect, regions with the highest tree densities also had the highest distribution line tree exposure. These regions generally have the highest number of interruptions each year. Vegetation program budget dollars, especially for hazard tree work, are oriented with these same facts in mind.

**Tree Interruptions by Region (Excluding major storms)**

<b>Rank</b>	<b>Region</b>	<b>Number of Interruptions</b>	<b>Customers Interrupted</b>	<b>SAIFI</b>
1	Northeast	909	100,589	0.45
2	Central	693	108,613	0.38
3	Mohawk Valley	458	45,181	0.33
4	Southwest	391	32,021	0.31
5	Capital	791	93,234	0.28
6	Northern	504	37,260	0.27
7	Genesee	184	20,717	0.21
8	Frontier	366	32,865	0.10
<b>System Totals</b>		<b>4,296</b>	<b>470,480</b>	<b>0.29</b>

9. ELECTRIC SUBSTATION PREVENTIVE MAINTENANCE PROGRAM

The Substation Computerized Maintenance Management System (“CMMS”) covers an array of inspections, diagnostics, and maintenance activities to be completed in accordance with National Grid Substation Maintenance Standards and Procedures. These documents identify intervals and maintenance activities to be performed on different types of substation equipment (transformers, circuit breakers, Load Tap Changers (“LTC”), batteries and chargers, etc.). Protection Systems Engineering Documents provide the substation relay calibration and testing requirements for the bulk power, transmission, distribution, and communication-protection systems.

National Grid Upstate New York Substations and Protection, Telecom and Operations (“PTO”) field personnel performed and documented 14,407 discrete maintenance activities across the system in calendar year 2018. Total expenditure for the Upstate New York Substation Maintenance Program was approximately \$4.831 million. The listing of specific substation maintenance activities are as follows:

<b><u>Substation Maintenance Programs</u></b> <b><u>Apparatus : Activity</u></b>	<b><u>Number</u></b> <b><u>Performed</u></b>
Animal Fence Maintenance	55
Battery: Diagnostic Inspection	515
Circuit Breaker: Diagnostics	634
Circuit Breaker: Mechanism Inspection (GCB2)	4
Circuit Switcher: Diagnostics	20
Disconnect: Motor Operator Operation	71
Load Tap Changer: DGA	880
Load Tap Changer: Internal Inspections	8
Substation: Visual & Operations (V&O) Inspections	4,631
Substation: Thermographic Inspections	730
Transformer: DGA	919
Transformer: Diagnostics	6
Transformer: Oil Quality (Screen Test)	23
Transformer: Cooler Cleaning	33
Voltage Regulator: DGA	36
Relay Testing: NERC	3,398
Relay Testing: Other	655
Battery: KF-1,KF-2 Battery Diagnostic Test (ST1/ST2)	34
Substation: KF-3 Station Service Critical Load Test (ST-3)	4
Standby Generator: KF-5 E Gen Run Test (ST-5)	148
Standby Generator: KF-6 E Gen Transfer Test (ST-6)	12
Battery: NERC PRC-005-6 Battery Bi-Monthly Check	1,235
Circuit Breaker: DC Trip Coil Verification Check - NERC PRC-005-6	356
Totals	14,407

The CMMS uses a Maintenance Scheduling Number (“MSN”) that provides detailed information to prioritize and schedule the substation maintenance program work tasks. The CMMS application, Cascade, is used as a data warehouse and scheduling tool to manage workloads and balance risk. It is also used to help justify decisions related to work force and budgeting requirements. Cascade is the database used to assist in the development of maintenance plans and asset replacement programs for the calendar, fiscal, or multi-year maintenance and replacement programs.

As a maintenance example, a MSN number is used to trigger maintenance notification. The MSN number continues to increase creating a prioritized backlog until the maintenance task is completed. The MSN number increases at a predetermined rate depending on the type of maintenance task. This notification allows for the scheduling of the necessary equipment outages for maintenance inspection, diagnostics, or other tests as specified by published standards or procedures. The range between 400 and 500 allows for the scheduling of outages and completion of the maintenance activity. If the equipment MSN number is greater than 500, it is now considered overdue. Variance reports are generated monthly to indicate the maintenance activities performed during the reporting period and year-to-date.

The tables below represent a snapshot of the Cascade generated monthly report.

### Substation Maintenance Status by Equipment Class – New York

#### Transmission

	≥ 500 Overdue*	400-499 Due	Total Units	Month TD COMP	FYTD COMP
Animal Fence Maintenance	0	0	9	0	6
Battery & Chg: Std Insp	0	59	348	26	146
CAP PrePeak Insp	0	0	50	0	43
Circuit Breaker Diag	1	2	777	1	30
Circuit Breaker Mech Insp (GCB2)	1	0	5	2	2
CKTSW Diag	0	2	142	0	1
Disconnects: MO Diag Insp	0	2	657	0	5
EGEN Diag	0	0	15	0	0
LTC:DGA	0	55	400	27	414
Substation V&O	0	177	353	195	1614
Thermographic Insp*	0	326	326	0	121
Transf DGA	1	85	542	41	453
Transf Oil Quality	0	9	98	0	22
TRF Cooler Cleaner	0	0	22	0	22

#### Distribution

	≥ 500 Overdue*	400-499 Due	Total Units	Month TD COMP	FYTD COMP
Animal Fence Maintenance	0	0	71	0	38
Battery & Chg: Std Insp	0	14	216	8	115
CAP PrePeak Insp	0	0	56	0	50
Circuit Breaker Diag	24	147	3865	41	582
CKTSW Diag	0	0	7	0	0
Disconnects: MO Diag Insp	0	0	93	0	0
LTC:DGA	0	40	292	25	292
LTC: Internal Insp	0	0	6	1	3
Substation V&O Insp	0	197	429	257	1973
Thermographic Insp*	0	410	412	1	110
Transf DGA	1	58	591	27	292
Transf Oil Quality	1	5	62	0	11
TRF Cooler Cleaning	1	0	6	0	5
VREG Internal	0	0	9	0	0
VREG: DGA	0	13	70	12	56

\* Testing is done by PTO Meter and Test.

\* ≥ 500 Overdue column includes overdue, exemptions, and OPEX. Does not include NPCC (refer to page 10).

In addition to its functionality as an asset register, the Cascade system manages other substation maintenance work. The system generates Work Orders when maintenance is required to track follow-up work with Trouble Orders and Follow-up Work Orders. As substation mechanics perform maintenance and inspections from automatically generated Work Orders, if problems are discovered, they will have several options; fix the problem while on site, initiate a Follow-up Work Order, and/or initiate a Trouble Order. Trouble Orders track problems and failures that have occurred during normal operation of the equipment and require immediate repair. Follow-up Work Orders track problems found during Visual & Operational (V&O) Inspections or scheduled equipment inspections.

Protective relays are tested on a calendar year basis. Triggers are based on the last test date and testing interval.



## **B. RELIABILITY PROGRAMS AND WORK FORCE INFORMATION**

### **1. RELIABILITY PROGRAMS**

National Grid has invested in a number of capital and maintenance programs to maintain the reliability of the electric system. Programs that are specifically designed to improve reliability are described below in detail with the exception of the vegetation management program which was described in a previous section of this report.

- **Engineering Reliability Reviews (“ERRs”)**
- **Sub-Transmission Automation**
- **Vegetation Management** – Enhanced right-of-way clearing and treatment and Enhanced Hazard Tree Maintenance (“EHTM”) removal of danger trees on critical sections of the distribution system.
- **TripSaver Installation Program** – Single-phase cutout mounted recloser installations

In addition to reliability programs, certain aspects of the Inspection & Maintenance (“I&M”) program contribute to improved reliability and increased likelihood that the company will comply with PSC reliability targets. The I&M program is designed to ensure the Company fulfills its obligation to provide safe and adequate service by inspecting its facilities and repairing safety and reliability issues identified in a timely fashion. Replacement of deteriorated overhead and underground assets helps prevent a future failure which has a cumulative effect of improving reliability over time.

#### **ERRs**

As discussed in the 2018 Asset Condition Report and Capital Investment Plan, the Customer Reliability & Analytics group generates the list of Worst Performing Feeders during the preparation of the Electric Service Reliability Report. The list of feeders includes interruptions associated with supply issues (transmission or substation) and excludes major storms. From the list, a small number of geographically diverse feeders are selected for an Engineering Reliability Review (“ERR”). The scope of an ERR is typically a:

- Review of one-year and multi-year historical reliability data for current issues and trends.
- Review of recently completed and/or future planned work that is expected to impact reliability.
- Review the need for the installation of radial and/or loop scheme reclosers.
- Review the need for additional line fuses to improve the sectionalization of the feeder.
- Comprehensive review of the coordination of protective devices to ensure proper operation.
- Review for equipment in poor condition.

- Review of heavily loaded equipment.
- Review for other feeder improvements such as fault indicators, feeder ties, capacitor banks, load balancing, additional switches to improve switching time, and primary reconductoring (overhead and/or underground).

This review has been in place since FY2007 with 323 feeders going through the process. To date, this program is responsible for several of the 952 recloser installations across Upstate NY.

### **Sub-Transmission Automation**

After an initial investigation of automation and communication technologies, National Grid began a targeted Sub-Transmission Automation pilot in 2008.

The following Sub-Transmission lines have operational automation systems:

- Boonville-Lowell 22 Line (23kV)
- Lighthouse Hill-Mallory 22 Line (34.5kV)
- Chestertown-Schroon Lake #3 Line (34.5 kV)
- Battenkill-Cement Mountain #5 Line (34.5 kV)
- Cement Mountain-Cambridge #2 Line (34.5 kV)
- Cambridge-Hoosick #3 Line (34.5 kV)

These systems use distributed intelligence through local controls and switches, with peer-to-peer communication through to a local substation Energy Management System (“EMS”) uplink point achieved using spread spectrum 900 MHz radios. By up linking to EMS, Supervisory Control & Data Acquisition (“SCADA”) capability of the automation devices is provided to the Company’s Control Centers. In addition, all data is brought back to a central database warehouse for future analysis.

Following the success of pilot automation installations in 2008 and 2009, which verified the capability of advanced distribution automation enabled equipment, the Company recognized the additional benefit of identifying projects where the installation of modernized switching schemes would provide increased reliability to the Sub-Transmission system.

Given the results of the pilot, automation has been installed on the following lines:

- Boonville-Alder Creek 21 Line (46.5kV)
- Trenton-Middleville 24 Line (46kV)
- Hartfield-Ashville 854 Line (34.5kV)
- Hartfield-South Dow 859 Line (34.5kV)
- Youngstown-Mountain 401 Line (34.5kV)
- Warrensburg-Queensbury 9 Line (34.5kV)
- Warrensburg-Fort Gage 8/Fort Gage-Queensbury 2 Line (34.5kV)
- North Angola-North Ashford 861/North Eden-Eden 860 Line (34.5kV)

- North Lakeville-Hemlock 224/North Lakeville-Richmond 226 Lines (34.5kV)
- North Lakeville-Ridge 218 Line (34.5kV)
- Dake Hill-Machias 803 Line (34.5kV)

In addition, automation on the Sub-Transmission system is being expanded. There are a number of lines being explored for additional automation based on their reliability performance. Currently, automation is planned to be installed on the following lines over the next several years:

- Phillips-Medina 301 Line (34.5kV)
- Valley-Inghams 27 Line (46kV)
- Delavan-Machias 801 Line (34.5kV)
- Nicholville-Malone 21 Line (34.5kV)
- Akwesasne-Nicholville 23 Line (34.5kV)
- Rathbun-Labrador #39 Line (34.5kV)
- Brook-Ballston #11 Line (34.5kV)
- Gasport-Telegraph #312 Line (34.5kV)
- Oakfield-Caledonia #201 Line (34.5kV)
- Salamanca-Homer Hill #805 Line (34.5kV)

### **TripSaver Installation Program**

The Company began installing cutout mounted reclosers system-wide in 2018. These reclosers are aimed at reducing the number of sustained interruptions related to temporary faults on fused portions of the distribution system. These devices will limit the exposure to transient faults, such as tree and animal contacts, lightning and unknown causes that have led to customer outages. Locations targeted for TripSaver installations include circuits with high customer counts and historical reliability issues.

## 2. CAPITAL AND O&M BUDGETS AND ACTUAL EXPENDITURES

The Company develops investment plans to meet its obligation to provide safe and adequate electric delivery service to 1.6 million customers at reasonable cost. Providing this service requires the Company to maintain a vast physical infrastructure located in 450 cities and towns across our 25,000 square mile service area.

The following tables show fiscal year Capital and Operation and Maintenance expenditure over the past five years.

<b>Fiscal Year Capital Actual Expenditures (\$ Millions )</b>						
<b>System</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019*</b>
Distribution	\$300.5	\$311.0	\$286.7	\$249.0	\$290.3	\$319.6
Sub-transmission	\$36.5	\$28.8	\$26.9	\$21.3	\$23.9	\$31.2
Transmission	\$154.8	\$167.5	\$170.3	\$191.5	\$177.1	\$199.2
<b>Totals</b>	<b>\$491.8</b>	<b>\$507.3</b>	<b>\$483.9</b>	<b>\$461.8</b>	<b>\$491.3</b>	<b>\$550.0</b>

\* Forecasted spend for FY 2019. Based on FY18/19 Q3 Quarterly Report (which is based on 9+3 PCM Forecast (01-30-19)).

The following table summarizes fiscal year tree trimming Operations and Maintenance expenditures over the past five years.

<b>Fiscal Year Transmission Tree Trimming Actual and Budgeted Expenditure (\$ Millions )</b>						
<b>Spending</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019*</b>
Actual	\$15.08	\$28.77	\$15.10	\$11.81	\$14.13	\$15.27
Budgeted	\$11.1	\$15.6	\$11.1	\$11.02	\$13.30	\$15.27

<b>Fiscal Year Distribution Tree Trimming Actual and Budgeted Expenditure (\$ Millions)</b>						
<b>Spending</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019*</b>
Actual	\$38.21	\$47.91	\$48.64	\$47.11	\$54.03	\$56.57
Budgeted	\$40.3	\$55.1	\$43.5	\$43.57	\$48.92	\$56.57

\* Forecasted spend for FY 2019.

### 3. WORK FORCE NUMBERS

The following table summarizes the work force numbers for field positions associated with overhead, underground, and substation crews. It should be noted that head counts are not tracked by reliability vs. non-reliability work.

#### Distribution

Title	2013	2014	2015	2016	2017	2018
Cable Splicer A	17	6	14	16	14	12
Cable Splicer B	7	18	18	11	13	14
Cable Splicer C	18	22	24	28	23	26
Cable Splicer Helper	2	3		6	6	5
Chief Cable Splicer A	27	26	23	26	30	32
Chief Electrician A	15	17	18	18	17	16
Chief Electrician B	3	3	2	2	1	1
Chief Equip Operator A	6	6	5	6	7	7
Chief Laborer A	1	1	1	1	1	1
Chief Line Mechanic A						
Chief Line Mechanic A Hot Stick	295	311	304	305	303	290
Chief Line Mechanic B Hot Stick						
Chief Maintenance Mechanic A	38	35	38	37	34	33
Chief Mechanic A	14	16	12	14	14	16
Chief Street Light Service Mechanic A	2	7	6	6	7	5
Distribution Inspector B	1					
Distribution Inspector C	32	33	29	28	25	25
Electrician A	3	1	3	2	5	4
Electrician B	7	5	2	4	3	7
Electrician C	40	39	36	38	30	29
Electrician Helper			1			
Equipment Operator A						
Equipment Operator B	3	3	2	1	1	1
Equipment Operator C	2	7	6	6	6	5
Field Helper					3	5
Gas Line Inspector B						
Gas Mechanic C						
Laborer						
Line Mechanic A	36	59	19	29	37	36
Line Mechanic B	46	48	85	72	41	60
Line Mechanic C	61	41	42	51	84	76
Line Mechanic Helper	8	11	8	21	18	25
Line Mechanic-Hot Stick	210	228	224	216	197	177
Maintenance Helper				2	1	1
Maintenance Mechanic A	7	7	6	4	5	8

<b>Title</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Maintenance Mechanic B	7	13	13	9	11	9
Maintenance Mechanic C	45	46	45	50	54	50
Mechanic A		1	1	5	2	3
Mechanic B	6	5	8	5	3	2
Mechanic C	20	19	18	24	26	22
Mechanic Helper		1	1	1	1	4
One Person Line/Trouble Mechanic	61	56	59	62	63	62
Platform Attendant	10	7	7	9	5	7
Relay Tester B					1	31
Relief Operator K						
Relief Operator M						
Relief Operator P	1	1	2	1	4	4
Safety Advocate	2	2	2	2	2	1
Street Light Service Mechanic Helper	1					
Street Light Service Mechanic A		1		2	4	1
Street Light Service Mechanic B	3	2	2	2		
Street Light Service Mechanic C	29	27	28	27	25	20
Technician D	1	1	1	1		-
Tech-Substation Dept.	3	3	3	2	4	4
Tran Line Worker Hot Stick						
Tran Live Line Bare Hand	1	1				
Traveling Operator A						
Traveling Operator B		1		1	1	
Traveling Operator C	13	15	15	14	13	13
Traveling Operator D	27	26	27	25	27	26
Trouble Mechanic A Hot Stick		1				
Trouble Mechanic C Hot Stick	5	4	4	4	5	5
Trouble Mechanic D Hot Stick	5	5	5	5	5	5
<b>Distribution Total</b>	<b>1,141</b>	<b>1,191</b>	<b>1,169</b>	<b>1,201</b>	<b>1,182</b>	<b>1,186</b>

## Transmission

Title	2013	2014	2015	2016	2017	2018
Chief Electrician B						
Chief Live Line Bare Hand Specialist	6	6	6	6	6	5
Chief Line Mechanic A Hot Stick						
Chief Line Mechanic B Hot Stick						
Electrician A						
Electrician B						
Electrician C						
Equipment Operator C	6	6	6	6	6	
Equipment Operator D						6
Line Worker A/3rd Class	3	2				5
Line Worker B/2nd Class	7	3	2	2		1
Line Worker C/1st Class	3	5	3	3	2	1
Line Worker Hot Stick	13	13	12	12	12	10
Live Line Bare Hand Specialist	11	13	19	19	22	26
Safety Advocate Electric	1	1	1	1	1	1
<b>Transmission Total</b>	<b>50</b>	<b>49</b>	<b>49</b>	<b>49</b>	<b>49</b>	<b>55</b>

<b>Distribution &amp; Transmission Grand Total</b>	<b>1,191</b>	<b>1,240</b>	<b>1,218</b>	<b>1,250</b>	<b>1,231</b>	<b>1,241</b>
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4. CONTRACTOR CREW SERVICES

The following table represents the average monthly contractor head counts utilized by the company to implement its work plans for distribution and sub-transmission overhead and underground line work during the past six years. It should be noted that contractor head counts are not tracked by reliability vs. non-reliability work.

<b>Distribution &amp; Sub-transmission</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Contractor average monthly head count	108	107	109	111	22	32

The following table represents the average monthly contractor head counts utilized by the company to implement its work plans for Transmission. It should also be noted that contractor head counts are not tracked by reliability vs. non-reliability work.

<b>Transmission</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Contractor average monthly head count	72	64	80	48	49	47

The following table represents the average monthly contractor head counts utilized by the company to implement its work plans for distribution vegetation management during the past six years. It should be noted that contractor head counts are not tracked by reliability vs. non-reliability work.

<b>Distribution Vegetation Management</b>	<b>2013</b>	<b>2014</b>	<b>2015*</b>	<b>2016*</b>	<b>2017*</b>	<b>2018*</b>
Contractor average monthly head count	157	186	430	423	427	423

\* Denotes the actual head count, previous year totals have represented the number of crews.



## C. CAPITAL REGION

### 1. OPERATING REGIONAL PERFORMANCE

#### a. HISTORIC CAIDI AND SAIFI INDICES

IDS Info:

	2018	2017	2016	2015	2014	2013
CAIDI (Target 2.025)	2.20	2.09	1.86	1.90	2.04	2.01
SAIFI (Target 1.024)	0.95	0.92	1.01	0.99	0.83	1.02
SAIDI	2.09	1.91	1.88	1.88	1.70	2.05
Interruptions	3,088	2,547	2,865	2,776	2,624	2,848
Customers Interrupted	311,134	297,590	324,304	315,159	264,724	323,951
Customer-Hours Interrupted	685,218	622,120	603,753	598,061	539,882	650,008
Customers Served	328,413	325,004	320,898	318,329	317,503	317,658
Customers Per Interruption	100.76	116.84	113.20	113.53	100.89	113.75
Availability Index	99.9762	99.9781	99.9786	99.9786	99.9806	99.9766
Interruptions/1000 Customers	9.40	7.84	8.93	8.72	8.26	8.97

#### b. DISCUSSION OF REGIONAL PERFORMANCE

In 2018, the Capital Region did not meet its CAIDI reliability target and met its SAIFI reliability target as set forth by the New York Public Service Commission (PSC). The final System Average Interruption Frequency Index (SAIFI) result was 0.95 interruptions, 7% below the PSC goal of 1.024 interruptions. As shown in the table above, the Customer Average Interruption Duration index (CAIDI) was 2.20 in 2018, 9% above the PSC's regional target of 2.025 hours.

The 2018 CAIDI result was 5% above the 2017 result of 2.09 hours, and 11% above the previous 5-year average of 1.98 hours. The 2018 SAIFI was 3% above the 2017 result of 0.92 interruptions, and equal to the previous 5-year average of 0.95 interruptions.

In 2018, excluding major storms, the Capital Region experienced 7 transmission interruptions. These interruptions accounted for 0.2% of the region's total interruptions (7 of 3,088), 5% of the region's total customers interrupted (CI), (16,935 of 311,134), and 3% (23,086 of 685,218) of the region's total customer-hours interrupted (CHI). Overall, transmission interruptions had a CAIDI of 1.36 hours, and a SAIFI of 0.05 interruptions.

The number of transmission-related interruptions decreased from 16 in 2017 to 7 in 2018 (a decrease of 56%). The number of customers interrupted decreased from 23,945 in 2017, to 16,935 in 2018 (a decrease of 29%), while the customer-hours interrupted decreased from 29,406 in 2017, to 23,086 in 2018 (a decrease of 21%).

In 2018, excluding major storms, the Capital Region experienced 8 substation interruptions. These interruptions accounted for 0.3% of the region's total interruptions (8 of 3,088), 6% of the region's total customers interrupted, (19,977 of 311,134), and 5% (31,664 of 685,218) of the region's total customer-hours interrupted. Overall, substation interruptions had a CAIDI of 1.59 hours, and a SAIFI of 0.06 interruptions.

The number of substation-related interruptions decreased from 11 to 8 from 2017 to 2018 (a decrease of 27%). The number of customers interrupted decreased from 35,536 in 2017, to 19,977 in 2018 (a decrease of 44%), while the customer-hours interrupted decreased from 41,919 in 2017, to 31,664 in 2018 (a decrease of 24%).

In 2018, excluding major storms, the Capital Region experienced 3,073 distribution interruptions. These interruptions accounted for 100% of the region's total interruptions (3,073 of 3,088), 88% of the region's total customers interrupted, (274,222 of 311,134), and 92% (630,468 of 685,218) of the region's total customer-hours interrupted. Overall, distribution interruptions had a CAIDI of 2.3 hours, and a SAIFI of 0.83 interruptions.

The number of distribution-related interruptions increased from 2,520 to 3,073 from 2017 to 2018 (an increase of 22%). The number of customers interrupted increased from 238,109 in 2017, to 274,222 in 2018 (an increase of 15%), while the customer-hours interrupted increased from 550,795 in 2017, to 630,468 in 2018 (an increase of 14%).

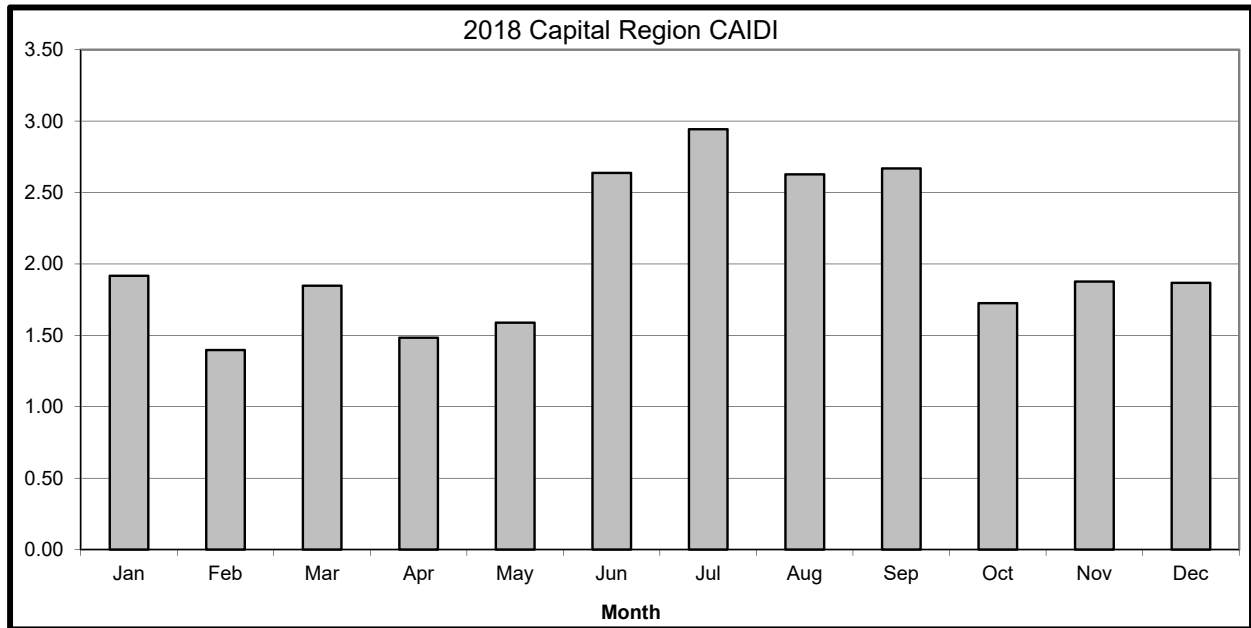
c. MONTHLY CAIDI AND SAIFI GRAPHS

The graphs on the following page show the monthly CAIDI and SAIFI for the Capital Region for 2018 (excluding Major Storms).

The CAIDI graph shows the individual CAIDI, by month, for 2018. The Capital Region was above the PSC minimum CAIDI goal of 2.025 hours throughout the year. The lowest three months were February (1.40), April (1.48) and May (1.59). CAIDI was above the PSC minimum for four months in 2018, with June (2.64), July (2.94), August (2.63), and September (2.67) being the largest months.

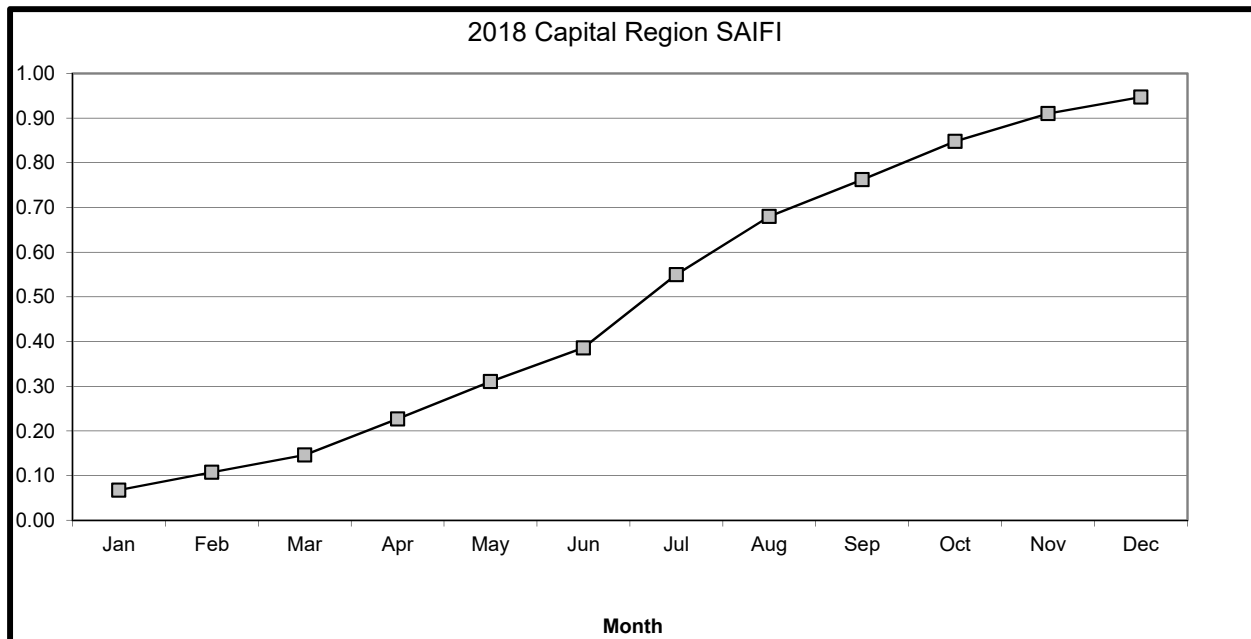
The SAIFI graph shows the cumulative SAIFI, by month, for 2018. The year-end SAIFI was below the PSC minimum SAIFI goal of 1.024 for the year. It showed the greatest increase during the months of July (0.16) and August (0.13); 39% of the SAIFI accrued during these two months. The lowest three months for SAIFI were February (0.04), March (0.04) and January (0.04); the interruptions which occurred during these three months contributed to only 21% of the total SAIFI.

GRAPH OF MONTHLY CAIDI AND SAIFI FOR THE CAPITAL REGION



PSC CAIDI Goal:	
Minimum	2.025
2018 Actual	2.20

PSC SAIFI Goal:	
Minimum	1.024
2018 Actual	0.95



d. PSC CAUSE CODES

1) Number of Events by Cause – Historical

IDS Info

Cause Code	2018	2017	2016	2015	2014	2013
01 Major Storms	1,433	1,037	546	223	607	578
02 Tree Contacts	791	777	686	651	616	755
03 Overloads	82	3	15	15	14	86
04 Operator Error	9	10	9	24	13	11
05 Equipment	954	781	877	829	782	792
06 Accidents	503	424	569	603	566	395
07 Prearranged	106	115	130	167	121	180
08 Customer Equip.	0	0	0	0	0	0
09 Lightning	65	32	34	49	97	192
10 Unknown	578	405	545	438	415	437
Total	4,521	3,584	3,411	2,999	3,231	3,426

2) Customers Interrupted by Cause – Historical

IDS Info

Cause Code	2018	2017	2016	2015	2014	2013
01 Major Storms	130,354	90,215	39,625	42,528	55,956	70,792
02 Tree Contacts	93,234	108,344	80,599	66,759	74,622	91,354
03 Overloads	4,675	217	1,417	4,734	1,514	7,129
04 Operator Error	775	4,044	2,464	18,217	7,666	1,552
05 Equipment	102,951	97,442	132,270	101,417	82,762	111,818
06 Accidents	68,240	35,246	60,286	80,534	51,469	56,008
07 Prearranged	9,677	9,667	7,762	13,613	5,973	11,724
08 Customer Equip.	0	0	0	0	0	0
09 Lightning	3,437	1,778	6,577	2,392	11,076	20,564
10 Unknown	28,145	40,852	32,929	27,493	29,642	23,802
Total	441,488	387,805	387,805	357,687	320,680	394,743

3) Customer-Hours Interrupted by Cause – Historical

IDS Info

Cause Code	2018	2017	2016	2015	2014	2013
01 Major Storms	848,107	555,898	215,269	127,395	363,528	631,907
02 Tree Contacts	238,510	260,581	197,390	139,822	171,907	217,521
03 Overloads	24,662	402	1,409	17,589	2,256	32,604
04 Operator Error	396	3,580	4,550	9,770	5,494	1,017
05 Equipment	240,622	198,920	235,270	227,997	205,004	221,875
06 Accidents	108,626	70,835	86,827	125,869	73,579	74,014
07 Prearranged	7,289	9,407	6,798	16,360	7,081	12,511
08 Customer Equip.	0	0	0	0	0	0
09 Lightning	14,599	8,116	19,451	7,330	31,078	43,615
10 Unknown	50,514	70,282	52,057	53,324	43,483	46,851
Total	1,533,325	1,178,019	819,021	725,456	903,409	1,281,915

4) Interruptions, Customers Interrupted, and Customer-Hours Interrupted – 2018

Cause Code	Interruptions		Customers Interrupted		Customer-hours Interrupted	
	Number	% Total	Number	% Total	Number	% Total
01 Major Storms	1,433	31.7%	130,354	29.5%	848,107	55.3%
02 Tree Contacts	791	17.5%	93,234	21.1%	238,510	15.6%
03 Overloads	82	1.8%	4,675	1.1%	24,662	1.6%
04 Operator Error	9	0.2%	775	0.2%	396	0.0%
05 Equipment	954	21.1%	102,951	23.3%	240,622	15.7%
06 Accidents	503	11.1%	68,240	15.5%	108,626	7.1%
07 Prearranged	106	2.3%	9,677	2.2%	7,289	0.5%
08 Customer Equip.	0	0.0%	0	0.0%	0	0.0%
09 Lightning	65	1.4%	3,437	0.8%	14,599	1.0%
10 Unknown	578	12.8%	28,145	6.4%	50,514	3.3%
Total	4,521	100.0%	441,488	100.0%	1,533,325	100.0%

e. **INTERRUPTION REVIEW BY PSC CAUSE CODES**

**Cause Code 01 - Major Storms**

In 2018, Major Storms accounted for 32% of interruptions, 30% of customers interrupted, and 55% of Customer-Hours Interrupted.

Interruptions due to Major Storms were up 38% from 2017, and up 140% over the 5 year average. Customers interrupted due to Major Storms were up 44% from 2017, and up 118% over the 5 year average. Customer-Hours interrupted were up 53% from 2017 and up 124% over the 5 year average.

The remaining PSC code descriptions do not include Major Storms in the percentages.

**Cause Code 02 - Tree Contacts**

In 2018, Tree Contacts accounted for 26% of interruptions, 30% of customers interrupted, and 35% of Customer-Hours Interrupted.

Interruptions due to Tree Contacts were up 2% from 2017, and up 13% over the 5 year average. Customers interrupted due to Tree Contacts were down 14% from 2017, and up 11% over the 5 year average. Customer-Hours interrupted were down 8% from 2017 and up 21% over the 5 year average.

Tree Contacts were the 2nd largest cause of interruptions in 2018.

**Cause Code 03 - Overloads**

In 2018, Overloads accounted for 3% of interruptions, 2% of customers interrupted, and 4% of Customer-Hours Interrupted.

Interruptions due to Overloads were up 2633% from 2017, and up 204% over the 5 year average. Customers interrupted due to Overloads were up 2054% from 2017, and up 56% over the 5 year average. Customer-Hours interrupted were up 6035% from 2017 and up 127% over the 5 year average.

Overloads were the 6th largest cause of interruptions in 2018.

**Cause Code 04 - Operator Error**

In 2018, Operator Error accounted for 0% of interruptions, 0% of customers interrupted, and 0% of Customer-Hours Interrupted.

Interruptions due to Operator Error were down 10% from 2017, and down 31% over the 5 year average. Customers interrupted due to Operator Error were down 81% from 2017, and down 89% over the 5 year average. Customer-Hours interrupted were down 89% from 2017 and down 92% over the 5 year average.

Operator Error was the 8th largest cause of interruptions in 2018.

### **Cause Code 05 - Equipment Failure**

In 2018, Equipment Failures accounted for 31% of interruptions, 33% of customers interrupted, and 35% of Customer-Hours Interrupted.

Interruptions due to Equipment Failure were up 22% from 2017, and up 17% over the 5 year average. Customers interrupted due to Equipment Failure were up 6% from 2017, and down 2% over the 5 year average. Customer-Hours interrupted were up 21% from 2017 and up 10% over the 5 year average.

Equipment Failures were the largest cause of interruptions in 2018.

### **Cause Code 06 - Accidents**

In 2018, Accidents accounted for 16% of interruptions, 22% of customers interrupted, and 16% of Customer-Hours Interrupted.

Interruptions due to Accidents were up 19% from 2017, and down 2% over the 5 year average. Customers interrupted due to Accidents were up 94% from 2017, and up 20% over the 5 year average. Customer-Hours interrupted were up 53% from 2017 and up 26% over the 5 year average.

Accidents were the 4th largest cause of interruptions in 2018.

### **Cause Code 07 - Prearranged**

In 2018, Prearranged accounted for 3% of interruptions, 3% of customers interrupted, and 1% of Customer-Hours Interrupted.

Interruptions due to Prearranged were down 8% from 2017, and down 26% over the 5 year average. Customers interrupted due to Prearranged were up 0% from 2017, and down 1% over the 5 year average. Customer-Hours interrupted were down 23% from 2017 and down 30% over the 5 year average.

Prearranged was the 5th largest cause of interruptions in 2018.

### **Cause Code 08 - Customer Equipment**

There were no Customer Equipment interruptions in 2018.

### **Cause Code 09 - Lightning**

In 2018, Lightning accounted for 2% of interruptions, 1% of customers interrupted, and 2% of Customer-Hours Interrupted.

Interruptions due to Lightning were up 103% from 2017, and down 20% over the 5 year average. Customers interrupted due to Lightning were up 93% from 2017, and down 59% over the 5 year average. Customer-Hours interrupted were up 80% from 2017 and down 33% over the 5 year average.



Lightning was the 7th largest cause of interruptions in 2018.

**Cause Code 10 - Unknown**

In 2018, Unknown causes accounted for 19% of interruptions, 9% of customers interrupted, and 7% of Customer-Hours Interrupted.

Interruptions due to Unknown causes were up 43% from 2017, and up 29% over the 5 year average. Customers interrupted due to Unknown causes were down 31% from 2017, and down 9% over the 5 year average. Customer-Hours interrupted were down 28% from 2017 and down 5% over the 5 year average.

Unknown causes were the 3rd largest cause of interruptions in 2018.

f. DISCUSSION OF REGIONAL CAPEX PROJECTS WITH 2018/19 SPENDS:

The Company continues to work on capital-related projects in the Capital Region to maintain customer satisfaction and future reliability. The company utilized initiatives such as the review of overloaded ratios and the Summer Preparedness Program to identify loading issues in order to have them addressed before peak load occurred. Multiple jobs were created as part of these programs, including ratio transformer size increases, load transfers (reallocating load to neighboring feeders), capacitor installations for reactive support and conversion jobs to remove overloaded ratio transformers.

National Grid has worked on solving hot spots from the Quick Resolution System (QRS) and other customer inquiries. These solutions varied, including asset replacement, fusing, adding tree wire, small rebuilds and also tree trimming.

Some specific projects that were constructed in CY18 or will be constructed in CY19 are listed below.

**Lasher Road Station Project**

The \$14 million Lasher Road Station Project will serve the growing Ballston Spa, NY area by increasing the reliability of electrical service to our residential customers. The project calls for the construction of a new 115kV switching station with a two bay breaker and a half configuration with a step-down 115/13.2kV, 15/20/25MVA power transformer with four feeders through a seven bay metalclad to serve the surrounding community.

The primary driver for this project is to relieve exposure to post-contingency thermal overloading of the Luther Forest-Eastover Road #308, 115kV line with the planned Global Foundries expansion. Once the new station is constructed, it will absorb distribution load from the surrounding community and allow for the eventual retirement of the existing 34.5/13.2kV Randall Road Substation and the 34.5/4.8kV Shore Road Substation.

Construction – Ongoing

Station Ready for Load – July 2019

**Grooms Rd 57 – Saratoga Road Conversion Project**

This project is primarily addressing low voltage issues on Saratoga Rd (Route 50), along with minimal feeder ties in a densely populated area (residential, commercial, and light industrial). The entire section of Saratoga Road is stepped down to 4.8kV via three 2,500 kVA pad-mount stepdown transformers on the Grooms Rd, Swaggertown, and Elnora feeders.

This project will convert over 3 miles of existing 3-phase distribution on Saratoga Road and Burnt Hills from 4.8kV to 13.2kV construction. This conversion will also complete a 13.2kV tie between Grooms Rd 57 and Swaggertown 52 feeders, as well as create a much needed feeder tie with the Shore Road 5kV substation.

Projected Construction Start Date – Spring 2019

Projected Completion Date – FY20

### **Grooms Road Transformer Replacement**

This project will replace the existing transformer banks TB1 and TB2 at the Grooms Road Substation. The primary driver for this project is asset condition. The load tap changers (LTCs) on these units have a history of chronic failures, and the design is prone to consistent and complicated mechanical issues. The secondary driver is system capacity. As the surrounding Clifton Park, NY area continues to grow; the existing transformer capacity is no longer sufficient.

Construction – Completed – December 2018

### **Partridge St – Avenue A #5, 34.5kV Cable Replacement**

The Partridge St – Ave A #5 cable has not been filled with nitrogen for more than 20 years due to numerous leaks which can no longer be repaired to maintain pressure. When not filled with gas this type of cable is at a greater risk for failure.

This project calls to replace approximately 7,000 feet of 350 Cu gas filled cable with 3-1/C 500 kcmil Cu EPR 35kV cable within a concrete encased, 5” 2x2 duct-line system. Approximately 2,300 feet of new manhole and duct-line will be built from the intersection of Partridge Street and Washington Avenue to Partridge Street and Madison Avenue in Albany, NY.

Construction – Ongoing

Projected Completion Date:

- Civil work – Summer 2019
- Cable work – Summer 2019

### **Rotterdam 13852 & 13853 - Lock 8 Mohawk River Relocation**

Per Canal Authority request, the Company will be relocating two distribution feeder getaways, the Rotterdam 13852 and 13853, off of Erie Canal Lock 8 in Rotterdam, NY. These getaways are vital to our distribution system as they serve large portions Scotia and Glenville, including the Scotia Industrial Park just north of the lock on State Route 5.

This project calls for installing a river crossing, via directional bore, for both distribution feeders using 1000 MCM Cu UG cable.

Completion Date - February 2019

### **Bethlehem Area conversions and transfers**

The southern Bethlehem area has seen a large growth in residential developments that is driving the need for load relief. Two separate projects have been entered to perform conversions and transfers to assist loading in this area. Load is being transferred from Bethlehem 02158 to Unionville 27651 and Selkirk 14952. Bethlehem 02158 will have the conversion of Selkirk 14952 for approximately 1.23 miles from 4.8kV 3-phase to 13.2kV on Creble Road and then transfer this section of Creble Road to Selkirk 14952 off of Bethlehem 02158 for the necessary load relief on the entire Bethlehem feeder sufficient for the additional load growth projected in 2019. Additionally there will be the installation of tie disconnect and transfer of load from Bethlehem 02158 to Unionville 27651 to provide load relief for capacity for a new customer URD. Both these jobs are ongoing and scheduled for completion in FY19.

Construction – Ongoing

Projected Completion Date – 6/1/2019

### **Avenue A Metal Clad, getaways and related Conversions**

This project is primarily addressing load growth issues in the University Heights area of Albany, along with limited N-1 contingencies with neighboring feeders in this densely populated area (residential, commercial, and light industrial). The entire area has several existing 4.8kV to 13.2kV pad mounted transformers that would just need to be removed to have the feeders at 13.2kV right from the station.

This project will convert over 3 miles of existing 3-phase 5kV distribution in the area to assist N-1 issues with Trinity, Delaware, Corliss, Partridge and New Krumkill distribution ties as well. The conversions from 4.8kV to 13.2kV and their related construction would be spread out over multiple years and be base on customer growth.

Construction – FY21

Projected Completion Date – FY22

### **Delaware Ave Getaway and Conversion**

Install two (2) 5” conduits in a manhole system in Delaware Ave station to utilize the 13.2kV spare breaker in Delaware Station. The overall work involved would also be to convert 33033 to 13.2kV and convert a portion of Trinity 16458 McCartney Ave up to Delaware 33033. Both sections of these feeders would become the new Delaware 33051.

Construction – FY20

Projected Completion Date – FY21

### **Corliss Park Station Project**

Corliss Park Substation transformer and North Troy Substation transformer are nearing normal limits. This job will upgrade the Corliss Park Substation transformer and reallocate load from the North Troy 12354 feeder to a new Corliss Park feeder. Additionally, all Corliss Park feeders and portions of the North Troy feeder 12354, presently operating at 4.16kV, will need to be converted to 13.2kV. This job will also resolve low voltage issues for the entire area of 115<sup>th</sup> St and 2<sup>nd</sup> Ave, as well as create much needed 13.2kV ties, as well as additional ties with the 4kV Lansingburgh feeders. This project is located in Troy, NY (Rensselaer County).

Construction – FY20

Projected Completion Date – FY23

### **Tibbets 29254 15<sup>th</sup> Ave and Pawling Ave Conversions**

This Conversion and load transfer to Sycaway 32751 will give the needed capacity on Tibbets TB1 for additional growth in Troy, NY. This gap closure, rebuild, and conversion will allow for the necessary load relief on the entire Tibbets Station sufficient for the additional load growth projected in 2018 Open and scheduled for completion in FY19.

Construction – FY20

Projected Completion Date – FY20

### **Albany Network Equipment**

There is an annual program for Albany area networks to review and change transformers and protectors due to deterioration as needed. The Albany area has approximately 250 vaults containing network transformers and protectors. The goal of this program is to replace the equipment before failure occurs. More detail on the low voltage AC network can be found in section 1.g.

**Major Capital Projects for Capital Region:**

<b>Region</b>	<b>Project Name</b>	<b>Project Type</b>	<b>Fin Sys Project No.</b>	<b>Finish</b>	<b>Total Spend</b>
CAPITAL	AVENUE A CONVERSIONS	D LINE	C081583	06/1/20	\$400,000
CAPITAL	AVENUE A METALCLAD	D LINE	C056609	03/1/20	\$4,975,000
CAPTIAL	GROOMS ROAD 34557 – SARATOGA ROAD CONVERSION	D LINE	C046761	03/31/19	\$1,765,771
CAPITAL	ROTTERDAM 13852 & 13853 RELOCATION	D LINE	C046422	02/08/19	\$5,355,968

g. DISCUSSION OF REGIONAL PERFORMANCE OF LOW VOLTAGE AC (LVAC) NETWORK DISTRIBUTION SYSTEM(S)

**Albany Secondary (LVAC) Network**

The Albany secondary network serves the downtown area of Albany, NY and is supplied by 10 – 13.2 kV feeders that originate from the Riverside and Trinity Substations. This system serves approximately 3,060 customer accounts and experienced a peak load of approximately 29.3 MVA in 2018.

The table below lists each distribution circuit serving the Albany secondary Network with the number of events that caused an operation of the Substation Breaker.

<b>Substation</b>	<b>Feeder</b>	<b># Breaker Operations from Faults / Failures</b>
Riverside	28801	3
Riverside	28802	0
Riverside	28805	0
Trinity	16406	1
Riverside	28807	0
Trinity	16408	0
Trinity	16410	1
Riverside	28811	2
Riverside	28812	1
Riverside	28815	1

As shown above the Albany Secondary Network experienced a total of 9 unplanned distribution circuit outages in 2018.

Major equipment replacements in 2018 consisted of 3 network protectors. Annual maintenance consisted of manhole and vault inspections, network protector and transformer inspections, and network protector operation checks.

### **Troy Secondary (LVAC) Network**

The Troy Secondary Network serves the downtown area bounded by River St., Congress St., and Union St. This network is supplied by 6 – 4.16 kV and 2 – 13.2 kV feeders that originate from the Liberty Street Substation. This system serves approximately 1,480 customer accounts and experienced a peak load of approximately 9.5 MVA in 2018.

The table below lists each distribution circuit serving the Troy Secondary Network with the number of events that caused an operation of the Substation Breaker.

<b>Substation</b>	<b>Feeder</b>	<b># Breaker Operations from Faults / Failures</b>
Liberty	09425	0
Liberty	09427	0
Liberty	09431	0
Liberty	09432	0
Liberty	09442	0
Liberty	09444	0
Liberty	09451	1
Liberty	09411	2

As shown above the Troy Secondary Network experienced a total of 3 unplanned distribution circuit outages in 2018. At no time was this network operated beyond its double contingency (N-2) design criteria.

Major equipment replacements in 2018 consisted of 2 network transformers and 1 network protector. Annual maintenance consisted of manhole and vault inspections, network protector and transformer inspections, and network protector operation checks.



### **Schenectady Secondary (LVAC) Network**

The Schenectady Secondary Network serves the downtown area around State Street from Nott Terrace to Washington Avenue, Erie Boulevard from State Street to River Road, and Broadway to Smith Street. This network is supplied by 5 – 13.2 kV feeders that originate from the Front Street Substation. This system serves approximately 1,200 customer accounts and experienced a peak load of approximately 11.8 MVA in 2018.

The table below lists each distribution circuit serving the Schenectady Secondary Network with the number of events that caused an operation of the Substation Breaker.

<b>Substation</b>	<b>Feeder</b>	<b># Breaker Operations from Faults / Failures</b>
Front	36002	0
Front	36003	1
Front	36006	2
Front	36007	0
Front	36008	0

As shown above the Schenectady Secondary Network experienced a total of 3 unplanned distribution circuit outages in 2018. At no time was this network operated beyond its double contingency (N-2) design criteria.

Annual maintenance consisted of manhole and vault inspections, network protector and transformer inspections, and network protector operation checks.

## 2. OPERATING CIRCUIT LISTS

The next three (3) tables will provide the following information for the Capital Region.

- a. Worst Performing Circuit List
- b. Worst Performing Circuits with 3 Year History for CAIDI and SAIFI Indices
- c. Worst Performing Circuits by # of Momentary Interruptions

a. NATIONAL GRID WORST PERFORMING CIRCUIT LIST

CAPITAL REGION

<b>FEEDER #</b>	<b>A CUST. SERVED</b>	<b>B TOTAL INTER.</b>	<b>C # CUST. INTER.</b>	<b>D CUST. HRS. INTER.</b>	<b>C/A SAIFI</b>	<b>D/A SAIDI</b>	<b>D/C CAIDI</b>	<b>NUMBER OF MOMENTARIES</b>
GREENBUSH 07852	2,325	25	5,586	18,250	2.40	7.85	3.27	0
BLUE STORES 30353	1,399	28	6,116	8,059	4.37	5.76	1.32	7
VOORHEESVILLE 17851	2,052	44	3,974	16,599	1.94	8.09	4.18	8
SWAGGERTOWN 36453	2,148	23	4,403	16,371	2.05	7.62	3.72	1
GROOMS ROAD 34552	1,684	22	4,862	9,590	2.89	5.69	1.97	2
MENANDS 10156	982	21	2,695	7,334	2.74	7.47	2.72	3
PINEBUSH 37153	1,653	25	3,791	9,314	2.29	5.63	2.46	4
BLUE STORES 30351	2,147	47	2,955	16,269	1.38	7.58	5.51	1
VALKIN 42752	2,414	39	6,135	8,372	2.54	3.47	1.36	2
GROOMS ROAD 34556	1,831	18	4,497	10,149	2.46	5.54	2.26	0
ELNORA 44258	1,768	22	3,773	9,197	2.13	5.20	2.44	3
TRINITY PLACE 16452	1,539	14	3,899	12,001	2.53	7.80	3.08	2
BOYNTONVILLE 33351	1,992	66	3,454	9,174	1.73	4.61	2.66	0
VOORHEESVILLE 17853	1,906	25	3,520	10,169	1.85	5.34	2.89	6
SWAGGERTOWN 36452	2,411	27	3,109	17,030	1.29	7.06	5.48	3
SWAGGERTOWN 36451	969	19	2,210	5,444	2.28	5.62	2.46	6
GROOMS ROAD 34557	1,890	15	7,077	7,726	3.74	4.09	1.09	2
BRUNSWICK 26452	1,956	26	4,555	6,155	2.33	3.15	1.35	0
BLUE STORES 30352	1,111	24	2,589	4,484	2.33	4.04	1.73	0
HOOSICK 31451	1,747	26	3,459	6,765	1.98	3.87	1.96	2

Regional Goals:  
CAIDI Min. 2.025  
SAIFI Min. 1.024

b. NATIONAL GRID WORST PERFORMING CIRCUITS WITH 3 YEAR HISTORY FOR CAIDI AND SAIFI INDICES

CAPITAL REGION

FEEDER #	2018 CAIDI	2017 CAIDI	2016 CAIDI	2015 CAIDI	2018 SAIFI	2017 SAIFI	2016 SAIFI	2015 SAIFI
GREENBUSH 07852	3.27	2.41	1.47	8.89	7.85	0.29	1.51	0.77
BLUE STORES 30353	1.32	2.51	1.70	5.84	5.76	2.12	0.62	0.31
VOORHEESVILLE 17851	4.18	2.25	1.11	2.00	8.09	0.97	1.76	4.04
SWAGGERTOWN 36453	3.72	2.26	2.32	2.11	7.62	2.65	1.94	1.08
GROOMS ROAD 34552	1.97	2.67	3.07	2.21	5.69	2.25	0.76	1.37
MENANDS 10156	2.72	3.63	2.28	3.90	7.47	1.10	0.48	0.20
PINEBUSH 37153	2.46	2.74	3.52	2.68	5.63	0.51	1.40	0.41
BLUE STORES 30351	5.51	3.32	3.70	3.18	7.58	1.09	1.93	0.72
VALKIN 42752	1.36	1.29	2.13	0.92	3.47	1.34	0.27	2.57
GROOMS ROAD 34556	2.26	1.46	3.94	1.71	5.54	0.77	0.08	1.31
ELNORA 44258	2.44	2.18	3.14	1.25	5.20	1.09	0.54	1.81
TRINITY PLACE 16452	3.08	2.23	1.57	2.24	7.80	0.08	2.83	1.10
BOYNTONVILLE 33351	2.66	1.63	1.55	2.92	4.61	2.36	2.26	1.81
VOORHEESVILLE 17853	2.89	1.41	3.79	1.88	5.34	3.87	0.16	0.22
SWAGGERTOWN 36452	5.48	1.88	2.37	2.29	7.06	3.86	0.81	0.65
SWAGGERTOWN 36451	2.46	1.00	3.45	2.67	5.62	1.24	0.68	0.68
GROOMS ROAD 34557	1.09	1.16	3.24	2.29	4.09	3.05	0.62	3.14
BRUNSWICK 26452	1.35	1.36	3.69	3.12	3.15	3.39	0.29	0.70
BLUE STORES 30352	1.73	0.84	5.97	2.35	4.04	1.37	1.49	0.37
HOOSICK 31451	1.96	1.53	1.05	2.33	3.87	1.42	2.96	1.88

Regional Goals:  
CAIDI Min. 2.025  
SAIFI Min. 1.024

c. NATIONAL GRID WORST PERFORMING CIRCUITS BY # OF MOMENTARY INTERRUPTIONS

CAPITAL REGION

Feeders			Customer Momentaries				Ranks		
Volts (kV)	Station Name	Ckt/F No.	Substation	Transmission	Distribution	Total	Within Region	Within System	Reliability Ranking
No circuits experienced 10 or more momentary interruptions in 2018.									

d. WORST PERFORMING CIRCUIT ANALYSIS

This year, the Capital Region's list of Worst Feeders consists of twenty 13.2kV feeders.

For the Capital Region the PSC minimum CAIDI is 2.025 and PSC minimum SAIFI is 1.024.

## 1. GREENBUSH 07852 - 13.2kV

Profile: 2,325 Customers, 71.824 Circuit Miles  
 Indices: CAIDI = 3.27, SAIFI = 2.40

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	3	12.00%	49	0.88%	230	1.26%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	13	52.00%	5,339	95.58%	17,609	96.48%
6	ACCIDENTS	6	24.00%	146	2.61%	251	1.37%
7	PREARRANGED	1	4.00%	5	0.09%	9	0.05%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	2	8.00%	47	0.84%	152	0.84%
Totals		25	100.00%	5,586	100.00%	18,250	100.00%

### **Problem Analysis:**

- There were 25 interruptions on the Greenbush 07852 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This Substation interruption occurred on June 09, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 42% of the total customers interrupted (2,326 of 5,586), and 27% of the total customer-hours interrupted (4,962 of 18,250). R540 tried clearing a fault out on the circuit and faulted itself to ground. This caused the 13.2kV 98 bus to clear. The R540 was racked out to inspect the cubicle. Upon successful inspection, the bus was re-energized. The initial operation of the breaker was likely due to the cable that was previously damaged by a fence post that was installed by a customer in the National Grid right of way. This caused the ground fault which destroyed the cable in the second sustained breaker operation.
- The remaining 24 events occurred at the distribution level.
- The distribution circuit breaker for the Greenbush 07852 experienced 0 momentary operations in 2018.
- The circuit breaker for the Greenbush 07852 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 41% of the total amount of customers interrupted (2,303 out of 5,586) and 54% of the total amount of the customer-hours interrupted (9,788 out of 18,250).
  - This sustained breaker interruption occurred on July 02, 2018, coded as a cause of insulation failure - cable (PSC cause code 05). This lockout accounted for 41% of

the total customers interrupted (2,303 of 5,586), and 54% of the total customer-hours interrupted (9,788 of 18,250). The cause of this interruption was a customer planting a fence post into the direct buried getaway cable damaging the cable. Another fence post was then planted directly next to the cable but the customer could not penetrate the underground cables outer jacket. The fence was located over this section of getaway and the damage was obviously from the customer work. The cable then faulted after water got to the conductor on the damaged cable.

- Equipment Failures were the leading cause of interruptions on the Greenbush 07852 in 2018, accounting for 52% of total interruptions (13 of 25). Accidents were the 2nd leading cause of interruptions, accounting for 24% of total interruptions (6 of 25). Trees were the 3rd leading cause of interruptions, accounting for 12% of total interruptions (3 of 25).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Greenbush 07852 in 2018, accounting for 96% of total customers interrupted (5,339 of 5,586). Accidents were the 2nd leading cause of customers interrupted, accounting for 3% of total customers interrupted (146 of 5,586). Trees were the 3rd leading cause of customers interrupted, accounting for 1% of total customers interrupted (49 of 5,586).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Greenbush 07852 in 2018, accounting for 96% of total customer-hours interrupted (17,609 of 18,250). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (251 of 18,250). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (230 of 18,250).
- Of the 25 interruptions on this circuit, 14 affected 17 customers or less, with 6 being single customer outages.

**Action Taken:**

- The customer's fence was removed from National Grid's right of way (ROW) and discussions with the customer took place to not locate a fence or other structures in the existing ROW easements per the existing easement agreements.
- There are three 3-phase reclosers on the Greenbush 07852 installed to minimize customers interrupted and customer-hours interrupted on the Greenbush 07852.
- Tree trimming of the Greenbush 07852 feeder was completed in FY2016.
- A maintenance foot patrol (I&M inspection) was performed on the Greenbush 07852 in 2016.

**Action Plan:**

- Monitor results of vegetation work from FY2016 on the Greenbush 07852 in 2019.
- Complete all level 3 maintenance work that was identified by the 2016 I&M inspection (foot patrol) on the Greenbush 07852 by October 2019.



## 2. BLUE STORES 30353 – 13.2kV

Profile: 1,399 Customers, 111.1 Circuit Miles  
Indices: CAIDI = 1.32, SAIFI = 4.37

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	11	39.29%	3,029	49.53%	4,079	50.61%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	21.43%	184	3.01%	423	5.25%
6	ACCIDENTS	4	14.29%	2,808	45.91%	3,328	41.30%
7	PREARRANGED	1	3.57%	3	0.05%	11	0.14%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	3.57%	14	0.23%	25	0.31%
10	UNKNOWN	5	17.86%	78	1.28%	192	2.38%
Totals		28	100.00%	6,116	100.00%	8,059	100.00%

### Problem Analysis:

- There were 28 interruptions on the Blue Stores 30353 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 28 events occurred at the distribution level.
- The distribution circuit breaker for the Blue Stores 30353 experienced 7 momentary operations in 2018.
- The circuit breaker for the Blue Stores 30353 experienced 4 sustained operations (lockouts) in 2018. These interruptions accounted for 91% of the total amount of customers interrupted (5,588 out of 6,116) and 76% of the total amount of the customer-hours interrupted (6,111 out of 8,059).
  - The first lockout occurred on April 03, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 23% of the total customers interrupted (1,402 of 6,116), and 30% of the total customer-hours interrupted (2,402 of 8,059). A vehicle hit pole 235 Route 9, resulting in a broken pole. Crews opened switches at pole 231 Route 9 to isolate the area and close back in the R530 breaker.
  - The second lockout occurred on July 06, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 23% of the total customers interrupted (1,402 of 6,116), and 11% of the total customer-hours interrupted (911 of 8,059). A vehicle hit pole 365 Route 9, resulting in a broken pole and downed wire.
  - The third lockout occurred on September 06, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 23% of the total customers interrupted (1,386 of 6,116), and 31% of the total customer-hours interrupted (2,472 of 8,059). A tree fell and broke the pole top and crossarm on pole 368 Route 9.

- The fourth lockout occurred on September 06, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 23% of the total customers interrupted (1,398 of 6,116), and 4% of the total customer-hours interrupted (326 of 8,059). A tree fell and took down the primary outside the substation. Switching was performed in order to limit the outage exposure to all customers.
- Trees were the leading cause of interruptions on the Blue Stores 30353 in 2018, accounting for 39% of total interruptions (11 of 28). Equipment Failures were the 2nd leading cause of interruptions, accounting for 21% of total interruptions (6 of 28). Unknown were the 3rd leading cause of interruptions, accounting for 18% of total interruptions (5 of 28).
- Trees were the leading cause of customers interrupted (CI) on the Blue Stores 30353 in 2018, accounting for 50% of total customers interrupted (3,029 of 6,116). Accidents were the 2nd leading cause of customers interrupted, accounting for 46% of total customers interrupted (2,808 of 6,116). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 3% of total customers interrupted (184 of 6,116).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Blue Stores 30353 in 2018, accounting for 51% of total customer-hours interrupted (4,079 of 8,059). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 41% of total customer-hours interrupted (3,328 of 8,059). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 5% of total customer-hours interrupted (423 of 8,059).
- Of the 28 interruptions on this circuit, 11 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- A maintenance foot patrol of the Blue Stores 30353 was completed in 2017 and all identified level 1 maintenance was completed before February 2017. All level 2 maintenance on the Blue Stores 30353 were completed by July 28<sup>th</sup> of 2018.
- There were three pole top reclosers installed on the Blue Stores 30353 in 2018.

**Action Plan:**

- Enhanced Hazard Tree Mitigation trimming/pruning for the Blue Stores 30353 is scheduled for FY19.
- The Blue Stores 30353 has Emerald Ash Bore ash tree removal scheduled for FY19 at the same time as the Enhanced Hazard Tree Mitigation work.
- Complete Level 3 maintenance on the Blue Stores 30353 by July 28<sup>th</sup> of 2020.
- An engineering review will analyze if the addition of a single phase recloser upstream of pole 6 State Highway 82, with integrated communication, will allow remote access to recloser data. This will assist in minimizing customer interruptions and customer-hour interruptions.

### 3. VOORHEESVILLE 17851 - 13.2kV

Profile: 2,052 Customers, 204.134 Circuit Miles

Indices: CAIDI = 4.18, SAIFI = 1.94

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	14	31.82%	1,695	42.65%	12,750	76.81%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	16	36.36%	358	9.01%	603	3.63%
6	ACCIDENTS	6	13.64%	1,881	47.33%	3,090	18.62%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	8	18.18%	40	1.01%	156	0.94%
Totals		44	100.00%	3,974	100.00%	16,599	100.00%

**Problem Analysis:**

- There were 44 interruptions on the Voorheesville 17851 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 44 events occurred at the distribution level.
- The distribution circuit breaker for the Voorheesville 17851 experienced 8 momentary operations in 2018.
- The circuit breaker for the Voorheesville 17851 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Voorheesville 17851 in 2018, accounting for 36% of total interruptions (16 of 44). Trees were the 2nd leading cause of interruptions, accounting for 32% of total interruptions (14 of 44). Unknown were the 3rd leading cause of interruptions, accounting for 18% of total interruptions (8 of 44).
- Accidents were the leading cause of customers interrupted (CI) on the Voorheesville 17851 in 2018, accounting for 47% of total customers interrupted (1,881 of 3,974). Trees were the 2nd leading cause of customers interrupted, accounting for 43% of total customers interrupted (1,695 of 3,974). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 9% of total customers interrupted (358 of 3,974).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Voorheesville 17851 in 2018, accounting for 77% of total customer-hours interrupted (12,750 of 16,599). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 19% of total customer-hours interrupted (3,090 of 16,599). Equipment Failures were the 3rd

leading cause of customer-hours interrupted, accounting for 4% of total customer-hours interrupted (603 of 16,599).

- Of the 44 interruptions on this circuit, 31 affected 15 customers or less, with 13 being single customer outages.

**Action Taken:**

- Enhanced Hazard Tree Mitigation (EHTM) was performed on the Voorheesville 17851 in 2017.
- Emerald Ash Borer Beetle tree removal was performed on the Voorheesville 17851 in 2017.
- There are five pole top reclosers installed on the Voorheesville 17851. The reclosers have proven to be beneficial to the reliability of the feeder since one of the mainline interruptions can be isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized Customers interrupted and customer-hour interrupted over the past year for the Voorheesville 17851.

**Action Plan:**

- Engineering will be installing multiple single phase (4.8kV and 7.62kV) trip savers via the funding project C053928 on Voorheesville 17851.
- Engineering to install side tap fusing against Funding Project C015510 for specific side taps where no fusing currently exists on Voorheesville 17851.
- Complete all level 3 maintenance work from the 2016 I&M inspection (foot patrol) on the Voorheesville 17851 by February 2019.

#### 4. SWAGGERTOWN 36453 – 13.2kV

Profile: 2,148 Customers, 100.0 Circuit Miles  
 Indices: CAIDI = 3.72, SAIFI = 2.05

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	9	39.13%	3,150	71.54%	10,276	62.77%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	4	17.39%	7	0.16%	42	0.26%
6	ACCIDENTS	4	17.39%	825	18.74%	5,247	32.05%
7	PREARRANGED	2	8.70%	15	0.34%	28	0.17%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	17.39%	406	9.22%	778	4.75%
Totals		23	100.00%	4,403	100.00%	16,371	100.00%

**Problem Analysis:**

- There were 23 interruptions on the Swaggertown 36453 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 23 events occurred at the distribution level.
- The distribution circuit breaker for the Swaggertown 36453 experienced 1 momentary operation in 2018.
- The circuit breaker for the Swaggertown 36453 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 49% of the total amount of customers interrupted (2,156 out of 4,403) and 49% of the total amount of the customer-hours interrupted (8,013 out of 16,371).
  - This lockout occurred on August 07, 2018, coded as a cause of tree fell (PSC cause code 02). Multiple tree issues in various locations resulted in the lockout of the R530 breaker. This lockout accounted for 49% of the total customers interrupted (2,156 of 4,403), and 49% of the total customer-hours interrupted (8,013 of 16,371).
- There was one interruption on the Swaggertown 36453 that involved 3-phase mainline but was not associated with the circuit breaker. It occurred on June 20, 2018 and the cause of the interruption is unknown. The recloser at pole 263 Sacandaga Road locked open. The line was patrolled by crews, but no cause was found. This interruption accounted for 8% of the total amount of customers interrupted (358 of 4,403) and 4% of the total amount of the customer-hours interrupted (704 of 16,371).

- There was one significant interruption on the Swaggertown 36453 that involved a fused branch off of the mainline. It occurred on July 12, 2018 due to a motor vehicle accident. A vehicle accident resulted in poles 52 and 53 breaking on Perth Road, resulting in the recloser at P346 Sacandaga Road to lock out. Crews were able to isolate the outage and re-energize customers. This interruption accounted for 18% of the total amount of customers interrupted (795 of 4,403) and 31% of the total amount of the customer-hours interrupted (5,152 of 16,371).
- Trees were the leading cause of interruptions on the Swaggertown 36453 in 2018, accounting for 39% of total interruptions (9 of 23). Equipment Failures were the 2nd leading cause of interruptions, accounting for 17% of total interruptions (4 of 23). Accidents were the 3rd leading cause of interruptions, accounting for 17% of total interruptions (4 of 23).
- Trees were the leading cause of customers interrupted (CI) on the Swaggertown 36453 in 2018, accounting for 72% of total customers interrupted (3,150 of 4,403). Accidents were the 2nd leading cause of customers interrupted, accounting for 19% of total customers interrupted (825 of 4,403). Unknown were the 3rd leading cause of customers interrupted, accounting for 9% of total customers interrupted (406 of 4,403).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Swaggertown 36453 in 2018, accounting for 63% of total customer-hours interrupted (10,276 of 16,371). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 32% of total customer-hours interrupted (5,247 of 16,371). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 5% of total customer-hours interrupted (778 of 16,371).
- Of the 23 interruptions on this circuit, 14 affected 10 customers or less, with 7 being single customer outages.

**Action Taken:**

- There are five 3-phase reclosers on the Swaggertown 36453. The reclosers have proven to be beneficial to the reliability of the feeder since one of the mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized customers interrupted and customer-hours interrupted over the past year for the Swaggertown 36453.
- Tree trimming of the Swaggertown 36453 feeder was completed in FY2016.
- A maintenance foot patrol (I&M inspection) was performed on the Swaggertown 36453 in 2018.

**Action Plan:**

- Monitor results of vegetation work from FY2016 on the Swaggertown 36453 in 2019.
- Complete all identified level 2 maintenance on the Swaggertown 36453 feeder by October 2019.
- Complete all identified level 3 maintenance on the Swaggertown 36453 feeder by October 2021.

## 5. GROOMS ROAD 34552 – 13.2kV

Profile: 1,684 Customers, 45.1 Circuit Miles

Indices: CAIDI = 1.97, SAIFI = 2.89

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	31.82%	525	10.80%	1,832	19.10%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	7	31.82%	2,617	53.83%	6,173	64.37%
6	ACCIDENTS	3	13.64%	1,696	34.88%	1,500	15.64%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	5	22.73%	24	0.49%	86	0.90%
Totals		22	100.00%	4,862	100.00%	9,590	100.00%

### **Problem Analysis:**

- There were 22 interruptions on the Grooms Road 34552 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 22 events occurred at the distribution level.
- The distribution circuit breaker for the Grooms Road 34552 experienced 2 momentary operations in 2018.
- The circuit breaker for the Grooms Road 34552 experienced 2 sustained operations (lockouts) in 2018. These interruptions accounted for 69% of the total amount of customers interrupted (3,367 out of 4,862) and 63% of the total amount of the customer-hours interrupted (6,050 out of 9,590).
  - The first lockout occurred on March 28, 2018, coded as a cause of deterioration (PSC cause code 05). A blown riser switch resulted in the lockout of the R520 breaker. This lockout accounted for 35% of the total customers interrupted (1,687 of 4,862), and 48% of the total customer-hours interrupted (4,566 of 9,590).
  - The second lockout occurred on October 31, 2018, coded as a cause of non-company activities (PSC cause code 06). The Town of Clifton Park Water Department dug up underground getaway cable for the Grooms Road 34552 feeder, resulting in the lockout of the R520 breaker. This lockout accounted for 35% of the total customers interrupted (1,680 of 4,862), and 15% of the total customer-hours interrupted (1,484 of 9,590).
- There were 3 interruptions on the Grooms Road 34552 that involved 3-phase mainline but were not associated with the circuit breaker. The isolating devices were all pole-top

reclosers. These interruptions accounted for 21% of the total amount of customers interrupted (1,013 of 4,862) and 20% of the total amount of the customer-hours interrupted (1,945 of 9,590).

- The first interruption occurred on August 7, 2018 as a result of trees falling across primary wire. The recloser at pole 18h-1 Clifton Park Center Road locked open as a result. This interruption accounted for 8% of the total amount of customers interrupted (392 of 4,862) and 13% of the total amount of the customer-hours interrupted (1,222 of 9,590).
- The second interruption occurred on August 11, 2018 as a result of device failure. Loose grounds at service transformer pad 14 on Pine Forest Lane resulted in the recloser at pole ½ Greenlea Drive to lockout. This interruption accounted for 9% of the total amount of customers interrupted (432 of 4,862) and less than 1% of the total amount of the customer-hours interrupted (36 of 9,590).
- The third interruption occurred on October 11, 2018 as a result of device failure. Crews replaced a switchgear and transformer on Clifton Commons Boulevard, opening the recloser at pole 260h-1 Vishers Ferry Road to isolate the area of concern. This interruption accounted for 4% of the total amount of customers interrupted (189 of 4,862) and 7% of the total amount of the customer-hours interrupted (687 of 9,590).
- Trees were the leading cause of interruptions on the Grooms Road 34552 in 2018, accounting for 32% of total interruptions (7 of 22). Equipment Failures were the 2nd leading cause of interruptions, accounting for 32% of total interruptions (7 of 22). Unknown were the 3rd leading cause of interruptions, accounting for 23% of total interruptions (5 of 22).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Grooms Road 34552 in 2018, accounting for 54% of total customers interrupted (2,617 of 4,862). Accidents were the 2nd leading cause of customers interrupted, accounting for 35% of total customers interrupted (1,696 of 4,862). Trees were the 3rd leading cause of customers interrupted, accounting for 11% of total customers interrupted (525 of 4,862).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Grooms Road 34552 in 2018, accounting for 64% of total customer-hours interrupted (6,173 of 9,590). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 19% of total customer-hours interrupted (1,832 of 9,590). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 16% of total customer-hours interrupted (1,500 of 9,590).
- Of the 22 interruptions on this circuit, 12 affected 10 customers or less, with 4 being single customer outages.



**Action Taken:**

- There were three pole-top reclosers installed on the Grooms Road 34552. The reclosers have proven to be beneficial to the reliability of the feeder since three of the mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized Customers interrupted and customer-hours interrupted over the past year for the Grooms Road 34552.
- The Oronacah Farm underground residential development had a history of secondary cable failures. A project was completed to replace 185 feet of secondary and conduit within the neighborhood on Bridgewater Court.
- A maintenance foot patrol (I&M inspection) was performed on the Grooms Road 34552 in 2018.
- Tree trimming of the Grooms Road 34552 feeder was completed in FY2016.

**Action Plan:**

- Replacing existing expulsion fuses at pole 24 Clifton Park Center Road with TripSavers will reduce Customers interrupted and customer-hours interrupted in the future.
- Monitor results of vegetation work from FY2016 on the Grooms Road 34552 in 2019.
- Complete all identified level 3 maintenance on the Grooms Road 34552 feeder by August 2021.

## 6. MENANDS 10156 - 13.2kV

Profile: 982 Customers, 56.934 Circuit Miles

Indices: CAIDI = 2.72, SAIFI = 2.74

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	5	23.81%	1,563	58.00%	5,597	76.32%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	14.29%	22	0.82%	70	0.95%
6	ACCIDENTS	9	42.86%	1,079	40.04%	1,349	18.39%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	2	9.52%	23	0.85%	309	4.21%
10	UNKNOWN	2	9.52%	8	0.30%	9	0.12%
Totals		21	100.00%	2,695	100.00%	7,334	100.00%

### **Problem Analysis:**

- There were 21 interruptions on the Menands 10156 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This Substation interruption occurred on May 16, 2018, coded as a cause of animal (PSC cause code 06). This lockout accounted for 36% of the total customers interrupted (970 of 2,695), and 16% of the total customer-hours interrupted (1,148 of 7,334). The station breaker for 10156 operated when a squirrel crossed the live bus of the R5 tie breaker. This caused the bus to operate all breakers including the R56 breaker to de-energize the bus.
- The remaining 20 events occurred at the distribution level.
- The distribution circuit breaker for the Menands 10156 experienced 3 momentary operations in 2018.
- The circuit breaker for the Menands 10156 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 36% of the total amount of customers interrupted (978 out of 2,695) and 55% of the total amount of the customer-hours interrupted (4,033 out of 7,334).
  - This lockout occurred on July 24, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 36% of the total customers interrupted (978 of 2,695), and 55% of the total customer-hours interrupted (4,033 of 7,334). Due to the extremely wet summer, a large tree fell into the 34.5kV Menands-Central Ave #8 line at Sub-Transmission pole 21, dragging down eight poles between transmission poles 20 thru 27. Fuses on pole #24, nested internal to the larger

outage, operated and needed to be replaced when they were discovered to have operated only upon energization of the line. National Grid overhead crews isolated and operated feeder ties to limit the size of this outage from both the station side and with feeder tie with Everett Road 42054. This section of Sub-Transmission and distribution is built through an area that with heavy rainfall becomes a swamp with common reeds over 10' high, clouds of mosquitoes and hip-deep swamp water. This forestry work and restoration work was heroic.

- Accidents were the leading cause of interruptions on the Menands 10156 in 2018, accounting for 43% of total interruptions (9 of 21). Trees were the 2nd leading cause of interruptions, accounting for 24% of total interruptions (5 of 21). Equipment Failures were the 3rd leading cause of interruptions, accounting for 14% of total interruptions (3 of 21).
- Trees were the leading cause of customers interrupted (CI) on the Menands 10156 in 2018, accounting for 58% of total customers interrupted (1,563 of 2,695). Accidents were the 2nd leading cause of customers interrupted, accounting for 40% of total customers interrupted (1,079 of 2,695). Lightning were the 3rd leading cause of customers interrupted, accounting for 1% of total customers interrupted (23 of 2,695).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Menands 10156 in 2018, accounting for 76% of total customer-hours interrupted (5,597 of 7,334). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 18% of total customer-hours interrupted (1,349 of 7,334). Lightning were the 3rd leading cause of customer-hours interrupted, accounting for 4% of total customer-hours interrupted (309 of 7,334).
- Of the 21 interruptions on this circuit, 15 affected 11 customers or less, with 0 outages being single customer outages.

**Action Taken:**

- Enhanced Tree Mitigation was performed on the Menands 10156 in 2018.
- Emerald Ash Bore tree removal was performed on the Menands 10156 in 2018.

**Action Plan:**

- The I&M inspection (foot patrol) is scheduled for the Menands 10156 in FY20.
- Complete all level 1 maintenance work from the 2020 I&M inspection (foot patrol) on the Menands 10156 scheduled for 2020 immediately.
- Complete all level 2 maintenance work to be completed by FY20.

**7. PINEBUSH 37153 – 13.2kV**

*Profile: 1,653 Customers, 41.628 Circuit Miles  
Indices: CAIDI = 2.46, SAIFI = 2.29*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	8	32.00%	1,819	47.98%	1,734	18.62%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	13	52.00%	1,853	48.88%	7,443	79.90%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	16.00%	119	3.14%	138	1.48%
Totals		25	100.00%	3,791	100.00%	9,314	100.00%

**Problem Analysis:**

- There were 25 interruptions on the Pinebush 37153 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 25 events occurred at the distribution level.
- The distribution circuit breaker for the Pinebush 37153 experienced 4 momentary operations in 2018.
- The distribution circuit breaker for the Pinebush 37153 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Pinebush 37153 in 2018, accounting for 52% of total interruptions (13 of 25). Trees were the 2nd leading cause of interruptions, accounting for 32% of total interruptions (8 of 25). Unknown were the 3rd leading cause of interruptions, accounting for 16% of total interruptions (4 of 25).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Pinebush 37153 in 2018, accounting for 49% of total customers interrupted (1,853 of 3,791). Trees were the 2nd leading cause of customers interrupted, accounting for 48% of total customers interrupted (1,819 of 3,791). Unknown were the 3rd leading cause of customers interrupted, accounting for 3% of total customers interrupted (119 of 3,791).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Pinebush 37153 in 2018, accounting for 80% of total customer-hours interrupted (7,443 of 9,314). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 19% of total customer-hours interrupted (1,734 of 9,314). Unknown were the 3rd leading

cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (138 of 9,314).

- Of the 25 interruptions on this circuit, 5 affected 10 customers or less, with 3 being single customer outages.

**Action Taken:**

- A maintenance foot patrol of the Pinebush 37153 was completed in 2016 and all identified Level 1 maintenance was completed before February 2016 and all Level 2 maintenance on the Pinebush 37153 was completed before January 27<sup>th</sup> of 2017 and all Level 3 maintenance was completed before January 27<sup>th</sup> of 2019.
- There are two pole top reclosers installed on the Pinebush 37153. The reclosers have proven to be beneficial to the reliability of the feeder since one of the mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized CI and CHI over the past year for the Pinebush 37153.

**Action Plan:**

- Tree Enhanced Hazard Tree Mitigation trimming/pruning for the Pinebush 37153 is scheduled for FY19.
- The Pinebush 37153 has Emerald Ash Bore ash tree removal scheduled for FY19 at the same time as the Enhanced Hazard Tree Mitigation work.
- Engineering install will be installing multiple single phase (4.8kV and 7.62kV) trip savers via the CMR funding project C053928 on Pinebush 37153.

## 8. BLUE STORES 30351 – 13.2kV

Profile: 2,147 Customers, 111.6 Circuit Miles

Indices: CAIDI = 5.51, SAIFI = 1.38

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	17	36.17%	476	16.11%	2,499	15.36%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	14	29.79%	1,784	60.37%	10,969	67.42%
6	ACCIDENTS	2	4.26%	378	12.79%	1,360	8.36%
7	PREARRANGED	2	4.26%	61	2.06%	125	0.77%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	6	12.77%	115	3.89%	818	5.03%
10	UNKNOWN	6	12.77%	141	4.77%	498	3.06%
Totals		47	100.00%	2,955	100.00%	16,269	100.00%

### **Problem Analysis:**

- There were 47 interruptions on the Blue Stores 30351 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 47 events occurred at the distribution level.
- The distribution circuit breaker for the Blue Stores 30351 experienced 1 momentary operation in 2018.
- The distribution circuit breaker for the Blue Stores 30351 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Blue Stores 30351 in 2018, accounting for 36% of total interruptions (17 of 47). Equipment Failures were the 2nd leading cause of interruptions, accounting for 30% of total interruptions (14 of 47). Lightning were the 3rd leading cause of interruptions, accounting for 13% of total interruptions (6 of 47).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Blue Stores 30351 in 2018, accounting for 60% of total customers interrupted (1,784 of 2,955). Trees were the 2nd leading cause of customers interrupted, accounting for 16% of total customers interrupted (476 of 2,955). Accidents were the 3rd leading cause of customers interrupted, accounting for 13% of total customers interrupted (378 of 2,955).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Blue Stores 30351 in 2018, accounting for 67% of total customer-hours interrupted (10,969 of 16,269). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 15% of total customer-hours interrupted (2,499 of 16,269). Accidents were the 3rd

leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (1,360 of 16,269).

- Of the 47 interruptions on this circuit, 22 affected 10 customers or less, with 11 being single customer outages.

**Action Taken:**

- There are four pole top reclosers installed on the Blue Stores 30351. These reclosers have proven to be beneficial to the reliability of this feeder since one of the mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These reclosers minimized CI and CHI over the past year on the Blue Stores 30351.
- A maintenance foot patrol of the Blue Stores 30351 was completed in 2018 and all identified level 1 and 2 maintenance has been completed.
- Enhanced Hazard Tree Mitigation (EHTM) on the Blue Stores 30351 was completed in FY17.
- Emerald Ash Bore (EAB) ash tree removal on the Blue Stores 30351 was completed in FY17.

**Action Plan:**

- Complete all identified level 3 maintenance issues by August 11th 2020 for the maintenance foot patrol completed in 2018 for Blue Stores 30351.

## 9. VALKIN 42752 – 13.2kV

Profile: 2,414 Customers, 73.4 Circuit Miles

Indices: CAIDI = 1.36, SAIFI = 2.54

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	8	20.51%	444	7.24%	1,121	13.39%
3	OVERLOADS	2	5.13%	18	0.29%	23	0.27%
4	OPER. ERROR	1	2.56%	593	9.67%	217	2.60%
5	EQUIPMENT	15	38.46%	2,492	40.62%	2,770	33.08%
6	ACCIDENTS	8	20.51%	2,570	41.89%	4,210	50.28%
7	PREARRANGED	1	2.56%	7	0.11%	2	0.02%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	2.56%	1	0.02%	3	0.04%
10	UNKNOWN	3	7.69%	10	0.16%	26	0.32%
Totals		39	100.00%	6,135	100.00%	8,372	100.00%

### **Problem Analysis:**

- There were 39 interruptions on the Valkin 42752 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 39 events occurred at the distribution level.
- The distribution circuit breaker for the Valkin 42752 experienced 2 momentary operations in 2018.
- The circuit breaker for the Valkin 42752 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 39% of the total amount of customers interrupted (2,414 out of 6,135) and 49% of the total amount of the customer-hours interrupted (4,064 out of 8,372).
  - This lockout occurred on May 19, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 39% of the total customers interrupted (2,414 of 6,135), and 49% of the total customer-hours interrupted (4,064 of 8,372). A vehicle hit a pole on Route 9H, resulting in a broken pole.
- Equipment Failures were the leading cause of interruptions on the Valkin 42752 in 2018, accounting for 38% of total interruptions (15 of 39). Trees were the 2nd leading cause of interruptions, accounting for 21% of total interruptions (8 of 39). Accidents were the 3rd leading cause of interruptions, accounting for 21% of total interruptions (8 of 39).
- Accidents were the leading cause of customers interrupted (CI) on the Valkin 42752 in 2018, accounting for 42% of total customers interrupted (2,570 of 6,135). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 41% of total



- customers interrupted (2,492 of 6,135). Operator Errors were the 3rd leading cause of customers interrupted, accounting for 10% of total customers interrupted (593 of 6,135).
- Accidents were the leading cause of customer-hours interrupted (CHI) on the Valkin 42752 in 2018, accounting for 50% of total customer-hours interrupted (4,210 of 8,372). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 33% of total customer-hours interrupted (2,770 of 8,372). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 13% of total customer-hours interrupted (1,121 of 8,372).
  - Of the 39 interruptions on this circuit, 25 affected 10 customers or less, with 12 being single customer outages.

**Action Taken:**

- There are two 3-phase reclosers on the Valkin 42752. The reclosers have proven to be beneficial to the reliability of the feeder since one of the mainline interruptions was isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized customers interrupted and customer-hours interrupted over the past year for the Valkin 42752.
- The Valkin 42752 has Emerald Ash Borer ash tree removal scheduled for FY18.

**Action Plan:**

- Tree Enhanced Hazard Tree Mitigation trimming/pruning for the Valkin 42752 is scheduled for FY20.

## 10. GROOMS ROAD 34556 – 13.2kV

Profile: 1,831 Customers, 47.6 Circuit Miles  
 Indices: CAIDI = 2.26, SAIFI = 2.46

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	6	33.33%	1,199	26.66%	2,689	26.50%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	4	22.22%	1,536	34.16%	4,296	42.33%
6	ACCIDENTS	3	16.67%	1,552	34.51%	2,517	24.80%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	5.56%	81	1.80%	419	4.12%
10	UNKNOWN	4	22.22%	129	2.87%	228	2.25%
Totals		18	100.00%	4,497	100.00%	10,149	100.00%

### Problem Analysis:

- There were 18 interruptions on the Grooms Road 34556 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 18 events occurred at the distribution level.
- The distribution circuit breaker for the Grooms Road 34556 experienced 0 momentary operations in 2018.
- The circuit breaker for the Grooms Road 34556 experienced 0 sustained operations (lockouts) in 2018.
- There were three interruptions on the Grooms Road 34556 that involved 3-phase mainline but were not associated with the circuit breaker. The isolating devices were pole-top reclosers, and solid blades. These interruptions accounted for 94% of the total amount of customers interrupted (4,216 of 4,497) and 88% of the total amount of the customer-hours interrupted (8,954 of 10,149).
  - The first interruption occurred on July 30, 2018 as a result of trees falling across primary wire. The recloser at pole 78 Clifton Park Road locked open as a result. This interruption accounted for 25% of the total amount of customers interrupted (1,145 of 4,497) and 22% of the total amount of the customer-hours interrupted (2,214 of 10,149).
  - The second interruption occurred on November 13, 2018 as a result of device failure. Primary wire burned open between poles one and two on Miller Road. Crews opened switches at pole 24 Miller Road to isolate and make repairs. This interruption accounted for 34% of the total amount of customers interrupted (1,529

- of 4,497) and 42% of the total amount of the customer-hours interrupted (4,242 of 10,149).
  - The third interruption occurred on November 28, 2018 as a result of motor vehicle accident. A motor vehicle hit pole 8 at Miller Road. Crews opened switches at pole 24 Miller Road to isolate and make repairs. This interruption accounted for 34% of the total amount of customers interrupted (1,542 of 4,497) and 25% of the total amount of the customer-hours interrupted (2,498 of 10,149).
- Trees were the leading cause of interruptions on the Grooms Road 34556 in 2018, accounting for 33% of total interruptions (6 of 18). Equipment Failures were the 2nd leading cause of interruptions, accounting for 22% of total interruptions (4 of 18). Unknown were the 3rd leading cause of interruptions, accounting for 22% of total interruptions (4 of 18).
- Accidents were the leading cause of customers interrupted (CI) on the Grooms Road 34556 in 2018, accounting for 35% of total customers interrupted (1,552 of 4,497). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 34% of total customers interrupted (1,536 of 4,497). Trees were the 3rd leading cause of customers interrupted, accounting for 27% of total customers interrupted (1,199 of 4,497).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Grooms Road 34556 in 2018, accounting for 42% of total customer-hours interrupted (4,296 of 10,149). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 26% of total customer-hours interrupted (2,689 of 10,149). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 25% of total customer-hours interrupted (2,517 of 10,149).
- Of the 18 interruptions on this circuit, 11 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- Tree trimming of the Grooms Road 34556 feeder was completed in FY2016.
- A maintenance foot patrol (I&M inspection) was performed on the Grooms Road 34556 in 2018.

**Action Plan:**

- Reconfiguration of the feeder so that a portion of it is served from the Swaggertown 36451, reducing the CI for mainline outages.
- Monitor results of vegetation work from FY2016 on the Grooms Road 34556 in 2019.
- Complete all identified level 2 maintenance on the Grooms Road 34556 by September 2019.
- Complete all identified level 3 maintenance on the Grooms Road 34556 feeder by August 2021.

## 11. ELNORA 44258 – 13.2kV

Profile: 1,768 Customers, 39.4 Circuit Miles

Indices: CAIDI = 2.44, SAIFI = 2.13

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	2	9.09%	1,753	46.46%	3,813	41.46%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	22.73%	1,611	42.70%	4,264	46.36%
6	ACCIDENTS	1	4.55%	1	0.03%	7	0.08%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	14	63.64%	408	10.81%	1,113	12.10%
Totals		22	100.00%	3,773	100.00%	9,197	100.00%

### Problem Analysis:

- There were 22 interruptions on the Elnora 44258 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 22 events occurred at the distribution level.
- The distribution circuit breaker for the Elnora 44258 experienced 3 momentary operations in 2018.
- The circuit breaker for the Elnora 44258 experienced 0 sustained operations (lockouts) in 2018.
- There were three interruptions on the Grooms Road 34556 that involved 3-phase mainline but were not associated with the circuit breaker. The isolating devices were pole-top reclosers, and solid blades. These interruptions accounted for 81% of the total amount of customers interrupted (3,049 of 3,773) and 63% of the total amount of the customer-hours interrupted (5,783 of 9,197).
  - The first interruption occurred on September 5, 2018 as a result of trees falling across primary wire at pole 86 Tanner Road. Crews opened switches at pole 84, on Tanner Road, to isolate and make repairs. This interruption accounted for 46% of the total amount of customers interrupted (1,742 of 3,773) and 41% of the total amount of the customer-hours interrupted (3,767 of 9,197).
  - The second interruption occurred on October 6, 2018 as a result of device failure. The recloser at pole 2 Plank Road failed, isolating customers downstream. Crews were able to bypass and re-energize customers. This interruption accounted for 17%

- of the total amount of customers interrupted (656 of 3,773) and 12% of the total amount of the customer-hours interrupted (1,061 of 9,197).
- The third interruption occurred on November 12, 2018 as a result of device failure. The cable at recloser at pole 2 Plank Road failed due to water intrusion, isolating customers downstream. This interruption accounted for 17% of the total amount of customers interrupted (651 of 3,773) and 10% of the total amount of the customer-hours interrupted (955 of 9,197).
- Unknown were the leading cause of interruptions on the Elnora 44258 in 2018, accounting for 64% of total interruptions (14 of 22). Equipment Failures were the 2nd leading cause of interruptions, accounting for 23% of total interruptions (5 of 22). Trees were the 3rd leading cause of interruptions, accounting for 9% of total interruptions (2 of 22).
- Trees were the leading cause of customers interrupted (CI) on the Elnora 44258 in 2018, accounting for 46% of total customers interrupted (1,753 of 3,773). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 43% of total customers interrupted (1,611 of 3,773). Unknown were the 3rd leading cause of customers interrupted, accounting for 11% of total customers interrupted (408 of 3,773).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Elnora 44258 in 2018, accounting for 46% of total customer-hours interrupted (4,264 of 9,197). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 41% of total customer-hours interrupted (3,813 of 9,197). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 12% of total customer-hours interrupted (1,113 of 9,197).
- Of the 22 interruptions on this circuit, 11 affected 10 customers or less, with 7 being single customer outages.

**Action Taken:**

- There are four 3-phase reclosers on the Elnora 44258. The reclosers have proven to be beneficial to the reliability of the feeder since two of the mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized CI and CHI over the past year for the Elnora 44258.
- Recloser at Pole 2 Plank Road were replaced, and its settings were revised in October 2018.
- Tree trimming of the Elnora 44258 feeder was completed in 2018.
- Elnora 44258 completed an enhanced Emerald Ash Bore tree mitigation project along with the Enhanced Hazard Tree Maintenance in 2018.
- A maintenance foot patrol (I&M inspection) of the Elnora 44258 was completed in 2014, and all identified level 1, 2 and 3 maintenance has been completed.

**Action Plan:**

- A project is scheduled for FY2020 to construct approximately 3,300 feet of new 13.2kV three phase distribution on existing telephone set poles along Route 146 (Clifton Park Road), this will allow us to remove 3,700 feet of three-phase rear lot mainline, improving the reliability of the feeder.
- Reconfiguration of the feeder so that a portion of it is served from the Swaggertown 36451, reducing the CI for mainline outages.
- Monitor results of vegetation work from FY2016 on the Grooms Road 34556 in 2019.
- Complete all identified level 2 maintenance on the Grooms Road 34556 by September 2020.

**12. TRINITY PLACE 16452 – 13.2kV**

*Profile: 1,539 Customers, 9.196 Circuit Miles*  
*Indices: CAIDI = 3.08, SAIFI = 2.53*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	1	7.14%	14	0.36%	92	0.77%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	11	78.57%	3,541	90.82%	11,013	91.77%
6	ACCIDENTS	1	7.14%	280	7.18%	719	5.99%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	1	7.14%	64	1.64%	177	1.48%
Totals		14	100.00%	3,899	100.00%	12,001	100.00%

**Problem Analysis:**

- There were 14 interruptions on the Trinity Place 16452 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 14 events occurred at the distribution level.
- The distribution circuit breaker for the Trinity Place 16452 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the Trinity Place 16452 experienced 2 sustained operations (lockouts) in 2018. These interruptions accounted for 78% of the total amount of customers interrupted (3,048 out of 3,899) and 82% of the total amount of the customer-hours interrupted (9,856 out of 12,001).
  - The first lockout occurred on August 18, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 39% of the total customers interrupted (1,524 of 3,899), and 69% of the total customer-hours interrupted (8,307 of 12,001). Switchgear 7511 flashed over upon failure of components internal to the switchgear.
  - The second lockout occurred on September 19, 2018, coded as a cause of insulation failure - cable (PSC cause code 05). This lockout accounted for 39% of the total customers interrupted (1,524 of 3,899), and 13% of the total customer-hours interrupted (1,549 of 12,001). The Trinity 16452 was temporarily tied to 16457 for routine station breaker diagnostic testing when cable fault on the 16457 occurred removing the feeder. This underground cable failure was not due to loading.

- Equipment Failures were the leading cause of interruptions on the Trinity Place 16452 in 2018, accounting for 79% of total interruptions (11 of 14). Trees were the 2nd leading cause of interruptions, accounting for 7% of total interruptions (1 of 14). Accidents were the 3rd leading cause of interruptions, accounting for 7% of total interruptions (1 of 14).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Trinity Place 16452 in 2018, accounting for 91% of total customers interrupted (3,541 of 3,899). Accidents were the 2nd leading cause of customers interrupted, accounting for 7% of total customers interrupted (280 of 3,899). Unknown were the 3rd leading cause of customers interrupted, accounting for 2% of total customers interrupted (64 of 3,899).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Trinity Place 16452 in 2018, accounting for 92% of total customer-hours interrupted (11,013 of 12,001). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 6% of total customer-hours interrupted (719 of 12,001). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (177 of 12,001).
- Of the 14 interruptions on this circuit, 4 affected 10 customers or less, with 2 being single customer outages.

**Action Taken:**

- A maintenance foot patrol (I&M inspection) of the Trinity 16452 was completed in September of 2017, and all identified level 1 and 2 maintenance requirements has been completed.
- Integrated Vegetation Management (Pruning cycle) was completed in FY18 on the Trinity 16452 distribution corridors.

**Action Plan:**

- A maintenance foot patrol (I&M inspection) of the Trinity 16452 was completed in 2017. Complete Level 3 maintenance on the Trinity 16452 by September 13<sup>th</sup> of 2020.
- WR 27903418 has been entered to transfer a portion of Trinity 16452 onto neighboring feeder 16454 which will assist reliability on the Trinity 16452.

### 13. BOYNTONVILLE 33351 – 13.2kV

Profile: 1,992 Customers, 136.8 Circuit Miles

Indices: CAIDI = 2.66, SAIFI = 1.73

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	21	31.82%	2,863	82.89%	7,678	83.69%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	18	27.27%	89	2.58%	501	5.46%
6	ACCIDENTS	9	13.64%	90	2.61%	134	1.46%
7	PREARRANGED	1	1.52%	58	1.68%	56	0.61%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	17	25.76%	354	10.25%	804	8.77%
Totals		66	100.00%	3,454	100.00%	9,174	100.00%

**Problem Analysis:**

- There were 66 interruptions on the Boyntonville 33351 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 66 events occurred at the distribution level.
- The distribution circuit breaker for the Boyntonville 33351 experienced 0 momentary operations in 2018.
- The circuit breaker for the Boyntonville 33351 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Boyntonville 33351 in 2018, accounting for 32% of total interruptions (21 of 66). Equipment Failures were the 2nd leading cause of interruptions, accounting for 27% of total interruptions (18 of 66). Unknown were the 3rd leading cause of interruptions, accounting for 26% of total interruptions (17 of 66).
- Trees were the leading cause of customers interrupted (CI) on the Boyntonville 33351 in 2018, accounting for 83% of total customers interrupted (2,863 of 3,454). Unknown were the 2nd leading cause of customers interrupted, accounting for 10% of total customers interrupted (354 of 3,454). Accidents were the 3rd leading cause of customers interrupted, accounting for 3% of total customers interrupted (90 of 3,454).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Boyntonville 33351 in 2018, accounting for 84% of total customer-hours interrupted (7,678 of 9,174). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 9% of total customer-hours interrupted (804 of 9,174). Equipment Failures were the 3rd leading



cause of customer-hours interrupted, accounting for 5% of total customer-hours interrupted (501 of 9,174).

- Of the 66 interruptions on this circuit, 41 affected 10 customers or less, with 16 being single customer outages.

**Action Taken:**

- There are six pole top reclosers installed on the Boyntonville 33351. These reclosers have proven to be beneficial to the reliability of this feeder since two of the mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These reclosers minimized CI and CHI over the past year on the Boyntonville 33351.
- All Level 1 and 2 work on the Boyntonville 33351 that is associated with the I&M inspection (foot patrol) that was performed in 2016 was completed prior to July 2017.
- Enhanced Hazard Tree Maintenance was completed on the Boyntonville in FY16.

**Action Plan:**

- Complete Level 3 maintenance on the Boyntonville 33351 by end of 2019.
- Enhanced Hazard Tree Maintenance is scheduled to be completed in FY20 on the Boyntonville 33351.
- Engineering to review if the installation of recloser loop scheme will assist in minimizing CI and CHI and install if it does assist.
- Engineering to review if the addition of single phase trip savers will assist in minimizing CI and CHI and install if it does assist.

## 14. VOORHEESVILLE 17853 - 13.2kV

Profile: 1,906 Customers, 105.494 Circuit Miles

Indices: CAIDI = 2.89, SAIFI = 1.85

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	9	36.00%	2,925	83.10%	4,135	40.66%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	12	48.00%	355	10.09%	3,623	35.63%
6	ACCIDENTS	2	8.00%	217	6.16%	2,370	23.31%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	4.00%	3	0.09%	13	0.13%
10	UNKNOWN	1	4.00%	20	0.57%	27	0.27%
Totals		25	100.00%	3,520	100.00%	10,169	100.00%

### Problem Analysis:

- There were 25 interruptions on the Voorheesville 17853 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 25 events occurred at the distribution level.
- The distribution circuit breaker for the Voorheesville 17853 experienced 6 momentary operations in 2018.
- The circuit breaker for the Voorheesville 17853 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 55% of the total amount of customers interrupted (1,920 out of 3,520) and 21% of the total amount of the customer-hours interrupted (2,180 out of 10,142).
  - This lockout occurred on October 17, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 55% of the total customers interrupted (1,920 of 3,520), and 21% of the total customer-hours interrupted (2,180 of 10,169). This lockout occurred when a large tree fell into pole 7 on North Main St., dragging the primary to the ground.
- Equipment Failures were the leading cause of interruptions on the Voorheesville 17853 in 2018, accounting for 48% of total interruptions (12 of 25). Trees were the 2nd leading cause of interruptions, accounting for 36% of total interruptions (9 of 25). Accidents were the 3rd leading cause of interruptions, accounting for 8% of total interruptions (2 of 25).
- Trees were the leading cause of customers interrupted (CI) on the Voorheesville 17853 in 2018, accounting for 83% of total customers interrupted (2,925 of 3,520). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 10% of total

customers interrupted (355 of 3,520). Accidents were the 3rd leading cause of customers interrupted, accounting for 6% of total customers interrupted (217 of 3,520).

- Trees were the leading cause of customer-hours interrupted (CHI) on the Voorheesville 17853 in 2018, accounting for 41% of total customer-hours interrupted (4,135 of 10,169). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 36% of total customer-hours interrupted (3,623 of 10,169). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 23% of total customer-hours interrupted (2,370 of 10,169).
- Of the 25 interruptions on this circuit, 10 affected 10 customers or less, with 3 being single customer outages.

**Action Taken:**

- There were three pole top reclosers installed on the Voorheesville 17853. The reclosers have proven to be beneficial to the reliability of the feeder since two of the mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized CI and CHI over the past year for the Voorheesville 17853.
- A maintenance foot patrol was performed on the Voorheesville 17853 in January 2018. All Level 1 maintenance on the Voorheesville 17853 was completed by the end of February 2018.
- There are three pole top reclosers installed on the Voorheesville 17853. The reclosers have proven to be beneficial to the reliability of the feeder since one of the mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized CI and CHI over the past year for the Voorheesville 17853.

**Action Plan:**

- The Voorheesville 17853 was tree trimmed in its entirety in 2016 and is scheduled for Enhanced Tree Maintenance tree removal cycle in 2020.
- Engineering install will be installing multiple single phase (4.8kV and 7.62kV) trip savers via the CMR funding project C053928 on Voorheesville 17853 in 2020.
- Complete Level 2 maintenance on the Voorheesville 17853 by January 19<sup>th</sup> 2019.
- Complete Level 3 maintenance on the Voorheesville 17853 by January 19<sup>th</sup> 2021.

**15. SWAGGERTOWN 36452 – 13.2kV**

*Profile: 2,411 Customers, 66.6 Circuit Miles*

*Indices: CAIDI = 5.48, SAIFI = 1.29*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	9	33.33%	2,307	74.20%	10,749	63.12%
3	OVERLOADS	2	7.41%	12	0.39%	36	0.21%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	10	37.04%	752	24.19%	6,097	35.80%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	3.70%	1	0.03%	3	0.02%
10	UNKNOWN	5	18.52%	37	1.19%	146	0.86%
Totals		27	100.00%	3,109	100.00%	17,030	100.00%

**Problem Analysis:**

- There were 27 interruptions on the Swaggertown 36452 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 27 events occurred at the distribution level.
- The distribution circuit breaker for the Swaggertown 36452 experienced 3 momentary operations in 2018.
- The circuit breaker for the Swaggertown 36452 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 70% of the total amount of customers interrupted (2,161 out of 3,109) and 60% of the total amount of the customer-hours interrupted (10,229 out of 17,030).
  - This lockout occurred on August 07, 2018, coded as a cause of tree fell (PSC cause code 02). Multiple tree issues throughout the circuit led to the lock-out of the station breaker. This lockout accounted for 70% of the total customers interrupted (2,161 of 3,109), and 60% of the total customer-hours interrupted (10,229 of 17,030).
- There was one interruption on the Swaggertown 36452 that involved 3-phase mainline but was not associated with the circuit breaker. The isolating device was a pole-top recloser. On June 18, 2018, multiple poles and primary were knocked down, resulting in recloser R24073 locking out. Crews isolated the outage within five hours, restoring 81% of the customers while work continued to rebuild damaged infrastructure. This interruption accounted for 21% of the total amount of customers interrupted (652 of 3,109) and 29% of the total amount of the customer-hours interrupted (4,888 of 17,030).

- Equipment Failures were the leading cause of interruptions on the Swaggertown 36452 in 2018, accounting for 37% of total interruptions (10 of 27). Trees were the 2nd leading cause of interruptions, accounting for 33% of total interruptions (9 of 27). Unknown were the 3rd leading cause of interruptions, accounting for 19% of total interruptions (5 of 27).
- Trees were the leading cause of customers interrupted (CI) on the Swaggertown 36452 in 2018, accounting for 74% of total customers interrupted (2,307 of 3,109). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 24% of total customers interrupted (752 of 3,109). Unknown were the 3rd leading cause of customers interrupted, accounting for 1% of total customers interrupted (37 of 3,109).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Swaggertown 36452 in 2018, accounting for 63% of total customer-hours interrupted (10,749 of 17,030). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 36% of total customer-hours interrupted (6,097 of 17,030). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (146 of 17,030).
- Of the 27 interruptions on this circuit, 17 affected 10 customers or less, with 9 being single customer outages.

**Action Taken:**

- There are five 3-phase reclosers on the Swaggertown 36452. The reclosers have proven to be beneficial to the reliability of the feeder since one of the mainline interruptions was isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized CI and CHI over the past year for the Swaggertown 36452.
- A project is currently scheduled in FY2019 to convert over three miles of existing three-phase 4.8kV (delta) to three-phase 13.2kV (wye) construction on Saratoga Road in Glenville and Burnt Hills. This conversion will also complete a 13.2kV tie between the Grooms Road 34557 and Swaggertown 36452 feeders, as well as create a much-needed feeder tie with the Shore Road 34.5/4.8kV substation.
- A maintenance foot patrol (I&M inspection) of the Swaggertown 36452 was completed in 2016.
- Tree trimming of the Swaggertown 36452 feeder was completed in FY2016.

**Action Plan:**

- Complete Level 3 maintenance on the Swaggertown 36452 by March 2019.
- Monitor results of vegetation work from FY2016 on the Swaggertown 36452 in 2019.

## 16. SWAGGERTOWN 36451 – 13.2kV

Profile: 969 Customers, 17.7 Circuit Miles

Indices: CAIDI = 2.46, SAIFI = 2.28

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	36.84%	1,523	68.91%	2,468	45.33%
3	OVERLOADS	3	15.79%	315	14.25%	1,521	27.93%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	31.58%	318	14.39%	1,357	24.93%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	3	15.79%	54	2.44%	99	1.81%
Totals		19	100.00%	2,210	100.00%	5,444	100.00%

### Problem Analysis:

- There were 19 interruptions on the Swaggertown 36451 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 19 events occurred at the distribution level.
- The distribution circuit breaker for the Swaggertown 36451 experienced 6 momentary operations in 2018.
- The circuit breaker for the Swaggertown 36451 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 44% of the total amount of customers interrupted (967 out of 2,210) and 25% of the total amount of the customer-hours interrupted (1,363 out of 5,444).
  - This lockout occurred on August 08, 2018, coded as a cause of tree fell (PSC cause code 02). Breaker R513 was opened under emergency due to wire down and burning near pole 7 Onderdonk Road. Fuses were opened at pole 2, Onderdonk Road, isolating the outage and restoring 97% of the customers while work continued at the location of the fault. This lockout accounted for 44% of the total customers interrupted (967 of 2,210), and 25% of the total customer-hours interrupted (1,363 of 5,444).
- There were two interruptions on the Swaggertown 36451 that involved 3-phase mainline but were not associated with the circuit breaker. The isolating devices were pole-top reclosers, and solid blades. These interruptions accounted for 31% of the total amount of customers interrupted (687 of 2,210) and 33% of the total amount of the customer-hours interrupted (1,816 of 5,444).

- The first interruption occurred on June 19, 2018 as a result of trees falling across primary wire. The recloser at pole 79 Sacandaga Road locked open as a result. This interruption accounted for 22% of the total amount of customers interrupted (492 of 2,210) and 15% of the total amount of the customer-hours interrupted (828 of 5,444).
- The second interruption occurred on November 26, 2018 as a result of device failure. Primary wire was down at pole 70 Spring Road. Crews opened switches at pole 77, Spring Road, to isolate and make repairs. This interruption accounted for 9% of the total amount of customers interrupted (195 of 2,210) and 18% of the total amount of the customer-hours interrupted (988 of 5,444).
- Trees were the leading cause of interruptions on the Swaggertown 36451 in 2018, accounting for 37% of total interruptions (7 of 19). Equipment Failures were the 2nd leading cause of interruptions, accounting for 32% of total interruptions (6 of 19). Overloads were the 3rd leading cause of interruptions, accounting for 16% of total interruptions (3 of 19).
- Trees were the leading cause of customers interrupted (CI) on the Swaggertown 36451 in 2018, accounting for 69% of total customers interrupted (1,523 of 2,210). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 14% of total customers interrupted (318 of 2,210). Overloads were the 3rd leading cause of customers interrupted, accounting for 14% of total customers interrupted (315 of 2,210).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Swaggertown 36451 in 2018, accounting for 45% of total customer-hours interrupted (2,468 of 5,444). Overloads were the 2nd leading cause of customer-hours interrupted, accounting for 28% of total customer-hours interrupted (1,521 of 5,444). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 25% of total customer-hours interrupted (1,357 of 5,444).
- Of the 19 interruptions on this circuit, 7 affected 10 customers or less, with 3 being single customer outages.

**Action Taken:**

- There are two 3-phase reclosers on the Swaggertown 36451. The reclosers have proven to be beneficial to the reliability of the feeder since one of the mainline interruptions was isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized CI and CHI over the past year for the Swaggertown 36451.
- A project to relocate the feeder tie between Front St 36051 and Swaggertown 36451 in 2016. The original tie location, at pole 76 Swaggertown Road, was at the corner of Swaggertown & Van Buren Roads on a curved hill. It could not be operated under contingency without flaggers, which risked extending an outage. The feeder tie was relocated to pole 66 Swaggertown Road.
- A maintenance foot patrol (I&M inspection) of the Swaggertown 36451 was completed in 2018.
- Tree trimming of the Swaggertown 36451 feeder was completed in FY2016.

**Action Plan:**

- Complete Level 3 maintenance on the Swaggertown 36451 by March 2021.
- Monitor results of vegetation work from FY2016 on the Swaggertown 36451 in 2019.

## 17. GROOMS ROAD 34557 – 13.2kV

Profile: 1,890 Customers, 44.5 Circuit Miles  
 Indices: CAIDI = 1.09, SAIFI = 3.74

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	5	33.33%	1,961	27.71%	2,703	34.99%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	4	26.67%	1,545	21.83%	600	7.77%
6	ACCIDENTS	3	20.00%	3,564	50.36%	4,371	56.58%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	6.67%	1	0.01%	22	0.28%
10	UNKNOWN	2	13.33%	6	0.08%	30	0.39%
Totals		15	100.00%	7,077	100.00%	7,726	100.00%

### Problem Analysis:

- There were 15 interruptions on the Grooms Road 34557 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 15 events occurred at the distribution level.
- The distribution circuit breaker for the Grooms Road 34557 experienced 2 momentary operations in 2018.
- The circuit breaker for the Grooms Road 34557 experienced 2 sustained operations (lockouts) in 2018. These interruptions accounted for 53% of the total amount of customers interrupted (3,786 out of 7,077) and 63% of the total amount of the customer-hours interrupted (4,841 out of 7,726).
  - The first lockout occurred on August 13, 2018, coded as a cause of tree fell (PSC cause code 02). Trees took primary down at pole 20 on Grooms Road. Crews were able to isolate the outage, restoring 92% of the customers in 50 minutes before work proceeded to fix the damaged infrastructure. This lockout accounted for 27% of the total customers interrupted (1,895 of 7,077), and 28% of the total customer-hours interrupted (2,131 of 7,726).
  - The second lockout occurred on October 31, 2018, coded as a cause of non-company activities (PSC cause code 06). The Town of Clifton Park Water Department inadvertently dug up underground getaway cable by the Grooms Road Substation. Crews were able to re-energize the customers in less than 90 minutes. This lockout accounted for 27% of the total customers interrupted (1,891 of 7,077), and 35% of the total customer-hours interrupted (2,710 of 7,726).



- There were two interruptions on the Grooms Road 34557 that involved 3-phase mainline but were not associated with the circuit breaker. The isolating devices were pole-top reclosers, and solid blades. These interruptions accounted for 45% of the total amount of customers interrupted (3,172 of 7,071) and 30% of the total amount of the customer-hours interrupted (2,110 of 7,077).
  - The first interruption occurred on July 6, 2018 as a result of a motor vehicle accident at pole 22 on Alplaus Ave. The recloser at pole 13 Riverview Road locked open as a result. This interruption accounted for 23% of the total amount of customers interrupted (1,631 of 7,071) and 21% of the total amount of the customer-hours interrupted (1,520 of 7,077).
  - The second interruption occurred on October 1, 2018 as a result of device deterioration. A broken cross arm at pole 37 Alplaus Road needed to be replaced. Crews opened switches at pole 62 Alplaus Road to isolate and make repairs. This interruption accounted for 22% of the total amount of customers interrupted (1,541 of 7,071) and 8% of the total amount of the customer-hours interrupted (591 of 7,077)
- Trees were the leading cause of interruptions on the Grooms Road 34557 in 2018, accounting for 33% of total interruptions (5 of 15). Equipment Failures were the 2nd leading cause of interruptions, accounting for 27% of total interruptions (4 of 15). Accidents were the 3rd leading cause of interruptions, accounting for 20% of total interruptions (3 of 15).
- Accidents were the leading cause of customers interrupted (CI) on the Grooms Road 34557 in 2018, accounting for 50% of total customers interrupted (3,564 of 7,077). Trees were the 2nd leading cause of customers interrupted, accounting for 28% of total customers interrupted (1,961 of 7,077). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 22% of total customers interrupted (1,545 of 7,077).
- Accidents were the leading cause of customer-hours interrupted (CHI) on the Grooms Road 34557 in 2018, accounting for 57% of total customer-hours interrupted (4,371 of 7,726). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 35% of total customer-hours interrupted (2,703 of 7,726). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (600 of 7,726).
- Of the 15 interruptions on this circuit, 8 affected 10 customers or less, with 5 being single customer outages.

**Action Taken:**

- There are six 3-phase reclosers on the Grooms Road 34557. The reclosers have proven to be beneficial to the reliability of the feeder since one of the mainline interruptions was isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized CI and CHI over the past year for the Grooms Road 34557.
- A maintenance foot patrol (I&M inspection) of the Grooms Road 34557 was completed in 2018.
- Tree trimming of the Grooms Road 34557 feeder was completed in FY2016.

**Action Plan:**

- A project is currently scheduled in FY2019 to convert over three miles of existing three-phase 4.8kV (delta) to three-phase 13.2kV (wye) construction on Saratoga Road in Glenville and Burnt Hills. This conversion will also complete a 13.2kV tie between the Grooms Road 34557 and Swaggertown 36452 feeders, as well as create a much-needed feeder tie with the Shore Road 34.5/4.8kV substation.
- Complete Level 2 maintenance on the Grooms Road 34557 by October 2019.
- Complete Level 3 maintenance on the Grooms Road 34557 by October 2021.
- Monitor results of vegetation work from FY2016 on the Grooms Road 34557 in 2019.

**18. BRUNSWICK 26452 – 13.2kV**

*Profile: 1,956 Customers, 93.4 Circuit Miles*

*Indices: CAIDI = 1.35, SAIFI = 2.33*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	9	34.62%	281	6.17%	1,064	17.29%
3	OVERLOADS	1	3.85%	3	0.07%	24	0.38%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	23.08%	176	3.86%	671	10.90%
6	ACCIDENTS	6	23.08%	4,035	88.58%	4,262	69.24%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	3.85%	3	0.07%	23	0.38%
10	UNKNOWN	3	11.54%	57	1.25%	112	1.81%
Totals		26	100.00%	4,555	100.00%	6,155	100.00%

**Problem Analysis:**

- There were 26 interruptions on the Brunswick 26452 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 26 events occurred at the distribution level.
- The distribution circuit breaker for the Brunswick 26452 experienced 0 momentary operations in 2018.
- The circuit breaker for the Brunswick 26452 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 43% of the total amount of customers interrupted (1,953 out of 4,555) and 51% of the total amount of the customer-hours interrupted (3,125 out of 6,155).
  - This lockout occurred on May 08, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 43% of the total customers interrupted (1,953 of 4,555), and 51% of the total customer-hours interrupted (3,125 of 6,155). The 26452 feeder was tied to a neighboring feeder (26453) to perform work on the R520 feeder breaker. During this time, a motor vehicle accident (MVA) occurred on the neighboring feeder (26453). A single-phase hydraulic recloser failed to operate and isolate the MVA. This caused the next upstream device (the R530 station feeder breaker) to operate. Work to replace the single-phase hydraulic recloser with a CMR TripSaver has been completed.
- Trees were the leading cause of interruptions on the Brunswick 26452 in 2018, accounting for 35% of total interruptions (9 of 26). Equipment Failures were the 2nd leading cause of

interruptions, accounting for 23% of total interruptions (6 of 26). Accidents were the 3rd leading cause of interruptions, accounting for 23% of total interruptions (6 of 26).

- Accidents were the leading cause of customers interrupted (CI) on the Brunswick 26452 in 2018, accounting for 89% of total customers interrupted (4,035 of 4,555). Trees were the 2nd leading cause of customers interrupted, accounting for 6% of total customers interrupted (281 of 4,555). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 4% of total customers interrupted (176 of 4,555).
- Accidents were the leading cause of customer-hours interrupted (CHI) on the Brunswick 26452 in 2018, accounting for 69% of total customer-hours interrupted (4,262 of 6,155). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 17% of total customer-hours interrupted (1,064 of 6,155). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 11% of total customer-hours interrupted (671 of 6,155).
- Of the 26 interruptions on this circuit, 10 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- There were three pole top reclosers installed on the Brunswick 26452. The reclosers have proven to be beneficial to the reliability of the feeder since two of the mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized CI and CHI over the past year for the Brunswick 26452.
- A maintenance foot patrol of the Brunswick 26452 was completed in 2018 and all identified level 1 maintenance work has been completed.
- The enhanced Emerald Ash Bore tree mitigation project was completed on the Brunswick 26452 in FY18 in addition to the Enhanced Hazard Tree Maintenance in FY16.
- A small capital improvement project was designed and completed to replace fuses with CMR TripSavers. This will increase reliability.

**Action Plan:**

- Complete all level 2 maintenance work from the 2018 I&M inspection (foot patrol) on the Brunswick 26452 scheduled for 2019.
- Enhanced Hazard Tree Maintenance is scheduled to be completed in FY20 on the Brunswick 26452.
- All level 3 maintenance work from the 2018 I&M inspection (foot patrol) on the Brunswick 26452 to be completed before 2022.

## 19. BLUE STORES 30352 – 13.2kV

Profile: 1,111 Customers, 52.4 Circuit Miles  
 Indices: CAIDI = 1.73, SAIFI = 2.33

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	9	37.50%	2,483	95.91%	3,739	83.39%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	25.00%	90	3.48%	676	15.08%
6	ACCIDENTS	1	4.17%	1	0.04%	1	0.03%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	4	16.67%	7	0.27%	23	0.50%
10	UNKNOWN	4	16.67%	8	0.31%	45	1.00%
Totals		24	100.00%	2,589	100.00%	4,484	100.00%

### Problem Analysis:

- There were 24 interruptions on the Blue Stores 30352 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 24 events occurred at the distribution level.
- The distribution circuit breaker for the Blue Stores 30352 experienced 0 momentary operations in 2018.
- The circuit breaker for the Blue Stores 30352 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 43% of the total amount of customers interrupted (1,113 out of 2,589) and 33% of the total amount of the customer-hours interrupted (1,484 out of 4,484).
  - This lockout occurred on September 06, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 43% of the total customers interrupted (1,113 of 2,589), and 33% of the total customer-hours interrupted (1,484 of 4,484). A tree fell and broke the insulator pin on pole 5 Mill Road.
- Trees were the leading cause of interruptions on the Blue Stores 30352 in 2018, accounting for 38% of total interruptions (9 of 24). Equipment Failures were the 2nd leading cause of interruptions, accounting for 25% of total interruptions (6 of 24). Lightning was the 3rd leading cause of interruptions, accounting for 17% of total interruptions (4 of 24).
- Trees were the leading cause of customers interrupted (CI) on the Blue Stores 30352 in 2018, accounting for 96% of total customers interrupted (2,483 of 2,589). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 3% of total

customers interrupted (90 of 2,589). Unknown was the 3rd leading cause of customers interrupted, accounting for 0% of total customers interrupted (8 of 2,589).

- Trees were the leading cause of customer-hours interrupted (CHI) on the Blue Stores 30352 in 2018, accounting for 83% of total customer-hours interrupted (3,739 of 4,484). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 15% of total customer-hours interrupted (676 of 4,484). Unknown was the 3rd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (45 of 4,484).
- Of the 24 interruptions on this circuit, 14 affected 10 customers or less, with 9 being single customer outages.

**Action Taken:**

- The Blue Stores 30352 was tree trimmed in its entirety in 2016.
- A maintenance foot patrol was performed on the Blue Stores 30352 in March of 2016. All Level 1 maintenance was performed immediately and all level 2 maintenance on the Blue Stores 30352 was completed by January 2017.
- Enhanced Hazard Tree Mitigation (EHTM) on the Blue Stores 30352 was completed in FY16 which removed 197 danger trees.

**Action Plan:**

- Complete Level 3 maintenance on the Blue Stores 30352 by March 2018.

## 20. HOOSICK 31451 – 13.2kV

Profile: 1,747 Customers, 96.4 Circuit Miles

Indices: CAIDI = 1.96, SAIFI = 1.98

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	11	42.31%	971	28.07%	3,634	53.72%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	9	34.62%	717	20.73%	2,623	38.77%
6	ACCIDENTS	1	3.85%	6	0.17%	16	0.24%
7	PREARRANGED	1	3.85%	1,742	50.36%	377	5.58%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	15.38%	23	0.66%	114	1.69%
Totals		26	100.00%	3,459	100.00%	6,765	100.00%

### Problem Analysis:

- There were 26 interruptions on the Hoosick 31451 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This Substation interruption occurred on February 22, 2018, coded as a cause of maintenance (PSC cause code 07). This lockout accounted for 50% of the total customers interrupted (1,742 of 3,459), and 6% of the total customer-hours interrupted (377 of 6,765).
- The remaining 25 events occurred at the distribution level.
- The distribution circuit breaker for the Hoosick 31451 experienced 2 momentary operations in 2018.
- The circuit breaker for the Hoosick 31451 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Hoosick 31451 in 2018, accounting for 42% of total interruptions (11 of 26). Equipment Failures were the 2nd leading cause of interruptions, accounting for 35% of total interruptions (9 of 26). Unknown were the 3rd leading cause of interruptions, accounting for 15% of total interruptions (4 of 26).
- Prearranged were the leading cause of customers interrupted (CI) on the Hoosick 31451 in 2018, accounting for 50% of total customers interrupted (1,742 of 3,459). Trees were the 2nd leading cause of customers interrupted, accounting for 28% of total customers interrupted (971 of 3,459). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 21% of total customers interrupted (717 of 3,459).

- Trees were the leading cause of customer-hours interrupted (CHI) on the Hoosick 31451 in 2018, accounting for 54% of total customer-hours interrupted (3,634 of 6,765). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 39% of total customer-hours interrupted (2,623 of 6,765). Prearranged were the 3rd leading cause of customer-hours interrupted, accounting for 6% of total customer-hours interrupted (377 of 6,765).
- Of the 26 interruptions on this circuit, 11 affected 10 customers or less, with 7 being single customer outages.

**Action Taken:**

- Engineering Reliability Review (ERR) performed in 2015 for the Hoosick 31451, and recommendations for system improvements (added lightning arrestors, fusing, etc.) was completed FY16.
- Tree trimming, which removed over 345 hazard trees on the Hoosick 31451 was completed in FY16.
- Overloaded ratio on pole 2 State Highway #7 was increased in size for improved reliability in FY17.
- A maintenance foot patrol of the Hoosick 31451 was completed in 2018 and all identified level 1 maintenance work has been completed.

**Action Plan:**

- Complete all level 2 maintenance work from the 2018 I&M inspection (foot patrol) on the Hoosick 31451 scheduled for 2019.
- All level 3 maintenance work from the 2018 I&M inspection (foot patrol) on the Hoosick 31451 to be completed before 2022.
- A small capital improvement project was designed and scheduled to be started FY20 to complete a conversion/feeder tie between the Hoosick 31451 and Hoosick 31452 feeders. This will increase reliability on the Hoosick 31451.



3. ACTION PLAN SUMMARIES

a. SUMMARY OF ACTION ITEM PLANS FOR 2018 WORST PERFORMING CIRCUITS

Station	Feeder	Report Year	Action Plan	Estimated Completion Date	Estimated Cost	Comments
Blue Stores	30352	2018	Complete level 3 maintenance	3/29/19		On Schedule
Blue Stores	30353	2018	Enhanced Hazard Tree Mitigation(EHTM) & Emerald Ash Bore (EAB) mitigation	4/19/19		On schedule
Blue Stores	30353	2018	Complete level 3 maintenance	7/28/19		On schedule
Boyntonville	33351	2018	Complete level 3 maintenance	12/30/19		On Schedule
Boyntonville	33351	2018	Engineering review for additional trip savers	12/30/19		On Schedule
Boyntonville	33351	2018	Enhanced Hazard Tree Mitigation(EHTM)	12/30/20		On Schedule
Brunswick	26452	2018	Complete level 2 maintenance	12/18/19		On Schedule
Brunswick	26452	2018	Complete level 3 maintenance	12/18/20		On Schedule
Brunswick	26452	2018	Enhanced Hazard Tree Mitigation(EHTM)	12/30/19		On Schedule
Elnora	44258	2018	Reconfiguration to transfer portions to Swaggertown 36451	12/30/19	>\$5,000	On Schedule
Elnora	44258	2018	Monitor results of vegetation work from FY16	12/30/19		On Schedule
Elnora	44258	2018	Complete level 3 maintenance	9/30/19		On Schedule
Greenbush	7852	2018	Monitor results of vegetation work from FY16	4/19/19		On schedule
Greenbush	7852	2018	Complete level 3 maintenance	10/19/19		On schedule
Grooms Road	34552	2018	Trip Saver installations under CMR funding # C053928	4/18/19		On Schedule
Grooms Road	34552	2018	Monitor results of vegetation work from FY16	4/18/19		On Schedule
Grooms Road	34552	2018	Complete level 3 maintenance	8/1/21		On Schedule
Grooms Road	34556	2018	Reconfiguration to transfer portions to Swaggertown 36451	12/30/19	>\$5,000	On Schedule
Grooms Road	34556	2018	Monitor results of vegetation work from FY16	12/30/19		On Schedule
Grooms Road	34556	2018	Complete level 3 maintenance	9/30/19		On Schedule
Grooms Road	34556	2018	Complete level 3 maintenance	9/30/19		On Schedule
Grooms Road	34557	2018	Reconfiguration to transfer portions to Swaggertown 36452	2/20/19	>\$5,000	On Schedule
Grooms Road	34557	2018	Monitor results of vegetation work from FY16	2/20/19		On Schedule
Grooms Road	34557	2018	Complete level 2 maintenance	10/20/19		On Schedule
Grooms Road	34557	2018	Complete level 3 maintenance	10/20/21		On Schedule
Hoosick	31451	2018	Complete level 2 maintenance	12/30/19		On schedule
Hoosick	31451	2018	Complete level 3 maintenance	12/30/22		On schedule
Hoosick	31451	2018	Conversion for enhanced tie for increased reliability between Hoosick 31451 and 31452	12/30/20	>\$5,000	On schedule
Menands	10156	2018	I&M Inspection (foot patrol)	12/18/19		On Schedule
Menands	10156	2018	I&M Inspection (foot patrol) Level 1 Maintenance	3/1/20		On schedule
Menands	10156	2018	Complete level 2 maintenance	6/1/20		On schedule
Pinebush	37153	2018	Enhanced Hazard Tree Mitigation(EHTM) & Emerald Ash Bore (EAB) mitigation	12/18/19		On Schedule
Pinebush	37153	2018	Trip Saver installations under CMR funding # C053928	12/18/19		On Schedule
Swaggertown	36451	2018	Complete level 3 maintenance	3/18/21		On Schedule
Swaggertown	36451	2018	Monitor results of vegetation work from FY16	2/18/19		On Schedule
Swaggertown	36452	2018	Complete level 3 maintenance	3/29/19		On Schedule
Swaggertown	36452	2018	Monitor results of vegetation work from FY16	9/18/19		On Schedule
Swaggertown	36453	2018	Monitor results of vegetation work from FY16	12/18/19		On Schedule
Swaggertown	36453	2018	Complete level 2 maintenance	10/1/19		On Schedule
Swaggertown	36453	2018	Complete level 3 maintenance	10/1/19		On Schedule
Trinity Place	16452	2018	Complete level 3 maintenance	2/19/19		On Schedule
Trinity Place	16452	2018	Reconfiguration to transfer portions to Trinity 16454	2/19/19	\$72,000	On Schedule
Valkin	42752	2018	Enhanced Hazard Tree Mitigation(EHTM) & Emerald Ash Bore (EAB) mitigation	12/30/19		On schedule
Voorheesville	17851	2018	Complete level 3 maintenance	8/20/19		On schedule
Voorheesville	17851	2018	Trip Saver installations under CMR funding # C053928	8/20/19		On schedule
Voorheesville	17853	2018	Enhanced Hazard Tree Mitigation(EHTM)	10/19/19		On Schedule

Station	Feeder	Report Year	Action Plan	Estimated Completion Date	Estimated Cost	Comments
Voorheesville	17853	2018	Trip Saver installations under CMR funding # C053928	12/30/19		On Schedule
Voorheesville	17853	2018	Complete level 2 maintenance	1/19/19		On Schedule
Voorheesville	17853	2018	Complete level 3 maintenance	10/19/21		On Schedule
Blue Stores	30352	2018	Complete level 3 maintenance	3/29/19		On Schedule

b. STATUS OF ACTION PLANS FOR 2017 WORST PERFORMING CIRCUITS

Station	Feeder	Report Year	Action Plan	Actual Completion Date	Actual Cost	Comments
Swaggertown	36452	2017	Monitor results of vegetation work from FY16	18-Dec	\$1.795M	Complete
Swaggertown	36452	2017	Complete level 3 maintenance	19-Jan		On Schedule
Swaggertown	36452	2017	Monitor results of vegetation work from FY16	18-Dec		Cycle trim scheduled for FY20
Curry Road	36552	2017	Complete level 3 maintenance	19-Feb		On Schedule
Curry Road	36553	2017	Monitor results of vegetation work from FY16	18-Dec		Cycle trim scheduled for FY20
Curry Road	36553	2017	Complete level 3 maintenance	19-Oct		On Schedule
Swaggertown	36453	2017	Enhanced Hazard Tree Mitigation(EHTM) & Emerald Ash Bore (EAB) mitigation	18-Sept		EAB Mitigation Complete, Cycle Trim Scheduled for FY 20
Grooms Road	34552	2017	Complete level 2 maintenance	18-Feb		Repatrolled in 2018
Grooms Road	34552	2017	Complete level 3 maintenance	20-Feb		On Schedule
Curry Road	36557	2017	Enhanced Hazard Tree Mitigation(EHTM) & Emerald Ash Bore (EAB) mitigation	18-Dec		EAB Mitigation Complete
Curry Road	36557	2017	Engineering review for additional 3-phase recloser	18-Dec		Review Complete, WRs initiated and in Construction/Design: 26917108 & 26917726
Curry Road	36551	2017	Enhanced Hazard Tree Mitigation(EHTM) & Emerald Ash Bore (EAB) mitigation	18-Dec		EAB Mitigation Complete, Cycle Trim Scheduled for FY 20
Curry Road	36551	2017	I&M Inspection (foot patrol)	18-Sep		Complete 11/17/2018
Brunswick	26453	2017	Engineering review for additional trip saver	18-Dec		Review Complete, settings updates issued
Brunswick	26453	2017	Complete level 2 maintenance	19-Jan		On Schedule
Altamont	28355	2017	Complete level 3 maintenance	21-Jan		On Schedule
Altamont	28355	2017	Enhanced Hazard Tree Mitigation (EHTM)	18-Dec		Cycle trim scheduled for FY20
Altamont	28355	2017	Complete level 2 maintenance	18-July		On Schedule
Altamont	28355	2017	Complete level 3 maintenance	20-July		On Schedule
Brunswick	26452	2017	Engineering review for additional trip saver	18-Dec		Review complete, no changes
Brunswick	26452	2017	Complete level 3 maintenance	19-July		On Schedule
Voorheesville	17853	2017	Engineering review for additional trip savers	18-Dec		Review complete, 5 locations identified, WR in design approval or awaiting scheduling
Voorheesville	17853	2017	I&M Inspection (foot patrol)	18-Nov		Complete 5/22/2018
Voorheesville	17853	2017	Integrated Vegetation Management (pruning cycle)	18-Dec		Complete
Voorheesville	17853	2017	Monitor results of vegetation work from FY16	18-Dec		Complete
Blue Stores	30353	2017	Complete level 3 maintenance	19-Jan		On Schedule
Blue Stores	30353	2017	Monitor results of vegetation work from FY16	18-Dec		Cycle trim scheduled for FY20
Blue Stores	30353	2017	Complete level 3 maintenance	19-Feb		On Schedule
Boyntonville	33351	2017	Monitor results of vegetation work from FY16	18-Dec		Cycle trim scheduled for FY20
Boyntonville	33351	2017	Complete level 3 maintenance	18-Dec		On Schedule
Menands	10157	2017	Enhanced Hazard Tree Mitigation(EHTM) & Emerald Ash Bore (EAB) mitigation	18-Nov		EAB Mitigation Complete, Cycle Trim Scheduled for FY 20
Menands	10157	2017	Complete level 2 maintenance	18-Dec		Patrolled in 2018
Menands	10157	2017	Complete level 2 maintenance	18-Dec		Patrolled in 2018
Swaggertown	36453	2017	Complete ERR	18-Apr		Field Engineering
Bethlehem	02158	2017	Engineering review for Reclosers for possible additional recloser	17-Dec		Field Engineering

Station	Feeder	Report Year	Action Plan	Actual Completion Date	Actual Cost	Comments
Front St	36051	2017	Front St 52 & 53 OH to UG relocation	17-Dec		OH Lines
Front St	36053	2017	Front St 52 & 53 OH to UG relocation	17-Dec		OH Lines
Front St	36053	2017	Complete ERR	18-Apr		Field Engineering
McClellan St	30452	2017	Complete level 3 maintenance	17-Jul		OH Lines

#### 4. OPERATING REGION PERFORMANCE BELOW MINIMUM

##### a. MAINTENANCE HISTORY AND ANALYSIS OF FACTORS WHICH CAUSED THE BELOW MINIMUM PERFORMANCE

In 2018, the Capital Region meet the PSC minimum goal for SAIFI of 1.024 interruptions, ending the year with a total SAIFI of 0.95 interruptions. This was an 3.3% increase over 2017's SAIFI of 0.92. The 2018 SAIFI was .4% less than the 5-year SAIFI average of 0.954.

Additionally, the Capital Region did not meet the PSC minimum goal for CAIDI of 2.025 hours, ending the year with an average interruption duration of 2.20 hours. This was a 5.3% increase over 2017's CAIDI of 2.09. The 2018 CAIDI was 11.1% greater than the 5-year CAIDI average of 1.98.

Excluding Major Storms, the 2018 data indicates that the number of interruptions was 13% above the previous 5-year average; the customers interrupted were 0.4% above the previous 5-year average while the customer-hours interrupted were 13.7% above the previous 5-year average.

##### 2018 CAIDI and SAIFI data by facility type (excluding major storms):

The 2018 CAIDI for transmission facilities was 1.36 hours, below the PSC target value of 2.00 hours for the Region. This consisted of 7 interruptions, which made up 5.0% of total customers interrupted and 3% of total customer-hours interrupted. The 2018 SAIFI for transmission facilities contributed 0.05 interruptions (5.3%) of the 2018 total SAIFI for the Region of 0.95 interruptions.

The 2018 CAIDI for substation facilities was 1.59 hours, below the PSC target value of 2.00 hours. This consisted of 8 outages which resulted in 6% of the total number of customers interrupted for the year with 19,977 customers being interrupted by these outages. The 2018 SAIFI for substation facilities contributed 0.06 interruptions (6.3%) of the 2018 total SAIFI for the Region of 0.95 interruptions.

The 2018 CAIDI for distribution facilities was 2.3 hours, above the PSC target of 2.00 hours. This consisted of 3,073 interruptions which resulted in 88.0% of the total number of customers interrupted for the year with 274,222 customers being interrupted by these outages. The 2018 SAIFI for distribution facilities contributed 0.83 interruptions (87.4%) to the 2017 total SAIFI for the Region of 0.95 interruptions.

2018 data by cause code that had either CAIDI or SAIFI greater than the previous year's results (excluding Major Storms):

(02) Tree Contacts

The overall SAIFI for tree contacts was 0.28 interruptions, which is 7.7% above the previous 5-year average (0.26), and 15.2% less than the 2017 SAIFI of 0.33. Tree-related outages contributed to 30.0% of the total number of customers interrupted (93,234 of 311,134), and 34.8% of the total customer-hours interrupted for the Region (238,510 of 685,218).

There was a 1.8% increase in interruptions caused by tree contacts from 2017 to 2018 (777 to 791). Customers interrupted decreased by 16.2% (108,344 to 93,234), and customer-hours interrupted increased by 9.3% from 2017 (from 260,851 to 238,510). This suggests that tree-related outages were a factor in determining why the Region did not meet the PSC target for CAIDI.

(03) Overloads

The overall CAIDI for overloads was 5.28 hours, which is 146.3% above the previous 5-year average (3.61), and 285% above the 2017 CAIDI of 1.85. Overload-related outages contributed to 0.2% of the total number of customers interrupted (4,675 of 311,134), and 3.6% of the total customer-hours interrupted for the Region (24,662 of 685,218). Overloads were the largest factor in determining why the Region did not meet the PSC target for CAIDI. Last summer was the hottest summer the Capital region has experienced in over 8 years and the averaged warmest summer the Capital region has experienced in recorded history. The high temperatures are a contributing factor in the overload of National Grid equipment that occurred over the summer months.

(04) Operator Error

The overall SAIFI for equipment failure was 0.001 interruptions, which is 95% below the previous 5-year average (0.02), and 10% below the 2017 SAIFI of 0.01. Operator Error related outages contributed to 0.2% of the total number of customers interrupted (775 of 311,134), and .06% of the total customer-hours interrupted for the Region (396 of 685,218).

(05) Equipment Failure

The overall CAIDI for equipment failure was 2.34 hours, which is 11.5% above the previous 5-year average (2.07), and 12.8% above the 2017 CAIDI of 2.04. Equipment-related outages contributed to 33.1% of the total number of customers interrupted (102,951 of 311,134), and 35.1% of the total customer-hours interrupted for the Region (240,622 of 685,218).

There was a 18.1% increase in interruptions caused by equipment failure from 2017 to 2018 (781 to 954). Customers Interrupted increased by 5.4% (from 97,442 to 102,951) and customer-hours interrupted increased by 17.3% from 2017 (from 198,920 to 240,622).



One particular equipment failure that occurred over two separate incidents with a high number of customer-hours interrupted had a significant impact on the total CAIDI for equipment failure-related outages as well as for the total CAIDI for the Region. The first event occurred when there was a sustained breaker interruption on June 09, 2018 when the feeder getaway cable faulted partially. The second event was the cable failed completely. Together these related lockouts accounted for 4,629 customers interrupted with 14,750 customer hours interrupted. This event accounted for 4.5% of the total number of customers interrupted due to equipment failure (4,629 of 102,951) and 6.1% of the customer-hours interrupted in the Capital Region due to equipment failures in 2018 (14,750 of 240,622).

#### (06) Accidents

The overall CAIDI for accidents was 1.59 hours, which is 4.4% above the previous 5-year average (1.52), and 20.1% below the 2017 CAIDI of 2.01. Accident-related outages contributed to 21.9% of the total number of customers interrupted (68,240 of 311,134), and 15.9% of the total customer-hours interrupted for the Region (108,626 of 685,218).

There was a 15.7% decrease in interruptions caused by accidents from 2017 to 2018 (424 to 503). Customers Interrupted increased by 11.7% (68,240 to 60,286) and customer-hours interrupted increased by 34.8% from 2017 (70,835 to 108,626).

#### (07) Prearranged

The overall CAIDI for prearranged interruptions was 0.75 hours, which is 29.9% below the previous 5-year average (1.07), and 22.7% above the 2017 CAIDI of 0.97. Prearranged outages contributed to 3.1% of the total number of customers interrupted (9,677 of 311,134), and 1.1% of the total customer-hours interrupted for the Region (7,289 of 685,218).

#### (09) Lightning

The overall CAIDI for lightning was 4.25 hours, which is 39.0% above the previous 5-year average (2.59), and 6.8% below the 2017 CAIDI of 4.56. Lightning-related outages contributed to 1.1% of the total number of customers interrupted (3,437 of 311,134), and 2.1% of the total customer-hours interrupted for the Region (14,599 of 685,218).

There was a 50.7% increase in interruptions caused by lightning from 2017 to 2018 (32 to 65). Customers Interrupted increased by 48.3% (1,778 to 3,437) and customer-hours interrupted increased by 44.4% from 2016 (8,116 to 14,599). There were more lightning related outages, but the lengths of those outages was less than previous years resulting in lower CAIDI time.

(10) Unknown

The overall CAIDI for unknown outages was 1.79 hours, which is 3.9% above the previous 5-year average (1.72), and 3.9% above the 2017 CAIDI of 1.72. Unknown outages contributed to 9.0% of the total number of customers interrupted (28,145 of 311,134), and 7.4% of the total customer-hours interrupted for the Region (50,514 of 685,218).

The overall SAIFI for unknown failures was 0.09 interruptions, which is 10% less than the previous 5-year average (0.10), and 18.2% below the 2017 SAIFI of 0.11.

b. **PLANNED PROGRAMS OR PLANNED CORRECTIVE ACTIONS AND PROPOSED IMPROVEMENTS TO THE PERFORMANCE INDICES**

The Company is continuing its efforts in the Capital Region to maintain reliability. These efforts include distribution patrols, maintenance programs, single phase and three phase line recloser installations, protection coordination studies, lightning protection installations, and tree trimming programs. All of these programs and corrective actions not only will reduce the number of interruptions and/or customers interrupted but also the restoration times. The Company will continue to stay on schedule for tree trimming and believes that this maintained schedule for tree trimming and miles trimmed will reduce both the incidence and duration of tree-related interruptions.

**Substation Improvements**

- 1) When substation equipment is being installed or repaired, animal guards are being installed.
- 2) When opportunities arise, feeder-ties will be constructed to temporarily transfer load onto adjacent substations. This will improve reliability for the affected station.
- 3) The Company's ongoing maintenance program for substations should help reduce the potential for substation problems in 2019. This program includes:
  - Circuit breaker diagnostic tests
  - Circuit breaker mechanism checks
  - Load tap changer internal inspections
  - Dissolved gas analysis on load tap changers and transformers.
  - Calibration/inspections on relay positions and communication packages
  - Functional testing of relays
  - Battery maintenance
- 4) Network - Annual program for Albany area networks to review and change out transformers and protectors due to deterioration as needed. The Albany area has approximately 250 vaults containing network transformers and protectors. The goal of this program is to replace the equipment before failure occurs.

**Engineering Reliability Reviews (ERR)**

In a separate initiative based on primary distribution interruptions only, each region of the company is presented with a list of worst performing feeders. The review's purpose was to identify corrective measures that would improve that feeder's reliability statistics, determine the associated incremental reliability improvement, and each corrective measures' associated cost.

In addition to these preventative maintenance measures, the Company will perform ERR's on a select number of the worst performing feeders in order to review these feeders in detail and also to provide recommendations to improve the reliability on the feeder. These recommendations may include but are not limited to, the addition of reclosers and fuses, the construction of feeder ties, and the identification and

replacement of overloaded equipment.

As part of the ERR, the Company plans to sectionalize more feeders in the Capital Region. This will help reduce the number of customers that are impacted by incidents that cannot be avoided. One method of sectionalizing will be the use of pole top reclosers. The installation of radial line reclosers has a positive impact on the Company's SAIFI performance by reducing the number of customer interruptions. Further benefits can be realized to the extent that these devices provide remote monitoring and control and provide a platform for future automation schemes.

To help minimize interruptions caused by animal contact, the Company will continue to install animal guards on all new transformer installations and retrofit animal guards on existing transformers in areas plagued with animal-related interruptions in the Capital Region.

Taken together, the Company believes these preventative actions will help minimize the potential for unplanned interruptions and improve the Capital Region's SAIFI and CAIDI performance.

## D. CENTRAL REGION

### 1. OPERATING REGIONAL PERFORMANCE

#### a. HISTORIC CAIDI AND SAIFI INDICES

IDS Info:

	2018	2017	2016	2015	2014	2013
CAIDI (Target 1.899)	1.80	1.70	1.86	1.83	1.62	1.84
SAIFI (Target 1.226)	1.17	1.16	1.12	1.19	1.26	0.90
SAIDI	2.11	1.98	2.07	2.18	2.03	1.66
Interruptions	2,313	2,033	2,201	2,023	2,029	2,021
Customers Interrupted	334,013	328,521	312,792	332,703	350,855	252,765
Customer-Hours Interrupted	601,662	558,888	580,949	607,511	567,101	464,793
Customers Served	285,558	282,491	280,384	278,647	279,236	279,326
Customers Per Interruption	144.41	161.59	142.11	164.46	172.92	125.07
Availability Index	99.9759	99.9774	99.9764	99.9751	99.9768	99.9810
Interruptions/1000 customers	8.10	7.20	7.85	7.26	7.27	7.24

#### b. DISCUSSION OF REGIONAL PERFORMANCE

In 2018, the Central Region met its CAIDI reliability target and met its SAIFI reliability target as set forth by the New York Public Service Commission (PSC). The final System Average Interruption Frequency Index (SAIFI) result was 1.17 interruptions, 5% below the PSC goal of 1.226 interruptions. As shown in the table above, the Customer Average Interruption Duration index (CAIDI) was 1.80 in 2018, 5% below the PSC's regional target of 1.899 hours.

The 2018 CAIDI result was 6% above the 2017 result of 1.7 hours, and 2% above the previous 5-year average of 1.76 hours. The 2018 SAIFI was 1% above the 2017 result of 1.16 interruptions, and 4% above the previous 5-year average of 1.13 interruptions.

In 2018, excluding major storms, the Central Region experienced 15 transmission interruptions. These interruptions accounted for 1% of the region's total interruptions (15 of 2,313), 8% of the region's total customers interrupted (CI), (26,633 of 334,013), and 5% (28,616 of 601,661) of the region's total customer-hours interrupted (CHI). Overall, transmission interruptions had a CAIDI of 1.07 hours, and a SAIFI of 0.09 interruptions.

The number of transmission-related interruptions decreased from 27 in 2017 to 15 in 2018 (a decrease of 44%). The number of customers interrupted decreased from 94,286 in 2017, to 26,633 in 2018 (a decrease of 72%), while the customer-hours interrupted decreased from 76,325 in 2017, to 28,616 in 2018 (a decrease of 63%).

In 2018, excluding major storms, the Central Region experienced 24 substation interruptions. These interruptions accounted for 1% of the region's total interruptions (24 of 2,313), 17% of the region's total customers interrupted, (57,582 of 334,013), and 8% (50,805 of 601,661) of the region's total customer-hours interrupted. Overall, substation interruptions had a CAIDI of .88 hours, and a SAIFI of 0.2 interruptions.

The number of substation-related interruptions increased from 18 to 24 from 2017 to 2018 (an increase of 33%). The number of customers interrupted increased from 37,960 in 2017, to 57,582 in 2018 (an increase of 52%), while the customer-hours interrupted decreased from 57,432 in 2017, to 50,805 in 2018 (a decrease of 12%).

In 2018, excluding major storms, the Central Region experienced 2,274 distribution interruptions. These interruptions accounted for 98% of the region's total interruptions (2,274 of 2,313), 75% of the region's total customers interrupted, (249,798 of 334,013), and 87% (522,240 of 601,661) of the region's total customer-hours interrupted. Overall, distribution interruptions had a CAIDI of 2.09 hours, and a SAIFI of 0.87 interruptions.

The number of distribution-related interruptions increased from 1,988 to 2,274 from 2017 to 2018 (an increase of 14%). The number of customers interrupted increased from 196,275 in 2017, to 249,798 in 2018 (an increase of 27%), while the customer-hours interrupted increased from 425,131 in 2017, to 522,240 in 2018 (an increase of 23%).

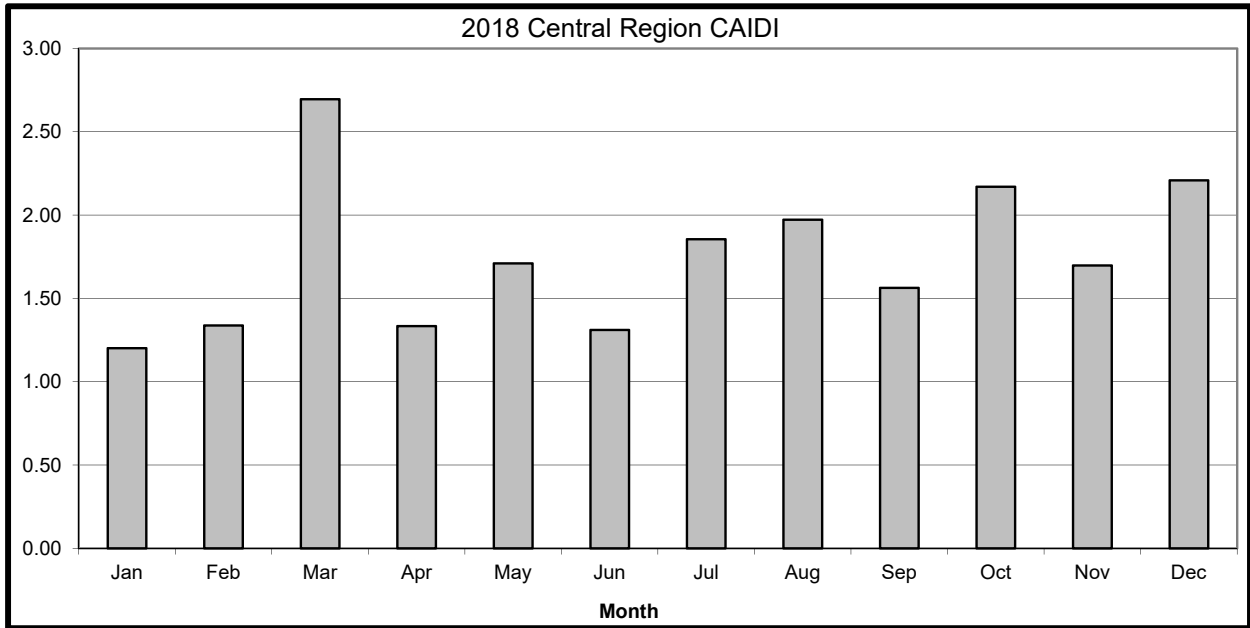
### c. MONTHLY CAIDI AND SAIFI GRAPHS

The following graphs show the monthly CAIDI and SAIFI for the Central Region for 2018 (Excluding Major Storms).

Regional CAIDI exceeded the PSC target of 1.899 hours in March (2.70), August (1.97), October (2.17) and December (2.21). CAIDI in March and October was influenced by minor storms. The storm dates were March 2<sup>nd</sup> and October 15<sup>th</sup>. On March 2<sup>nd</sup>, Mohawk Valley (neighboring region), Capital and Northeast regions all qualified for PSC Major Storms. On October 15<sup>th</sup>, Northeast Region qualified for a PSC Major Storm. CAIDI in August was influenced by a tree events (PSC cause code 02). Trees accounted for 21% of the customers interrupted and had a CAIDI of 2.74. CAIDI in December was influenced by events on December 28<sup>th</sup> and 29<sup>th</sup>. These two days had 29% of the customers interrupted for the month and a CAIDI of 2.58.

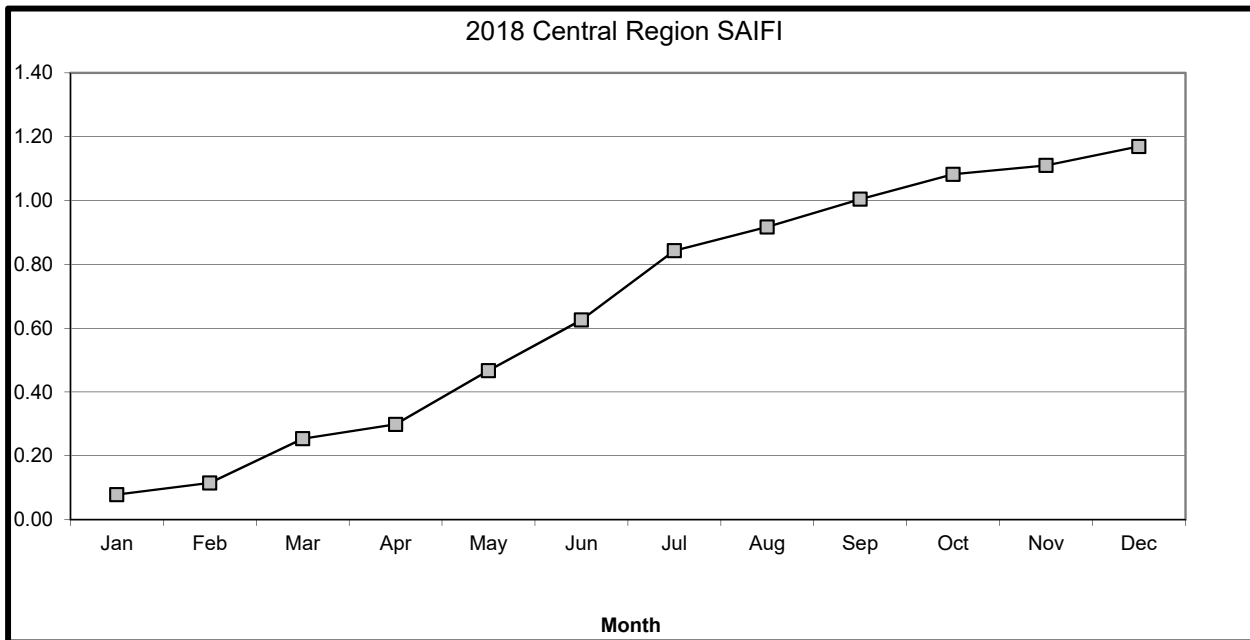
Regional SAIFI was above the monthly targets in March (0.13), May (0.17), June (0.16) and July (0.21). The SAIFI was above target in March and May due to Minor Storms. The storm dates were: March 2<sup>nd</sup> and May 4<sup>th</sup>. On March 2<sup>nd</sup>, Mohawk Valley (neighboring region), Capital and Northeast regions all qualified for PSC Major Storms. On May 4<sup>th</sup>, Frontier, Genesee, Mohawk Valley (neighboring region), Northern (neighboring region) and Capital Regions qualified for PSC Major Storms. June's SAIFI was affected by several substation interruptions. On June 13<sup>th</sup>, Gilbert Mills was interrupted to remove the mobile transformer and Bartell Road was interrupted on June 22<sup>nd</sup> due to animal contact. July's SAIFI was impacted by weather on the 2<sup>nd</sup> and substation events on the 18<sup>th</sup> and 19<sup>th</sup>. On July 18<sup>th</sup>, one of the 13.2kV buses at Ash Street was interrupted due to a slow breaker. On July 19<sup>th</sup>, an animal got into the distribution bus at Bartell Road.

GRAPH OF MONTHLY CAIDI AND SAIFI FOR CENTRAL REGION



PSC CAIDI Goal:	
Minimum	1.899
2017 Actual	1.80

PSC SAIFI Goal:	
Minimum	1.226
2017 Actual	1.17





d. PSC CAUSE CODES

1) Number of Events by Cause – Historical

IDS Info:

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	635	419	142	33	409	380
<b>02</b> Tree Contacts	693	577	601	497	507	535
<b>03</b> Overloads	69	9	33	32	25	33
<b>04</b> Operator Error	5	7	9	9	9	6
<b>05</b> Equipment	688	654	624	628	640	629
<b>06</b> Accidents	445	397	473	428	411	352
<b>07</b> Prearranged	81	67	93	106	82	174
<b>08</b> Customer Equip.	-	0	0	0	0	0
<b>09</b> Lightning	66	36	69	81	110	84
<b>10</b> Unknown	266	286	299	242	245	208
<b>Total</b>	<b>2,948</b>	<b>2,452</b>	<b>2,343</b>	<b>2,056</b>	<b>2,438</b>	<b>2,401</b>

2) Customers Interrupted by Cause – Historical

IDS Info:

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	96,440	49,394	21,105	14,716	65,205	81,627
<b>02</b> Tree Contacts	108,612	94,053	82,511	86,352	81,930	72,955
<b>03</b> Overloads	1,446	1,241	9,503	1,391	3,670	480
<b>04</b> Operator Error	7,145	1,807	6,906	6,175	4,230	789
<b>05</b> Equipment	104,157	106,175	88,358	89,296	128,070	93,388
<b>06</b> Accidents	49,516	34,450	58,636	91,555	67,309	53,813
<b>07</b> Prearranged	32,038	20,802	30,806	8,615	7,569	11,300
<b>08</b> Customer Equip.	-	0	0	0	0	0
<b>09</b> Lightning	4,531	5,568	5,758	11,966	26,026	2,535
<b>10</b> Unknown	26,568	64,425	30,314	37,353	32,051	17,505
<b>Total</b>	<b>430,453</b>	<b>377,915</b>	<b>333,897</b>	<b>347,419</b>	<b>416,060</b>	<b>334,392</b>

### 3) Customer-Hours Interrupted by Cause – Historical

IDS Info:

Cause Code	2018	2017	2016	2015	2014	2013
01 Major Storms	508,277	246,273	72,404	38,937	468,164	324,027
02 Tree Contacts	225,964	187,343	229,527	164,131	161,109	167,700
03 Overloads	3,961	354	3,906	8,713	3,264	1,424
04 Operator Error	4,382	1,103	2,533	4,872	3,269	504
05 Equipment	181,626	206,034	156,231	181,996	225,310	159,341
06 Accidents	89,571	58,404	88,460	146,486	80,295	78,103
07 Prearranged	15,378	10,547	18,852	14,772	17,794	15,622
08 Customer Equip.	-	0	0	0	0	0
09 Lightning	15,939	6,325	10,353	32,644	32,684	8,740
10 Unknown	64,843	88,780	71,086	53,898	43,376	33,359
Total	1,109,938	805,161	653,352	646,449	1,035,264	788,820

### 4) Interruptions, Customers Interrupted and Customer-Hours Interrupted - 2018

Cause Code	Interruptions		Customers Interrupted		Customer-Hours Interrupted	
	Number	% Total	Number	% Total	Number	% Total
01 Major Storms	635	21.5%	96,440	22.4%	508,277	45.8%
02 Tree Contacts	693	23.5%	108,612	25.2%	225,964	20.4%
03 Overloads	69	2.3%	1,446	0.3%	3,961	0.4%
04 Operator Error	5	0.2%	7,145	1.7%	4,382	0.4%
05 Equipment	688	23.3%	104,157	24.2%	181,626	16.4%
06 Accidents	445	15.1%	49,516	11.5%	89,571	8.1%
07 Prearranged	81	2.7%	32,038	7.4%	15,378	1.4%
08 Customer Equip.	0	0.0%	0	0.0%	0	0.0%
09 Lightning	66	2.2%	4,531	1.1%	15,939	1.4%
10 Unknown	266	9.0%	26,568	6.2%	64,843	5.8%
Total	2,948	100.0%	430,453	100.0%	1,109,941	100.0%

e. **INTERRUPTION REVIEW BY PSC CAUSE CODES**

**Cause Code 01 - Major Storms**

In 2018, Major Storms accounted for 22% of interruptions, 22% of customers interrupted, and 46% of Customer-Hours Interrupted.

Interruptions due to Major Storm were up 52% from 2017, and up 129% over the 5 year average. Customers interrupted due to Major Storms were up 95% from 2017, and up 108% over the 5 year average. Customer-Hours interrupted were up 106% from 2017 and up 121% over the 5 year average.

The remaining PSC code descriptions do not include Major Storms in the percentages.

**Cause Code 02 - Tree Contacts**

In 2018, Tree Contacts accounted for 30% of interruptions, 33% of customers interrupted, and 38% of Customer-Hours Interrupted.

Interruptions due to Tree Contacts were up 20% from 2017, and up 28% over the 5 year average. Customers interrupted due to Tree Contacts were up 15% from 2017, and up 30% over the 5 year average. Customer-Hours interrupted were up 21% from 2017 and up 24% over the 5 year average.

Tree Contacts were the largest cause of interruptions in 2018.

**Cause Code 03 - Overloads**

In 2018, Overloads accounted for 3% of interruptions, 0% of customers interrupted, and 1% of Customer-Hours Interrupted.

Interruptions due to Overloads were up 667% from 2017, and up 165% over the 5 year average. Customers interrupted due to Overloads were up 17% from 2017, and down 56% over the 5 year average. Customer-Hours interrupted were up 1019% from 2017 and up 12% over the 5 year average.

Overloads were the 6th largest cause of interruptions in 2018.

**Cause Code 04 - Operator Error**

In 2018, Operator Error accounted for 0% of interruptions, 2% of customers interrupted, and 1% of Customer-Hours Interrupted.

Interruptions due to Operator Error were down 29% from 2017, and down 38% over the 5 year average. Customers interrupted due to Operator Error were up 295% from 2017, and up 79% over the 5 year average. Customer-Hours interrupted were up 297% from 2017 and up 78% over the 5 year average.

Operator Error was the 8th largest cause of interruptions in 2018.

### **Cause Code 05 - Equipment Failure**

In 2018, Equipment Failures accounted for 30% of interruptions, 31% of customers interrupted, and 30% of Customer-Hours Interrupted.

Interruptions due to Equipment Failure were up 5% from 2017, and up 8% over the 5 year average. Customers interrupted due to Equipment Failure were down 2% from 2017, and up 3% over the 5 year average. Customer-Hours interrupted were down 12% from 2017 and down 2% over the 5 year average.

Equipment Failures were the 2nd largest cause of interruptions in 2018.

### **Cause Code 06 - Accidents**

In 2018, Accidents accounted for 19% of interruptions, 15% of customers interrupted, and 15% of Customer-Hours Interrupted.

Interruptions due to Accidents were up 12% from 2017, and up 8% over the 5 year average. Customers interrupted due to Accidents were up 44% from 2017, and down 19% over the 5 year average. Customer-Hours interrupted were up 53% from 2017 and down 1% over the 5 year average.

Accidents were the 3rd largest cause of interruptions in 2018.

### **Cause Code 07 - Prearranged**

In 2018, Prearranged accounted for 4% of interruptions, 10% of customers interrupted, and 3% of Customer-Hours Interrupted.

Interruptions due to Prearranged were up 21% from 2017, and down 22% over the 5 year average. Customers interrupted due to Prearranged were up 54% from 2017, and up 103% over the 5 year average. Customer-Hours interrupted were up 46% from 2017 and down 1% over the 5 year average.

Prearranged was the 5th largest cause of interruptions in 2018.

### **Cause Code 08 - Customer Equipment**

There were no Customer Equipment interruptions in 2018.

### **Cause Code 09 - Lightning**

In 2018, Lightning accounted for 3% of interruptions, 1% of customers interrupted, and 3% of Customer-Hours Interrupted.

Interruptions due to Lightning were up 83% from 2017, and down 13% over the 5 year average. Customers interrupted due to Lightning were down 19% from 2017, and down 56% over the 5 year average. Customer-Hours interrupted were up 152% from 2017 and down 12% over the 5 year average.

Lightning was the 7th largest cause of interruptions in 2018.

### **Cause Code 10 - Unknown**

In 2018, Unknown causes accounted for 12% of interruptions, 8% of customers interrupted, and 11% of Customer-Hours Interrupted.

Interruptions due to Unknown causes were down 7% from 2017, and up 4% over the 5 year average. Customers interrupted due to Unknown causes were down 59% from 2017, and down 27% over the 5 year average. Customer-Hours interrupted were down 27% from 2017 and up 12% over the 5 year average.

Unknown causes were the 4th largest cause of interruptions in 2018.

f. DISCUSSION OF REGIONAL CAPEX PROJECTS WITH 2017/18 SPENDS

The Company continues to work on capital projects in the Central Region in order to maintain customer satisfaction and future reliability. Some specific projects that were constructed in either CY18 or will be constructed in CY19 are listed below. Additional descriptions of other major infrastructure projects will follow.

There are several projects where lines are being rebuilt or recondoctored. These projects are either the result of engineering reliability reviews (ERRs) conducted on the Worst Performing Circuits or are the responses to customer inquiries via the Quick Resolution System (QRS). There are several sub-transmission line rebuild projects and a number of distribution line rebuild projects in progress.

Some of the distribution rebuild projects include recondoctoring approximately 5,000 feet on the Niles 51 feeder, recondoctoring approximately 7,500 feet on the Lords Hill 15066 feeder, and recondoctoring approximately 26,000 feet on the Lighthouse Hill 6144 feeder.

There are additional load relief projects scheduled to be completed throughout the region. Most of these load relief projects are ratio transformer replacements or voltage conversions. Line recondoctoring is also included in the voltage conversions, where appropriate.

There are also a number of substation projects that were completed or are either underway or slated to begin in 2019. All but one of these projects are load relief projects. These projects include constructing new substations or replacing transformers. New substation will be in Cicero and at Collamer Crossings. The substation slated for transformer replacement is Gilbert Mills. The switchgear at Hopkins Road is being replaced.

**Major Capital Projects for Central Region:**

<b>Region</b>	<b>Project Name</b>	<b>Project Type</b>	<b>Fin Sys Project No.</b>	<b>Finish</b>	<b>Total Spend</b>
Central	Ash-OCB Break Replacement & Relay Upgrade	Trans Sub	C043424	12/14/18	\$4,142,000
Central	Teall Ave to Ash St – Relay Replacement – LN 7&8	Trans Sub	C04342	12/14/18	\$4,142,000
Central	East Pulaski 324 Battery storage	Dist Sub		11/16/18	\$5,587,000
Central	Tully Center Replace TB1	Dist Sub		06/29/18	\$1,761,750

g. DISCUSSION OF REGIONAL PERFORMANCE OF LVAC (LOW VOLTAGE AC) NETWORK DISTRIBUTION SYSTEM(S)

**City of Syracuse - Ash Street LVAC Network**

The Ash Street LVAC Network serves the northern downtown area and James Street of the City of Syracuse. This system is supplied by ten 11.5kV feeders that originate from the Ash Street substation. This system serves approximately 2,048 customer accounts and experienced a peak load of approximately 29.877 MVA in 2018.

The table below lists the breaker operations in 2018 that were a result of a fault and/or failure.

<b>Substation</b>	<b>Feeder Number</b>	<b>Breaker Number</b>	<b>Breaker Number</b>	<b># Breaker Operations from Failures</b>
Ash Street	22340	R400	R4505	0
Ash Street	22341	R410	R4175	2
Ash Street	22342	R420	R4265	0
Ash Street	22343	R430	R4315	0
Ash Street	22344	R440	R4485	0
Ash Street	22345	R450	R4505	0
Ash Street	22346	R460	R4265	0
Ash Street	22347	R470	R4175	3
Ash Street	22348	R480	R4485	0
Ash Street	22349	R490	R4295	0

As shown above, the Ash Street LVAC Network experienced a total of five feeder outages in 2018. These outages caused zero customers to be interrupted. There were no customer interruptions and at no time was this network operated beyond its double contingency (N-2) design criteria.

There were no major events associated with the network in 2018.

Annual maintenance consisted of manhole and vault inspections, network protector and transformer inspections and network protector operation checks.

Equipment maintenance, in 2017, consisted of manhole and vault inspections, network protector and transformer inspections and network protector operation checks.

At this time, there are no major projects being designed and/or under construction.



### **City of Syracuse – Temple Street LVAC Network**

The Temple Street LVAC Network serves the southern downtown area of the City of Syracuse with several spot network services in the northern area. This network is supplied by seven 13.2kV feeders that originate from the Temple Street substation. This system serves approximately 270 customer accounts and experienced a peak load of approximately 20.341 MVA in 2018.

The table below lists the breaker operations in 2018 that were a result of a fault and/or failure.

<b>Substation</b>	<b>Feeder</b>	<b>Breaker</b>	<b>Breaker</b>	<b># Breaker Operations from Failures</b>
Temple Street	24349	R490	R4895	0
Temple Street	24350	R500	R5015	0
Temple Street	24353	R530	R5235	0
Temple Street	24354	R540	R5455	0
Temple Street	24356	R560	R5675	0
Temple Street	24357	R570	R5675	0
Temple Street	24358	R580	R5895	0

As shown above the Temple Street LVAC Network experienced zero feeder outages in 2018. There were no customer interruptions and at no time was this network operated beyond its double contingency (N-2) design criteria.

There were no major events associated with the network in 2018.

Annual maintenance consisted of manhole and vault inspections, network protector and transformer inspections and network protector operation checks.

Equipment maintenance in 2018 consisted of manhole and vault inspections, network protector and transformer inspections and network protector operation checks.

At this time, there are no major projects being designed and/or under construction.

## City of Cortland LVAC Network

The Cortland LVAC Network serves the downtown area of the City of Cortland along Main Street from Lincoln Avenue to Port Watson Street. This network is supplied by three 4.8kV feeders: two feeders from the Cortland Substation and one feeder from the Miller Street Substation. This system serves approximately 400 customer accounts and experienced a peak load of approximately 1.758 MVA in 2018.

The table below lists the breaker operations in 2017 that were a result of a fault and/or failure.

<b>Substation</b>	<b>Feeder Number</b>	<b>Breaker Number</b>	<b># Breaker Operations from Failures</b>
Cortland	50201	R010	0
Cortland	50204	R040	0
Miller Street	11705	R050	0

As shown above the Cortland LVAC Network experienced zero feeder outages in 2018. There were no customer interruptions and at no time was this network operated beyond its single contingency (N-1) design criteria.

There were no major events associated with the network in 2018.

Annual maintenance consisted of manhole and vault inspections, network protector and transformer inspections and network protector operation checks.

Equipment maintenance in 2018 consisted of manhole and vault inspections, network protector and transformer inspections and network protector operation checks.

No major projects have been recently installed, being currently designed, or being currently installed.

The Company has decided to transform this LVAC Network system into a LVAC Radial system. The project to disassemble the network is scheduled to begin in 2021.

## 2. OPERATING CIRCUIT LISTS

The next three (3) tables will provide the following information for the Central Region.

- a. Worst Performing Circuit List
- b. Worst Performing Circuits with 3 Year History for CAIDI and SAIFI Indices
- c. Worst Performing Circuits by # of Momentary Interruptions

a. NATIONAL GRID WORST PERFORMING CIRCUIT LIST

CENTRAL REGION

FEEDER #	A CUST. SERVED	B TOTAL INTER.	C # CUST. INTER.	D CUST. HRS. INTER.	C/A SAIFI	D/A SAIDI	D/C CAIDI	NUMBER OF MOMENTARIES
LIGHTHOUSE HILL 6144	2,212	70	14,250	27,601	6.44	12.48	1.94	0
WEST MONROE 27451	1,978	45	7,550	12,886	3.82	6.51	1.71	7
GILBERT MILLS 24751	2,135	22	11,503	16,185	5.39	7.58	1.41	1
TULLY CENTER 27851	2,124	39	7,617	10,420	3.59	4.91	1.37	3
TULLY CENTER 27853	1,229	22	7,187	7,610	5.85	6.19	1.06	3
BARTELL RD 32555	2,205	24	6,107	12,726	2.77	5.77	2.08	7
WHITAKER 29653	2,274	20	8,169	14,136	3.59	6.22	1.73	3
LIGHTHOUSE HILL 6141	858	25	2,307	5,857	2.69	6.83	2.54	0
WEST CLEVELAND 32651	737	14	2,735	10,208	3.71	13.85	3.73	5
NEW HAVEN 25653	1,992	19	4,848	12,295	2.43	6.17	2.54	1
SORRELL HILL 26952	2,669	24	6,101	11,992	2.29	4.49	1.97	0
PALOMA 25456	1,757	24	3,367	11,596	1.92	6.60	3.44	0
TEMPLE 24347	2,408	19	8,059	9,165	3.35	3.81	1.14	12
NILES 29451	1,298	36	2,257	6,836	1.74	5.27	3.03	2
SANDY CREEK 6651	1,738	38	3,207	7,901	1.85	4.55	2.46	5
PHOENIX 5164	1,010	10	3,634	10,616	3.60	10.51	2.92	3
COLOSSE 32151	2,559	30	4,121	10,519	1.61	4.11	2.55	7
GRANBY CENTER 29351	1,838	20	2,846	10,605	1.55	5.77	3.73	0
CONSTANTIA 1923	739	16	2,115	4,225	2.86	5.72	2.00	7
BARTELL RD 32554	2,742	14	5,729	14,330	2.09	5.23	2.50	2

Regional Goals:  
CAIDI Min. 1.899  
SAIFI Min. 1.226

b. NATIONAL GRID WORST PERFORMING CIRCUITS WITH 3 YEAR HISTORY FOR CAIDI AND SAIFI INDICES

CENTRAL REGION

FEEDER #	2018 CAIDI	2017 CAIDI	2016 CAIDI	2015 CAIDI	2018 SAIFI	2017 SAIFI	2016 SAIFI	2015 SAIFI
LIGHTHOUSE HILL 6144	1.94	3.49	1.95	3.23	6.44	2.44	5.24	1.62
WEST MONROE 27451	1.71	0.89	1.89	0.92	3.82	2.54	2.72	1.51
GILBERT MILLS 24751	1.41	0.55	2.83	2.11	5.39	2.34	1.06	1.49
TULLY CENTER 27851	1.37	0.60	1.14	2.48	3.59	4.90	3.00	0.46
TULLY CENTER 27853	1.06	1.30	1.87	4.60	5.85	7.57	1.29	0.48
BARTELL RD 32555	2.08	4.12	2.28	1.12	2.77	0.21	0.50	1.25
WHITAKER 29653	1.73	5.11	2.59	1.86	3.59	0.26	0.17	1.07
LIGHTHOUSE HILL 6141	2.54	2.95	3.13	3.55	2.69	0.21	0.58	1.54
WEST CLEVELAND 32651	3.73	3.73	2.64	1.36	3.71	3.79	5.07	2.42
NEW HAVEN 25653	2.54	3.38	0.55	2.11	2.43	0.23	4.50	3.62
SORRELL HILL 26952	1.97	1.86	3.39	3.16	2.29	1.26	0.17	0.34
PALOMA 25456	3.44	3.24	1.55	1.68	1.92	0.25	0.77	3.88
TEMPLE 24347	1.14	1.80	0.94	1.02	3.35	0.07	1.12	1.34
NILES 29451	3.03	2.55	5.04	2.65	1.74	2.20	1.19	2.88
SANDY CREEK 6651	2.46	2.50	2.73	2.64	1.85	0.45	1.19	2.15
PHOENIX 5164	2.92	1.13	0.64	1.03	3.60	1.16	0.03	1.05
COLOSSE 32151	2.55	1.51	3.04	0.79	1.61	2.58	2.32	4.01
GRANBY CENTER 29351	3.73	2.24	3.84	0.86	1.55	2.86	3.26	1.43
CONSTANTIA 1923	2.00	1.49	3.32	1.37	2.86	5.37	2.29	1.72
BARTELL RD 32554	2.50	2.87	4.27	2.12	2.09	0.23	0.68	1.62

Regional Goals:  
CAIDI Min. 1.899  
SAIFI Min. 1.226

c. NATIONAL GRID WORST PERFORMING CIRCUITS BY # OF MOMENTARY INTERRUPTIONS

CENTRAL REGION

Feeders			Customer Momentaries				Ranks		
Volts (kV)	Station Name	Ckt/F No.	Substation	Transmission	Distribution	Total	Within Region	Within System	Reliability Ranking
13.2	TEMPLE	11-24347	1	0	11	12	1	2	82

d. WORST PERFORMING CIRCUIT ANALYSIS

This year, 2018, the Central Region is required to analyze and report on twenty of the worst performing circuits. The list consists of sixteen 13.2kV circuits, two 12kV circuit, one 4.8kV circuits and one 4.16kV circuit.

The PSC minimum goals for the Central Region are 1.899 hours for CAIDI and 1.226 interruptions for SAIFI.

**1. LIGHTHOUSE HILL 6144 - 12.0kV**

*Profile: 2,212 Customers, 157.9 Circuit Miles*  
*Indices: CAIDI = 1.94, SAIFI = 6.44*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	34	48.57%	5,842	41.00%	13,926	50.45%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	7.14%	6,636	46.57%	9,446	34.22%
6	ACCIDENTS	7	10.00%	277	1.94%	333	1.21%
7	PREARRANGED	4	5.71%	189	1.33%	73	0.26%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	3	4.29%	371	2.60%	723	2.62%
10	UNKNOWN	17	24.29%	935	6.56%	3,101	11.23%
Totals		70	100.00%	14,250	100.00%	27,601	100.00%

**Problem Analysis:**

- There were 70 interruptions on the Lighthouse Hill 6144 in 2018.
- There were no transmission interruptions.
  - There were 2 substation interruptions. These interruptions accounted for 31% of the total amount of customers interrupted (4,417 out of 14,250) and 29% of the total amount of the customer-hours interrupted (7,876 out of 27,601).
  - The first interruption occurred on May 29, 2018, coded as a cause of device failed (PSC cause code 05). This event accounted for 15% of the total customers interrupted (2,203 of 14,250), and 15% of the total customer-hours interrupted (4,039 of 27,601). The interruption was due to the feeder regulator which had failed.
  - The second interruption occurred on July 27, 2018, coded as a cause of device failed (PSC cause code 05). This event accounted for 16% of the total customers interrupted (2,214 of 14,250), and 14% of the total customer-hours interrupted (3,838 of 27,601). This interruption was due to the failure of a 34.5kV switch on the 115-34.5kV transformer and the fact that Brookfield Hydro does not have reclosing on the distribution bus.
- The remaining 68 events occurred at the distribution level.
- The distribution circuit breaker for the Lighthouse Hill 6144 experienced 0 momentary operations in 2018.
- The circuit breaker for the Lighthouse Hill 6144 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 16% of the total amount of customers interrupted (2,214 out of 14,250) and 9% of the total amount of the customer-hours interrupted (2,399 out of 27,601).



- This lockout occurred on July 25, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 16% of the total customers interrupted (2,214 of 14,250), and 9% of the total customer-hours interrupted (2,399 of 27,601).
- Trees were the leading cause of interruptions on the Lighthouse Hill 6144 in 2018, accounting for 49% of total interruptions (34 of 70). Unknown were the 2nd leading cause of interruptions, accounting for 24% of total interruptions (17 of 70). Accidents were the 3rd leading cause of interruptions, accounting for 10% of total interruptions (7 of 70).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Lighthouse Hill 6144 in 2018, accounting for 47% of total customers interrupted (6,636 of 14,250). Trees were the 2nd leading cause of customers interrupted, accounting for 41% of total customers interrupted (5,842 of 14,250). Unknown were the 3rd leading cause of customers interrupted, accounting for 7% of total customers interrupted (935 of 14,250).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Lighthouse Hill 6144 in 2018, accounting for 50% of total customer-hours interrupted (13,926 of 27,601). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 34% of total customer-hours interrupted (9,446 of 27,601). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 11% of total customer-hours interrupted (3,101 of 27,601).
- Of the 70 interruptions on this circuit, 15 affected 10 customers or less, with 9 being single customer outages.
- The first set of switches on the feeder were opened on July 25, 2018, coded as a cause of device failed (PSC cause code 05). This interruption accounted for 16% of the total customers interrupted (2,214 of 14,250), and 6% of the total customer-hours interrupted (1,550 of 27,601). They were opened for an insulator that was burning.
- There were two separate recloser lockouts on the feeder. They accounted for 14% of the total customers interrupted (1,946 out of 14,250) and 15% of the total customer-hours interrupted.
  - The first interruption occurred on May 4, 2018, coded as a cause of tree fell (PSC cause code 02). This event accounted for 7% of the total customers interrupted (1,046 of 14,250), and 10% of the total customer-hours interrupted (2,885 of 27,601). This was the recloser on pole 159 County Route 2.
  - The second interruption occurred on July 26, 2018, coded as a cause of tree fell (PSC cause code 02). This event accounted for 7% of the total customers interrupted (900 of 14,250), and 4% of the total customer-hours interrupted (1,198 of 27,601). This was the recloser on pole 78 Tubbs Rd.

**Action Taken:**

- Completed all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by September 2018.
- Distribution Forestry completed hazard tree removal on the feeder in FY2017.
- Distribution Forestry cycle pruned the feeder in FY2014.
- Regulators installed outside the substation, August 2018.

**Action Plan:**

- Routine tree trimming/pruning to be completed in FY2020.
- Distribution forestry to perform hazard tree removals in FY2020.
- Rebuild N Osceola Rd in FY2020.
- Rebuild County Route 47 in FY2020.
- Install Trip Savers on the feeder in FY2019.

## 2. WEST MONROE 27451 - 13.2kV

Profile: 1,978 Customers, 87.7 Circuit Miles  
 Indices: CAIDI = 1.71, SAIFI = 3.82

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	16	35.56%	4,542	60.16%	7,039	54.63%
3	OVERLOADS	1	2.22%	7	0.09%	39	0.30%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	11	24.44%	2,145	28.41%	3,700	28.71%
6	ACCIDENTS	8	17.78%	107	1.42%	467	3.63%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.gt	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	3	6.67%	317	4.20%	687	5.33%
10	UNKNOWN	6	13.33%	432	5.72%	954	7.40%
Totals		45	100.00%	7,550	100.00%	12,886	100.00%

### Problem Analysis:

- There were 45 interruptions on the West Monroe 27451 in 2018.
- There were 2 transmission interruptions.
  - The first lockout occurred on March 31, 2018, coded as a cause of tree limb (PSC cause code 02). This lockout accounted for 26% of the total customers interrupted (1,965 of 7,550), and 20% of the total customer-hours interrupted (2,554 of 12,886). This event was on the 34.5kV subtransmission line that serve the substation.
  - The second lockout occurred on May 4, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 26% of the total customers interrupted (1,978 of 7,550), and 25% of the total customer-hours interrupted (3,264 of 12,886). This event was due to a down conductor on the 115kV transmission line that feeds the subtransmission system in the area.
- There were no substation interruptions.
- The remaining 43 events occurred at the distribution level.
- The distribution circuit breaker for the West Monroe 27451 experienced 7 momentary operations in 2018.
- The distribution circuit breaker for the West Monroe 27451 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 26% of the total amount of customers interrupted (1,981 out of 7,550) and 22% of the total amount of the customer-hours interrupted (2,773 out of 12,886).
  - This lockout occurred on March 03, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 26% of the total customers interrupted (1,981 of 7,550), and 22% of the total customer-hours interrupted (2,773 of 12,886).

- Trees were the leading cause of interruptions on the West Monroe 27451 in 2018, accounting for 36% of total interruptions (16 of 45). Equipment Failures were the 2nd leading cause of interruptions, accounting for 24% of total interruptions (11 of 45). Accidents were the 3rd leading cause of interruptions, accounting for 18% of total interruptions (8 of 45).
- Trees were the leading cause of customers interrupted (CI) on the West Monroe 27451 in 2018, accounting for 60% of total customers interrupted (4,542 of 7,550). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 28% of total customers interrupted (2,145 of 7,550). Unknown were the 3rd leading cause of customers interrupted, accounting for 6% of total customers interrupted (432 of 7,550).
- Trees were the leading cause of customer-hours interrupted (CHI) on the West Monroe 27451 in 2018, accounting for 55% of total customer-hours interrupted (7,039 of 12,886). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 29% of total customer-hours interrupted (3,700 of 12,886). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 7% of total customer-hours interrupted (954 of 12,886).
- Of the 45 interruptions on this circuit, 22 affected 10 customers or less, with 11 being single customer outages.

**Action Taken:**

- Distribution Forestry cycle pruned the feeder in FY2015.
- Transmission forestry cycle pruned the 34.5kV subtransmission line in 2017.
- Transmission forestry removed Ash tree in 2017.
- The I&M inspection (foot patrol) of the feeder was completed in March 2018.

**Action Plan:**

- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by March 2019.
- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by March 2021.
- Distribution forestry to perform hazard tree removals in FY2021.
- Routine tree trimming/pruning to be completed in FY2021.
- Distribution Forestry to review the circuit.
- Install Trip Savers on the feeder in FY2019.

### 3. GILBERT MILLS 24751 - 13.2kV

Profile: 2,135 Customers, 77.1 Circuit Miles  
 Indices: CAIDI = 1.41, SAIFI = 5.39

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	5	22.73%	430	3.74%	497	3.07%
3	OVERLOADS	1	4.55%	1	0.01%	8	0.05%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	22.73%	8	0.07%	46	0.29%
6	ACCIDENTS	2	9.09%	2	0.02%	4	0.02%
7	PREARRANGED	4	18.18%	8,519	74.06%	1,278	7.90%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	5	22.73%	2,543	22.11%	14,352	88.67%
Totals		22	100.00%	11,503	100.00%	16,185	100.00%

**Problem Analysis:**

- There were 22 interruptions on the Gilbert Mills 24751 in 2018.
- There was 1 transmission interruption.
  - This interruption occurred on April 18, 2018, coded as a cause of prearranged (PSC cause code 07). This event accounted for 19% of the total customers interrupted (2,133 of 11,503), and 2% of the total customer-hours interrupted (356 of 16,185). This was to operate 115kV switch dead for scheduled switching.
- There were 3 substation interruptions.
  - These three interruptions occurred on May 14, June 2 and June 13, 2018, all coded as a cause of prearranged (PSC cause code 07). These events accounted for 56% of the total customers interrupted (6,386 of 11,503), and 6% of the total customer-hours interrupted (923 of 16,185). These events were for switching the mobile in and out of service.
- The remaining 18 events occurred at the distribution level.
- The distribution circuit breaker for the Gilbert Mills 24751 experienced 1 momentary operation in 2018.
- The distribution circuit breaker for the Gilbert Mills 24751 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 18% of the total amount of customers interrupted (2,128 out of 11,503) and 83% of the total amount of the customer-hours interrupted (13,406 out of 16,185).
  - This lockout occurred on March 02, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 18% of the total customers interrupted (2,128 of 11,503), and 83% of the total customer-hours interrupted (13,406 of 16,185). This event was during a minor storm.

- Trees were the leading cause of interruptions on the Gilbert Mills 24751 in 2018, accounting for 23% of total interruptions (5 of 22). Equipment Failures were the 2nd leading cause of interruptions, accounting for 23% of total interruptions (5 of 22). Unknown were the 3rd leading cause of interruptions, accounting for 23% of total interruptions (5 of 22).
- Prearranged were the leading cause of customers interrupted (CI) on the Gilbert Mills 24751 in 2018, accounting for 74% of total customers interrupted (8,519 of 11,503). Unknown were the 2nd leading cause of customers interrupted, accounting for 22% of total customers interrupted (2,543 of 11,503). Trees were the 3rd leading cause of customers interrupted, accounting for 4% of total customers interrupted (430 of 11,503).
- Unknown were the leading cause of customer-hours interrupted (CHI) on the Gilbert Mills 24751 in 2018, accounting for 89% of total customer-hours interrupted (14,352 of 16,185). Prearranged were the 2nd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (1,278 of 16,185). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 3% of total customer-hours interrupted (497 of 16,185).
- Of the 22 interruptions on this circuit, 9 affected 10 customers or less, with 7 being single customer outages.

**Action Taken:**

- Completed all level 2 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by June 2018.
- Distribution Forestry completed hazard tree removals in FY2016.

**Action Plan:**

- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by June 2020.
- Distribution forestry to perform hazard tree/ash tree removals in FY2019.

#### 4. TULLY CENTER 27851 - 13.2kV

Profile: 2,124 Customers, 109.0 Circuit Miles  
 Indices: CAIDI = 1.37, SAIFI = 3.59

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	18	46.15%	1,307	17.16%	3,033	29.11%
3	OVERLOADS	1	2.56%	5	0.07%	22	0.21%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	8	20.51%	2,241	29.42%	2,946	28.28%
6	ACCIDENTS	4	10.26%	1,278	16.78%	2,336	22.42%
7	PREARRANGED	2	5.13%	2,128	27.94%	384	3.68%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	2	5.13%	19	0.25%	70	0.68%
10	UNKNOWN	4	10.26%	639	8.39%	1,628	15.62%
Totals		39	100.00%	7,617	100.00%	10,420	100.00%

**Problem Analysis:**

- There were 39 interruptions on the Tully Center 27851 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This interruption occurred on May 8, 2018, coded as a cause of prearranged (PSC cause code 07). This event accounted for 28% of the total customers interrupted (2,114 of 7,617), and 3% of the total customer-hours interrupted (352 of 10,420). This event was to install the mobile sub.
- The remaining 38 events occurred at the distribution level.
- The distribution circuit breaker for the Tully Center 27851 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Tully Center 27851 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 28% of the total amount of customers interrupted (2,125 out of 7,617) and 26% of the total amount of the customer-hours interrupted (2,720 out of 10,420).
  - This lockout occurred on April 21, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 28% of the total customers interrupted (2,125 of 7,617), and 26% of the total customer-hours interrupted (2,720 of 10,420). This event was due to failed insulators.
- Trees were the leading cause of interruptions on the Tully Center 27851 in 2018, accounting for 46% of total interruptions (18 of 39). Equipment Failures were the 2nd leading cause of interruptions, accounting for 21% of total interruptions (8 of 39). Accidents were the 3rd leading cause of interruptions, accounting for 10% of total interruptions (4 of 39).

- Equipment Failures were the leading cause of customers interrupted (CI) on the Tully Center 27851 in 2018, accounting for 29% of total customers interrupted (2,241 of 7,617). Prearranged were the 2nd leading cause of customers interrupted, accounting for 28% of total customers interrupted (2,128 of 7,617). Trees were the 3rd leading cause of customers interrupted, accounting for 17% of total customers interrupted (1,307 of 7,617).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Tully Center 27851 in 2018, accounting for 29% of total customer-hours interrupted (3,033 of 10,420). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 28% of total customer-hours interrupted (2,946 of 10,420). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 22% of total customer-hours interrupted (2,336 of 10,420).
- Of the 39 interruptions on this circuit, 15 affected 10 customers or less, with 6 being single customer outages.
- The switches (4188) on pole 22 US Hwy 11 were opened on October 26, 2018, coded as a MVA (PSC cause code 06). This interruption accounted for 17% of the total amount of customers interrupted (1,260 out of 7,617) and 22% of the total amount of the customer-hours interrupted (2,306 out of 10,420).
- There were six recloser lockouts in 2018. These interruptions accounted for 22% of the total amount of customers interrupted (1,645 out of 7,617) and 33% of the total amount of the customer-hours interrupted (3,401 out of 10,420).
  - The recloser (R41342) on North Rd lockout occurred on December 27, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 8% of the total customers interrupted (581 of 7,617), and 14% of the total customer-hours interrupted (1,462 of 10,420).
  - The recloser (R41340) on Sky High Rd locked out twice on April 12, 2018, coded as a cause of tree fell (PSC cause code 02). These lockouts accounted for 2% of the total customers interrupted (126 of 7,617), and 2% of the total customer-hours interrupted (169 of 10,420).
  - The recloser (R41343) on Apulia Rd lockout occurred on March 2, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 4% of the total customers interrupted (283 of 7,617), and 7% of the total customer-hours interrupted (684 of 10,420).
  - The recloser (R4134) on NYS Rte 80 lockouts occurred on July 2 and September 25, 2018, coded as a cause of tree fell (PSC cause code 02). These lockouts accounted for 9% of the total customers interrupted (655 of 7,617), and 10% of the total customer-hours interrupted (1,086 of 10,420).

**Action Taken:**

- The station transformer was replaced in June 2018.
- Distribution Forestry cycle pruned the feeder in FY2014.
- Distribution Forestry completed hazard tree removal on the feeder in FY2017.



**Action Plan:**

- Routine tree trimming/pruning to be completed in FY2020.
- Distribution forestry to perform hazard tree/ash tree removals in FY2019.
- Complete all level 2 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by January 2019.
- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by January 2021.

## 5. TULLY CENTER 27853 - 13.2kV

Profile: 1,229 Customers, 81.9 Circuit Miles  
 Indices: CAIDI = 1.06, SAIFI = 5.85

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	31.82%	3,261	45.37%	4,266	56.06%
3	OVERLOADS	1	4.55%	3	0.04%	20	0.26%
4	OPER. ERROR	1	4.55%	1,234	17.17%	247	3.24%
5	EQUIPMENT	6	27.27%	1,283	17.85%	2,537	33.33%
6	ACCIDENTS	4	18.18%	134	1.86%	267	3.50%
7	PREARRANGED	2	9.09%	1,258	17.50%	249	3.27%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	1	4.55%	14	0.19%	25	0.33%
Totals		22	100.00%	7,187	100.00%	7,610	100.00%

### Problem Analysis:

- There were 22 interruptions on the Tully Center 27853 in 2018.
- There were no transmission interruptions.
- There were 2 substation interruptions. These interruptions occurred on May 08 and June 25, 2018, coded as a cause of prearranged (PSC cause code 07). These events accounted for 34% of the total customers interrupted (2,458 of 7,187), and 6% of the total customer-hours interrupted (451 of 7,610). The May event was to install the mobile and the June event was to remove the mobile.
- The remaining 20 events occurred at the distribution level.
- The distribution circuit breaker for the Tully Center 27853 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Tully Center 27853 experienced 2 sustained operations (lockouts) in 2018. These interruptions accounted for 34% of the total amount of customers interrupted (2,441 out of 7,187) and 43% of the total amount of the customer-hours interrupted (3,303 out of 7,610).
  - The first lockout occurred on March 02, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 17% of the total customers interrupted (1,227 of 7,187), and 29% of the total customer-hours interrupted (2,168 of 7,610). This interruption occurred during a minor storm.
  - The second lockout occurred on September 25, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 17% of the total customers interrupted (1,214 of 7,187), and 15% of the total customer-hours interrupted (1,135 of 7,610).

- Trees were the leading cause of interruptions on the Tully Center 27853 in 2018, accounting for 32% of total interruptions (7 of 22). Equipment Failures were the 2nd leading cause of interruptions, accounting for 27% of total interruptions (6 of 22). Accidents were the 3rd leading cause of interruptions, accounting for 18% of total interruptions (4 of 22).
- Trees were the leading cause of customers interrupted (CI) on the Tully Center 27853 in 2018, accounting for 45% of total customers interrupted (3,261 of 7,187). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 18% of total customers interrupted (1,283 of 7,187). Prearranged were the 3rd leading cause of customers interrupted, accounting for 18% of total customers interrupted (1,258 of 7,187).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Tully Center 27853 in 2018, accounting for 56% of total customer-hours interrupted (4,266 of 7,610). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 33% of total customer-hours interrupted (2,537 of 7,610). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 4% of total customer-hours interrupted (267 of 7,610).
- Of the 22 interruptions on this circuit, 4 affected 10 customers or less, with 2 being single customer outages.
- One June 13, 2018, switches 4161 on pole 1 ½ Tully-Otisco Rd were opened, code as a cause of device failed (PSC cause code 05). This interruption accounted for 12% of the total amount of customers interrupted (839 out of 7,187) and 5% of the total amount of the customer-hours interrupted (378 out of 7,610). The switches were opened to isolate recloser R8421 which had failed.

**Action Taken:**

- Distribution Forestry cycle pruned the feeder in FY2014.
- The station transformer was replaced in June 2018.
- Recloser on pole 66 ½ NYS Hwy 80 was replaced in September 2018.
- Completed all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by August 2018.

**Action Plan:**

- Routine tree trimming/pruning to be completed in FY2020.
- Distribution forestry to perform hazard tree removals/ash tree in FY2019.

**6. BARTELL RD 32555 - 13.2kV**

*Profile: 2,205 Customers, 46.1 Circuit Miles*  
*Indices: CAIDI = 2.08, SAIFI = 2.77*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	8	33.33%	2,859	46.82%	5,880	46.20%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	12	50.00%	486	7.96%	1,921	15.09%
6	ACCIDENTS	2	8.33%	2,437	39.91%	3,833	30.12%
7	PREARRANGED	1	4.17%	324	5.31%	1,091	8.57%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	1	4.17%	1	0.02%	2	0.02%
Totals		24	100.00%	6,107	100.00%	12,726	100.00%

**Problem Analysis:**

- There were 24 interruptions on the Bartell Rd 32555 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This event occurred on June 22, 2018, coded as a cause of Animal (PSC cause code 06). This event accounted for 36% of the total customers interrupted (2,205 of 6,107), and 21% of the total customer-hours interrupted (2,720 of 12,726).
- The remaining 23 events occurred at the distribution level.
- The distribution circuit breaker for the Bartell Rd 32555 experienced 7 momentary operations in 2018.
- The distribution circuit breaker for the Bartell Rd 32555 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 16% of the total amount of customers interrupted (984 out of 6,107) and 13% of the total amount of the customer-hours interrupted (1,607 out of 12,726).
  - This lockout occurred on September 21, 2018, coded as a cause of tree - broken limb (PSC cause code 02). This lockout accounted for 16% of the total customers interrupted (984 of 6,107), and 13% of the total customer-hours interrupted (1,607 of 12,726).
- Equipment Failures were the leading cause of interruptions on the Bartell Rd 32555 in 2018, accounting for 50% of total interruptions (12 of 24). Trees were the 2nd leading cause of interruptions, accounting for 33% of total interruptions (8 of 24). Accidents were the 3rd leading cause of interruptions, accounting for 8% of total interruptions (2 of 24).

- Trees were the leading cause of customers interrupted (CI) on the Bartell Rd 32555 in 2018, accounting for 47% of total customers interrupted (2,859 of 6,107). Accidents were the 2nd leading cause of customers interrupted, accounting for 40% of total customers interrupted (2,437 of 6,107). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 8% of total customers interrupted (486 of 6,107).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Bartell Rd 32555 in 2018, accounting for 46% of total customer-hours interrupted (5,880 of 12,726). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 30% of total customer-hours interrupted (3,833 of 12,726). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 15% of total customer-hours interrupted (1,921 of 12,726).
- Of the 24 interruptions on this circuit, 8 affected 10 customers or less, with 6 being single customer outages.
- Recloser R40997 on Lakeshore Rd experienced 3 lockouts in 2018. They were on March 2, November 10 and November 12, 2018. The first 2 events were coded as a cause of tree - broken limb (PSC cause code 02) and the last one was coded as a cause of tree growth (PSC cause code 02). These events accounted for 22% of the total customers interrupted (1,374 of 6,107), and 29% of the customer-hours interrupted (3,736 of 12,726).
- The Champlain on the Lake URD experienced 5 interruptions in 2018. They were on May 16, August 8, August 26, September 5 and September 30, 2018. All events were coded as a cause of device failed (cable fault) (PSC cause code 05). These events accounted for 7% of the total customers interrupted (397 of 6,107), and 12% of the customer-hours interrupted (1,544 of 12,726).
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**Action Taken:**

- The I&M inspection (foot patrol) of the feeder was completed in December 2018.
- Distribution Forestry cycle pruned the feeder in FY2014.
- Distribution Forestry completed Ash tree removals on the feeder in FY2018.
- Champlain on the Lake URD cable was replaced in October 2018.
- An animal fence was installed at the Substation in September 2018.

**Action Plan:**

- Routine tree trimming/pruning to be completed in FY2020.
- Getaway cable to be replaced by June, 2019.
- Complete all level 2 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by December 2019.
- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by December 2021.

## 7. WHITAKER 29653 - 13.2kV

Profile: 2,274 Customers, 31.5 Circuit Miles  
 Indices: CAIDI = 1.73, SAIFI = 3.59

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	5	25.00%	2,270	27.79%	6,911	48.89%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	1	5.00%	2,255	27.60%	1,541	10.90%
5	EQUIPMENT	5	25.00%	2,927	35.83%	4,331	30.64%
6	ACCIDENTS	5	25.00%	436	5.34%	738	5.22%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	20.00%	281	3.44%	615	4.35%
Totals		20	100.00%	8,169	100.00%	14,136	100.00%

### Problem Analysis:

- There were 20 interruptions on the Whitaker 29653 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This event occurred on July 19, 2018, coded as a cause of operating/testing error (PSC cause code 04). This lockout accounted for 28% of the total customers interrupted (2,255 of 8,169), and 11% of the total customer-hours interrupted (1,541 of 14,136).
- The remaining 19 events occurred at the distribution level.
- The distribution circuit breaker for the Whitaker 29653 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Whitaker 29653 experienced 2 sustained operations (lockouts) in 2018. These interruptions accounted for 55% of the total amount of customers interrupted (4,529 out of 8,169) and 63% of the total amount of the customer-hours interrupted (8,912 out of 14,136).
  - The first lockout occurred on May 15, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 28% of the total customers interrupted (2,270 of 8,169), and 15% of the total customer-hours interrupted (2,100 of 14,136). This event was due to a down conductor.
  - The second lockout occurred on October 15, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 28% of the total customers interrupted (2,259 of 8,169), and 48% of the total customer-hours interrupted (6,812 of 14,136).

- Trees were the leading cause of interruptions on the Whitaker 29653 in 2018, accounting for 25% of total interruptions (5 of 20). Equipment Failures were the 2nd leading cause of interruptions, accounting for 25% of total interruptions (5 of 20). Accidents were the 3rd leading cause of interruptions, accounting for 25% of total interruptions (5 of 20).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Whitaker 29653 in 2018, accounting for 36% of total customers interrupted (2,927 of 8,169). Trees were the 2nd leading cause of customers interrupted, accounting for 28% of total customers interrupted (2,270 of 8,169). Operators Errors were the 3rd leading cause of customers interrupted, accounting for 28% of total customers interrupted (2,255 of 8,169).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Whitaker 29653 in 2018, accounting for 49% of total customer-hours interrupted (6,911 of 14,136). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 31% of total customer-hours interrupted (4,331 of 14,136). Operators Errors were the 3rd leading cause of customer-hours interrupted, accounting for 11% of total customer-hours interrupted (1,541 of 14,136).
- Of the 20 interruptions on this circuit, 10 affected 10 customers or less, with 4 being single customer outages.
- The ratio on W 5<sup>th</sup> Street experienced 2 sustained operations in 2018. These interruptions accounted for 12% of the total amount of customers interrupted (941 out of 8,169) and 16% of the total amount of the customer-hours interrupted (2,192 out of 14,136). The interruptions were on July 1 and August 27, 2018 coded as a cause of device failed (PSC cause code 05). In both cases, there was wire down on Beech St.

**Action Taken:**

- Completed all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by August 2017.
- Distribution Forestry cycle pruned the feeder in FY2013.

**Action Plan:**

- Routine tree trimming/pruning to be completed in FY2019.
- Distribution forestry to perform hazard tree/Ash tree removals in FY2019.
- The I&M inspection (foot patrol) of the feeder will be conducted 2019.
- Reconductor Beech St in 2019.

## 8. LIGHTHOUSE HILL 6141 - 12.0kV

*Profile: 858 Customers, 58.1 Circuit Miles*  
*Indices: CAIDI = 2.54, SAIFI = 2.69*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	10	40.00%	858	37.19%	3,190	54.46%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	8	32.00%	963	41.74%	1,835	31.33%
6	ACCIDENTS	3	12.00%	334	14.48%	279	4.77%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	16.00%	152	6.59%	553	9.44%
Totals		25	100.00%	2,307	100.00%	5,857	100.00%

**Problem Analysis:**

- There were 25 interruptions on the Lighthouse Hill 6141 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This interruption occurred on May 29, 2018, coded as a cause of device failed (PSC cause code 05). This event accounted for 37% of the total customers interrupted (848 of 2,307), and 24% of the total customer-hours interrupted (1,399 of 12,726). The feeder regulator on the 44 feeder failed causing the bus to lockout.
- The remaining 24 events occurred at the distribution level.
- The distribution circuit breaker for the Lighthouse Hill 6141 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the Lighthouse Hill 6141 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Lighthouse Hill 6141 in 2018, accounting for 40% of total interruptions (10 of 25). Equipment Failures were the 2nd leading cause of interruptions, accounting for 32% of total interruptions (8 of 25). Unknown were the 3rd leading cause of interruptions, accounting for 16% of total interruptions (4 of 25).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Lighthouse Hill 6141 in 2018, accounting for 42% of total customers interrupted (963 of 2,307). Trees were the 2nd leading cause of customers interrupted, accounting for 37% of total customers interrupted (858 of 2,307). Accidents were the 3rd leading cause of customers interrupted, accounting for 14% of total customers interrupted (334 of 2,307).



- Trees were the leading cause of customer-hours interrupted (CHI) on the Lighthouse Hill 6141 in 2018, accounting for 54% of total customer-hours interrupted (3,190 of 5,857). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 31% of total customer-hours interrupted (1,835 of 5,857). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 9% of total customer-hours interrupted (553 of 5,857).
- Of the 25 interruptions on this circuit, 10 affected 10 customers or less, with 4 being single customer outages.
- Switch 1673, pole 9 Cemetery Rd was opened 2 times in 2018. These interruptions accounted for 23% of the total amount of customers interrupted (535 out of 2,307) and 5% of the total amount of the customer-hours interrupted (313 out of 5,857).
  - The first interruption occurred on July 5, 2018, coded as a cause of vehicle (PSC cause code 06). This event accounted for 12% of the total customers interrupted (267 of 2,307), and 2% of the total customer-hours interrupted (120 of 5,857).
  - The second interruption occurred on November 30, 2018, coded as a cause of tree - broken limb (PSC cause code 02). This event accounted 12% of the total customers interrupted (268 of 2,307), and 3% of the total customer-hours interrupted (193 of 5,857).
- 

**Action Taken:**

- Completed all level 2 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by August 2017.
- Distribution Forestry cycle pruned the feeder in FY2013.

**Action Plan:**

- Routine tree trimming/pruning to be completed in FY2022.
- Distribution Forestry to review the circuit.
- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by August 2019.

**9. WEST CLEVELAND 32651 - 13.2kV**

*Profile: 737 Customers, 35.7 Circuit Miles*  
*Indices: CAIDI = 3.73, SAIFI = 3.71*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	6	42.86%	1,565	57.22%	7,634	74.78%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	21.43%	54	1.97%	371	3.64%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	5	35.71%	1,116	40.80%	2,203	21.58%
Totals		14	100.00%	2,735	100.00%	10,208	100.00%

**Problem Analysis:**

- There were 14 interruptions on the West Cleveland 32651 in 2018.
- There were 2 transmission interruptions.
  - The first lockout occurred on March 31, 2018, coded as a cause of tree limb (PSC cause code 02). This lockout accounted for 27% of the total customers interrupted (733 of 2,735), and 9% of the total customer-hours interrupted (953 of 10,208). This event was on the 34.5kV subtransmission line that serve the substation.
  - The second lockout occurred on May 4, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 27% of the total customers interrupted (737 of 2,735), and 12% of the total customer-hours interrupted (1,216 of 10,208). This event was due to a down conductor on the 115kV transmission line that feeds the subtransmission system in the area.
- There were no substation interruptions.
- The remaining 12 events occurred at the distribution level.
- The distribution circuit breaker for the West Cleveland 32651 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the West Cleveland 32651 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the West Cleveland 32651 in 2018, accounting for 43% of total interruptions (6 of 14). Unknown were the 2nd leading cause of interruptions, accounting for 36% of total interruptions (5 of 14). Equipment Failures were the 3rd leading cause of interruptions, accounting for 21% of total interruptions (3 of 14).

- Trees were the leading cause of customers interrupted (CI) on the West Cleveland 32651 in 2018, accounting for 57% of total customers interrupted (1,565 of 2,735). Unknown were the 2nd leading cause of customers interrupted, accounting for 41% of total customers interrupted (1,116 of 2,735). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 2% of total customers interrupted (54 of 2,735).
- Trees were the leading cause of customer-hours interrupted (CHI) on the West Cleveland 32651 in 2018, accounting for 75% of total customer-hours interrupted (7,634 of 10,208). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 22% of total customer-hours interrupted (2,203 of 10,208). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 4% of total customer-hours interrupted (371 of 10,208).
- Of the 14 interruptions on this circuit, 6 affected 10 customers or less, with 3 being single customer outages.
- There were 3 fuse interruptions for the fuses on pole 185, County Route 17 (Panther Lake Rd).
  - The first 2 interruptions occurred on October 9 and October 16, 2018, coded as a cause of tree fell (PSC cause code 02). These events accounted for 15% of the total customers interrupted (400 of 2,735), and 29% of the total customer-hours interrupted (2,922 of 10,208).
  - The third interruption occurred on November 3, 2018, coded as a cause of unknown (PSC cause code 10). This event accounted for 13% of the total customers interrupted (350 of 2,735), and 9% of the total customer-hours interrupted (911 of 10,208).

**Action Taken:**

- Completed all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by August 2018.
- Distribution Forestry completed hazard tree removals in FY2015.
- Distribution Forestry cycle pruned the feeder in FY2016.
- Transmission forestry cycle pruned the 34.5kV subtransmission line in 2017.
- Transmission forestry removed Ash trees on the 34.5kV subtransmission line in 2017.

**Action Plan:**

- Distribution Forestry to review the circuit.

## 10. NEW HAVEN 25653 - 13.2kV

*Profile:* 1,992 Customers, 77.2 Circuit Miles  
*Indices:* CAIDI = 2.54, SAIFI = 2.43

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	4	21.05%	3,261	67.26%	9,339	75.96%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	31.58%	188	3.88%	873	7.10%
6	ACCIDENTS	4	21.05%	80	1.65%	146	1.18%
7	PREARRANGED	1	5.26%	1,236	25.50%	1,607	13.07%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	21.05%	83	1.71%	331	2.69%
Totals		19	100.00%	4,848	100.00%	12,295	100.00%

### **Problem Analysis:**

- There were 19 interruptions on the New Haven 25653 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 19 events occurred at the distribution level.
- The distribution circuit breaker for the New Haven 25653 experienced 1 momentary operation in 2018.
- The distribution circuit breaker for the New Haven 25653 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 41% of the total amount of customers interrupted (1,988 out of 4,848) and 60% of the total amount of the customer-hours interrupted (7,389 out of 12,295).
  - This lockout occurred on May 04, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 41% of the total customers interrupted (1,988 of 4,848), and 60% of the total customer-hours interrupted (7,389 of 12,295).
- Equipment Failures were the leading cause of interruptions on the New Haven 25653 in 2018, accounting for 32% of total interruptions (6 of 19). Trees were the 2nd leading cause of interruptions, accounting for 21% of total interruptions (4 of 19). Accidents were the 3rd leading cause of interruptions, accounting for 21% of total interruptions (4 of 19).

- Trees were the leading cause of customers interrupted (CI) on the New Haven 25653 in 2018, accounting for 67% of total customers interrupted (3,261 of 4,848). Prearranged were the 2nd leading cause of customers interrupted, accounting for 25% of total customers interrupted (1,236 of 4,848). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 4% of total customers interrupted (188 of 4,848).
- Trees were the leading cause of customer-hours interrupted (CHI) on the New Haven 25653 in 2018, accounting for 76% of total customer-hours interrupted (9,339 of 12,295). Prearranged were the 2nd leading cause of customer-hours interrupted, accounting for 13% of total customer-hours interrupted (1,607 of 12,295). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 7% of total customer-hours interrupted (873 of 12,295).
- Of the 19 interruptions on this circuit, 9 affected 10 customers or less, with 3 being single customer outages.
- There was a prearranged interruption (PSC cause code 07) occurred on July 18, 2018. This interruption accounted for 26% of the total customers interrupted (1,236 of 4,848), and 13% of the total customer-hours interrupted (1,607 of 12,295). This outage was to replace a junction pole (there are no feeder ties beyond this point).
- The recloser R40428 experienced 1 lockout on September 21, 2018, code as a cause tree-broken limb (PSC cause code 02). This interruption accounted for 25% of the total amount of customers interrupted (1,217 out of 4,848) and 14% of the total amount of the customer-hours interrupted (1,765 out of 12,295).
- 

**Action Taken:**

- Distribution Forestry completed hazard tree removal on the feeder in FY2015.
- Distribution Forestry cycle pruned the feeder in FY2017.
- The I&M inspection (foot patrol) of the feeder was completed in April 2018.

**Action Plan:**

- Distribution forestry to perform hazard tree removals in FY2019.
- Routine tree trimming/pruning to be completed in FY2019.
- Complete all level 2 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by April 2019.
- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by April 2021.

**11. SORRELL HILL 26952 - 13.2kV**

*Profile: 2,669 Customers, 69.7 Circuit Miles*  
*Indices: CAIDI = 1.97, SAIFI = 2.29*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	29.17%	3,436	56.32%	7,525	62.75%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	20.83%	507	8.31%	606	5.06%
6	ACCIDENTS	7	29.17%	1,375	22.54%	2,908	24.25%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	4.17%	11	0.18%	16	0.14%
10	UNKNOWN	4	16.67%	772	12.65%	937	7.81%
Totals		24	100.00%	6,101	100.00%	11,992	100.00%

**Problem Analysis:**

- There were 24 interruptions on the Sorrell Hill 26952 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 24 events occurred at the distribution level.
- The distribution circuit breaker for the Sorrell Hill 26952 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the Sorrell Hill 26952 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 40% of the total amount of customers interrupted (2,451 out of 6,101) and 39% of the total amount of the customer-hours interrupted (4,705 out of 11,992).
  - This lockout occurred on July 22, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 40% of the total customers interrupted (2,451 of 6,101), and 39% of the total customer-hours interrupted (4,705 of 11,992).
- Trees were the leading cause of interruptions on the Sorrell Hill 26952 in 2018, accounting for 29% of total interruptions (7 of 24). Accidents were the 2nd leading cause of interruptions, accounting for 29% of total interruptions (7 of 24). Equipment Failures were the 3rd leading cause of interruptions, accounting for 21% of total interruptions (5 of 24).
- Trees were the leading cause of customers interrupted (CI) on the Sorrell Hill 26952 in 2018, accounting for 56% of total customers interrupted (3,436 of 6,101). Accidents were the 2nd leading cause of customers interrupted, accounting for 23% of total customers interrupted (1,375 of 6,101). Unknown were the 3rd leading cause of customers interrupted, accounting for 13% of total customers interrupted (772 of 6,101).

- Trees were the leading cause of customer-hours interrupted (CHI) on the Sorrell Hill 26952 in 2018, accounting for 63% of total customer-hours interrupted (7,525 of 11,992). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 24% of total customer-hours interrupted (2,908 of 11,992). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (937 of 11,992).
- Of the 24 interruptions on this circuit, 3 affected 10 customers or less, with 1 being single customer outages.
- There were two recloser (41488 on pole 1 Canton St) lockouts in 2018. These interruptions accounted for 16% of the total amount of customers interrupted (975 out of 6,101) and 12% of the total amount of the customer-hours interrupted (1,459 out of 11,992).
  - The first lockout occurred on June 1, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 8% of the total customers interrupted (484 of 6,101), and 5% of the total customer-hours interrupted (540 of 11,992).
  - The second lockout occurred on June 5, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 8% of the total customers interrupted (491 of 6,101), and 8% of the total customer-hours interrupted (919 of 11,992).
- Switch 40830 (pole 36 Downer St) was opened on July 23, 2018, coded as a cause of Vehicle (PSC cause code 06). This interruption accounted for 16% of the total customers interrupted (973 of 6,101) and 16% of the total customer-hours interrupted (1,901 of 11,992).

**Action Taken:**

- Distribution Forestry completed hazard tree removal on the feeder in FY2015.
- Distribution Forestry cycle pruned the feeder in FY2015.
- The I&M inspection (foot patrol) of the feeder was completed in July 2018.

**Action Plan:**

- Complete all level 2 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by July 2019.
- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by August 2021.
- Routine tree trimming/pruning to be completed in FY2021.

## 12. PALOMA 25456 - 13.2kV

*Profile:* 1,757 Customers, 79.3 Circuit Miles  
*Indices:* CAIDI = 3.44, SAIFI = 1.92

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	29.17%	658	19.54%	3,820	32.94%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	20.83%	1,981	58.84%	4,065	35.06%
6	ACCIDENTS	6	25.00%	133	3.95%	820	7.07%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	4.17%	345	10.25%	2,386	20.58%
10	UNKNOWN	5	20.83%	250	7.43%	504	4.35%
Totals		24	100.00%	3,367	100.00%	11,596	100.00%

### **Problem Analysis:**

- There were 24 interruptions on the Paloma (Fulton) 25456 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This interruption occurred on January 14, 2018, coded as a cause device failed (PSC cause code 05). This lockout accounted for 52% of the total customers interrupted (1,756 of 3,367), and 31% of the total customer-hours interrupted (3,600 of 11,596). This was due to a cable termination flashing inside of the metalclad and locking out the 13.2kV bus.
- The remaining 23 events occurred at the distribution level.
- The distribution circuit breaker for the Paloma (Fulton) 25456 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the Paloma (Fulton) 25456 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Paloma (Fulton) 25456 in 2018, accounting for 29% of total interruptions (7 of 24). Accidents were the 2nd leading cause of interruptions, accounting for 25% of total interruptions (6 of 24). Equipment Failures were the 3rd leading cause of interruptions, accounting for 21% of total interruptions (5 of 24).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Paloma (Fulton) 25456 in 2018, accounting for 59% of total customers interrupted (1,981 of 3,367). Trees were the 2nd leading cause of customers interrupted, accounting for 20% of total customers interrupted (658 of 3,367). Lightning were the 3rd leading cause of customers interrupted, accounting for 10% of total customers interrupted (345 of 3,367).



- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Paloma (Fulton) 25456 in 2018, accounting for 35% of total customer-hours interrupted (4,065 of 11,596). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 33% of total customer-hours interrupted (3,820 of 11,596). Lightning were the 3rd leading cause of customer-hours interrupted, accounting for 21% of total customer-hours interrupted (2,386 of 11,596).
- Of the 24 interruptions on this circuit, 8 affected 10 customers or less, with 2 being single customer outages.
- The fuses on pole 126, NYS Route 104 operated on July 2, 2018, coded as a cause of Lightning (PSC cause code 09). This interruption accounted for 10% of the total customers interrupted (345 of 3,367) and 21% of the total customer-hours interrupted (2,386 of 11,596).

**Action Taken:**

- Completed all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by January 2018.
- Distribution Forestry cycle pruned the feeder in FY2018.

**Action Plan:**

- Distribution Forestry to review the circuit.
- Install a new recloser and relocate another recloser in 2019.

### 13. TEMPLE 24347 - 13.2kV

Profile: 2,408 Customers, 13.6 Circuit Miles  
 Indices: CAIDI = 1.14, SAIFI = 3.35

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	5	26.32%	2,449	30.39%	2,204	24.04%
3	OVERLOADS	1	5.26%	13	0.16%	50	0.54%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	26.32%	4,946	61.37%	5,680	61.98%
6	ACCIDENTS	7	36.84%	640	7.94%	1,190	12.99%
7	PREARRANGED	1	5.26%	11	0.14%	41	0.45%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	0	0.00%	0	0.00%	0	0.00%
Totals		19	100.00%	8,059	100.00%	9,165	100.00%

**Problem Analysis:**

- There were 19 interruptions on the Temple 24347 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 19 events occurred at the distribution level.
- The distribution circuit breaker for the Temple 24347 experienced 12 momentary operations in 2018.
- The distribution circuit breaker for the Temple 24347 experienced 3 sustained operations (lockouts) in 2018. These interruptions accounted for 89% of the total amount of customers interrupted (7,198 out of 8,059) and 80% of the total amount of the customer-hours interrupted (7,364 out of 9,165).
  - The first lockout occurred on February 19, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 30% of the total customers interrupted (2,416 of 8,059), and 30% of the total customer-hours interrupted (2,720 of 9,165). This interruption was caused by insulators that failed.
  - The second lockout occurred on August 26, 2018, coded as a cause of insulation failure - cable (PSC cause code 05). This lockout accounted for 30% of the total customers interrupted (2,395 of 8,059), and 29% of the total customer-hours interrupted (2,645 of 9,165). The feeders cable failed on the riser pole.
  - The third lockout occurred on September 25, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 30% of the total customers interrupted (2,387 of 8,059), and 22% of the total customer-hours interrupted (1,998 of 9,165).

- Accidents were the leading cause of interruptions on the Temple 24347 in 2018, accounting for 37% of total interruptions (7 of 19). Trees were the 2nd leading cause of interruptions, accounting for 26% of total interruptions (5 of 19). Equipment Failures were the 3rd leading cause of interruptions, accounting for 26% of total interruptions (5 of 19).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Temple 24347 in 2018, accounting for 61% of total customers interrupted (4,946 of 8,059). Trees were the 2nd leading cause of customers interrupted, accounting for 30% of total customers interrupted (2,449 of 8,059). Accidents were the 3rd leading cause of customers interrupted, accounting for 8% of total customers interrupted (640 of 8,059).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Temple 24347 in 2018, accounting for 62% of total customer-hours interrupted (5,680 of 9,165). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 24% of total customer-hours interrupted (2,204 of 9,165). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 13% of total customer-hours interrupted (1,190 of 9,165).
- Of the 19 interruptions on this circuit, 6 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- Distribution Forestry cycle pruned the feeder in FY2016.
- Distribution Forestry completed Ash tree removals on the feeder in FY2018.
- Completed all level 2 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by April 2018.

**Action Plan:**

- Distribution forestry to perform hazard tree removals in FY2021.
- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by April 2020.

#### 14. NILES 29451 - 13.2kV

*Profile:* 1,298 Customers, 105.8 Circuit Miles  
*Indices:* CAIDI = 3.03, SAIFI = 1.74

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	14	38.89%	338	14.98%	2,310	33.79%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	13	36.11%	1,811	80.24%	3,957	57.88%
6	ACCIDENTS	1	2.78%	3	0.13%	11	0.16%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	8	22.22%	105	4.65%	558	8.17%
Totals		36	100.00%	2,257	100.00%	6,836	100.00%

**Problem Analysis:**

- There were 36 interruptions on the Niles 29451 in 2018.
- There was 1 transmission interruption.
  - This interruption occurred on May 7, 2018, coded as a cause of device failed (PSC cause code 05). This event accounted for 57% of the total customers interrupted (1,295 of 2,257), and 21% of the total customer-hours interrupted (1,468 of 6,836). The recloser on the subtransmission tap to Nile substation failed.
- There were no substation interruptions.
- The remaining 35 events occurred at the distribution level.
- The distribution circuit breaker for the Niles 29451 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the Niles 29451 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Niles 29451 in 2018, accounting for 39% of total interruptions (14 of 36). Equipment Failures were the 2nd leading cause of interruptions, accounting for 36% of total interruptions (13 of 36). Unknown were the 3rd leading cause of interruptions, accounting for 22% of total interruptions (8 of 36).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Niles 29451 in 2018, accounting for 80% of total customers interrupted (1,811 of 2,257). Trees were the 2nd leading cause of customers interrupted, accounting for 15% of total customers interrupted (338 of 2,257). Unknown were the 3rd leading cause of customers interrupted, accounting for 5% of total customers interrupted (105 of 2,257).

- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Niles 29451 in 2018, accounting for 58% of total customer-hours interrupted (3,957 of 6,836). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 34% of total customer-hours interrupted (2,310 of 6,836). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (558 of 6,836).
- Of the 36 interruptions on this circuit, 22 affected 10 customers or less, with 5 being single customer outages.
- The fuse on pole 2 Appletree Point had two operations which accounted for 6% of the total customers interrupted (132 of 2,257) and 21% of the total customer-hours interrupted (1,406 of 6,836). The first event was on September 25, 2018, coded as a cause of tree fell (PSC cause code 02). The second event was on October 11, 2018, coded as a cause of tree – broken limb (PSC cause code 02) and accounted for 1,242 of the customer-hours interrupted.

**Action Taken:**

- Distribution Forestry completed hazard tree removal on the feeder in FY2017.
- Distribution Forestry cycle pruned the feeder in FY2016.
- Trip Savers installed on feeder January 2019.
- The 34.5kV recloser on sub-transmission tap was replaced.

**Action Plan:**

- Dolphin Point Rd to be rebuilt in FY2020.
- The I&M inspection (foot patrol) of the feeder will be conducted 2019.
- Distribution Forestry to review the circuit.

**15. SANDY CREEK 6651 - 13.2kV**

*Profile: 1,738 Customers, 108.6 Circuit Miles*  
*Indices: CAIDI = 2.46, SAIFI = 1.85*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	18	47.37%	1,821	56.78%	5,829	73.78%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	7	18.42%	77	2.40%	188	2.38%
6	ACCIDENTS	5	13.16%	24	0.75%	31	0.40%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	8	21.05%	1,285	40.07%	1,852	23.44%
Totals		38	100.00%	3,207	100.00%	7,901	100.00%

**Problem Analysis:**

- There were 38 interruptions on the Sandy Creek 6651 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 38 events occurred at the distribution level.
- The distribution circuit breaker for the Sandy Creek 6651 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Sandy Creek 6651 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Sandy Creek 6651 in 2018, accounting for 47% of total interruptions (18 of 38). Unknown were the 2nd leading cause of interruptions, accounting for 21% of total interruptions (8 of 38). Equipment Failures were the 3rd leading cause of interruptions, accounting for 18% of total interruptions (7 of 38).
- Trees were the leading cause of customers interrupted (CI) on the Sandy Creek 6651 in 2018, accounting for 57% of total customers interrupted (1,821 of 3,207). Unknown were the 2nd leading cause of customers interrupted, accounting for 40% of total customers interrupted (1,285 of 3,207). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 2% of total customers interrupted (77 of 3,207).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Sandy Creek 6651 in 2018, accounting for 74% of total customer-hours interrupted (5,829 of 7,901). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 23% of total customer-hours interrupted (1,852 of 7,901). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 2% of total customer-hours interrupted (188 of 7,901).

- Of the 38 interruptions on this circuit, 16 affected 10 customers or less, with 11 being single customer outages.
- The fuses on pole 29, Smartville Rd experienced 4 interruptions in 2018. These interruptions accounted for 67% of the total amount of customers interrupted (2,146 out of 3,207) and 56% of the total amount of the customer-hours interrupted (4,412 out of 7,901).
  - The interruptions that occurred on July 4 and December 31, 2018, coded as a cause of unknown (PSC cause code 10). These interruptions accounted for 33% of the total customers interrupted (1,071 of 3,207), and 18% of the total customer-hours interrupted (1,384 of 7,901).
  - The interruptions that occurred on September 10 and December 21, 2018, coded as a cause of tree fell (PSC cause code 02). These interruptions accounted for 34% of the total customers interrupted (1,076 of 3,207), and 38% of the total customer-hours interrupted (3,027 of 7,901).
- 

**Action Taken:**

- Complete all level 2 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by September 2017.
- Distribution Forestry cycle pruned the feeder in FY2017.

**Action Plan:**

- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by September 2019.
- Distribution forestry to perform hazard tree removals in FY2020.
- Routine tree trimming/pruning to be completed in FY2020.

## 16. PHOENIX 5164 - 4.8kV

Profile: 1,010 Customers, 16.4 Circuit Miles  
 Indices: CAIDI = 2.92, SAIFI = 3.60

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	2	20.00%	1,012	27.85%	1,118	10.54%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	4	40.00%	2,547	70.09%	9,455	89.07%
6	ACCIDENTS	1	10.00%	51	1.40%	22	0.21%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	3	30.00%	24	0.66%	20	0.19%
Totals		10	100.00%	3,634	100.00%	10,616	100.00%

### Problem Analysis:

- There were 10 interruptions on the Phoenix 5164 in 2018.
- There was 1 transmission interruption.
  - This interruption occurred on May 4, 2018, coded as a cause of tree fell (PSC cause code 02). This event accounted for 28% of the total customers interrupted (1,011 of 3,634), and 10% of the total customer-hours interrupted (1,112 of 10,616).
- There were no substation interruptions.
- The remaining 9 events occurred at the distribution level.
- The distribution circuit breaker for the Phoenix 5164 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Phoenix 5164 experienced 2 sustained operations (lockouts) in 2018. These interruptions accounted for 56% of the total amount of customers interrupted (2,019 out of 3,634) and 86% of the total amount of the customer-hours interrupted (9,134 out of 10,616).
  - The first lockout occurred on March 02, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 28% of the total customers interrupted (1,014 of 3,634), and 68% of the total customer-hours interrupted (7,174 of 10,616). A subtransmission line fell into the distribution on Chestnut St.
  - The second lockout occurred on June 18, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 28% of the total customers interrupted (1,005 of 3,634), and 18% of the total customer-hours interrupted (1,960 of 10,616). A subtransmission line sagged into the distribution.



- Equipment Failures were the leading cause of interruptions on the Phoenix 5164 in 2018, accounting for 40% of total interruptions (4 of 10). Unknown were the 2nd leading cause of interruptions, accounting for 30% of total interruptions (3 of 10). Trees were the 3rd leading cause of interruptions, accounting for 20% of total interruptions (2 of 10).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Phoenix 5164 in 2018, accounting for 70% of total customers interrupted (2,547 of 3,634). Trees were the 2nd leading cause of customers interrupted, accounting for 28% of total customers interrupted (1,012 of 3,634). Accidents were the 3rd leading cause of customers interrupted, accounting for 1% of total customers interrupted (51 of 3,634).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Phoenix 5164 in 2018, accounting for 89% of total customer-hours interrupted (9,455 of 10,616). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 11% of total customer-hours interrupted (1,118 of 10,616). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 0% of total customer-hours interrupted (22 of 10,616).
- Of the 10 interruptions on this circuit, 3 affected 10 customers or less, with 3 being single customer outages.

**Action Taken:**

- Completed all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by April 2018.
- Distribution Forestry cycle pruned the feeder in FY2017.
- Transmission forestry removed Ash tree in 2017.
- Fuses installed on Chestnut St, October 2018.

**Action Plan:**

- Distribution Forestry to review the circuit.
- Transmission forestry to perform routine tree trimming/pruning on the 34.5kV subtransmission line in FY2019.

## 17. COLOSSE 32151 - 13.2kV

Profile: 2,559 Customers, 139.3 Circuit Miles  
 Indices: CAIDI = 2.55, SAIFI = 1.61

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	12	40.00%	384	9.32%	1,483	14.10%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	8	26.67%	3,180	77.17%	6,564	62.40%
6	ACCIDENTS	7	23.33%	483	11.72%	2,330	22.15%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	2	6.67%	71	1.72%	139	1.33%
10	UNKNOWN	1	3.33%	3	0.07%	3	0.02%
Totals		30	100.00%	4,121	100.00%	10,519	100.00%

**Problem Analysis:**

- There were 30 interruptions on the Colosse 32151 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This interruption occurred on January 23, 2018, coded as a cause of device failed (PSC cause code 05). This event accounted for 13% of the total customers interrupted (527 of 4,121), and 2% of the total customer-hours interrupted (237 of 10,519).
- The remaining 29 events occurred at the distribution level.
- The distribution circuit breaker for the Colosse 32151 experienced 7 momentary operations in 2018.
- The distribution circuit breaker for the Colosse 32151 experienced 1 sustained operations (lockouts) in 2018. This interruption accounted for 62% of the total amount of customers interrupted (2,564 out of 4,121) and 58% of the total amount of the customer-hours interrupted (6,089 out of 10,519).
  - This lockout occurred on July 8, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 62% of the total customers interrupted (2,565 of 4,121), and 58% of the total customer-hours interrupted (6,089 of 10,519). There was a wire down on US Hwy 11.
- Trees were the leading cause of interruptions on the Colosse 32151 in 2018, accounting for 40% of total interruptions (12 of 30). Equipment Failures were the 2nd leading cause of interruptions, accounting for 27% of total interruptions (8 of 30). Accidents were the 3rd leading cause of interruptions, accounting for 23% of total interruptions (7 of 30).

- Equipment Failures were the leading cause of customers interrupted (CI) on the Colosse 32151 in 2018, accounting for 77% of total customers interrupted (3,180 of 4,121). Accidents were the 2nd leading cause of customers interrupted, accounting for 12% of total customers interrupted (483 of 4,121). Trees were the 3rd leading cause of customers interrupted, accounting for 9% of total customers interrupted (384 of 4,121).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Colosse 32151 in 2018, accounting for 62% of total customer-hours interrupted (6,564 of 10,519). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 22% of total customer-hours interrupted (2,330 of 10,519). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 14% of total customer-hours interrupted (1,483 of 10,519).
- Of the 30 interruptions on this circuit, 11 affected 10 customers or less, with 2 being single customer outages.

**Action Taken:**

- Completed all level 2 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by September 2017.
- Distribution Forestry completed hazard tree removal on the feeder in FY2017.

**Action Plan:**

- Install Trip Saver on feeder in FY 2019.
- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by September 2019.
- Distribution forestry to perform hazard tree/Ash tree removals in FY2019.
- Routine tree trimming/pruning to be completed in FY2019.

**18. GRANBY CENTER 29351 - 13.2kV**

*Profile: 1,838 Customers, 67.6 Circuit Miles*  
*Indices: CAIDI = 3.73, SAIFI = 1.55*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	35.00%	1,794	63.04%	8,018	75.60%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	15.00%	17	0.60%	38	0.36%
6	ACCIDENTS	4	20.00%	17	0.60%	42	0.40%
7	PREARRANGED	2	10.00%	30	1.05%	37	0.35%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	5.00%	1	0.04%	13	0.12%
10	UNKNOWN	3	15.00%	987	34.68%	2,457	23.17%
Totals		20	100.00%	2,846	100.00%	10,605	100.00%

**Problem Analysis:**

- There were 20 interruptions on the Granby Center 29351 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 20 events occurred at the distribution level.
- The distribution circuit breaker for the Granby Center 29351 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the Granby Center 29351 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Granby Center 29351 in 2018, accounting for 35% of total interruptions (7 of 20). Accidents were the 2nd leading cause of interruptions, accounting for 20% of total interruptions (4 of 20). Equipment Failures were the 3rd leading cause of interruptions, accounting for 15% of total interruptions (3 of 20).
- Trees were the leading cause of customers interrupted (CI) on the Granby Center 29351 in 2018, accounting for 63% of total customers interrupted (1,794 of 2,846). Unknown were the 2nd leading cause of customers interrupted, accounting for 35% of total customers interrupted (987 of 2,846). Prearranged were the 3rd leading cause of customers interrupted, accounting for 1% of total customers interrupted (30 of 2,846).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Granby Center 29351 in 2018, accounting for 76% of total customer-hours interrupted (8,018 of 10,605). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 23% of total customer-hours interrupted (2,457 of 10,605). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 0% of total customer-hours interrupted (42 of 10,605).

- Of the 20 interruptions on this circuit, 10 affected 10 customers or less, with 5 being single customer outages.
- The recloser R5059 experienced 1 lockout on October 16, 2018, code as a cause unknown (PSC cause code 10). This interruption accounted for 16% of the total amount of customers interrupted (448 out of 2,846) and 17% of the total amount of the customer-hours interrupted (1,755 out of 10,605).
- The recloser R40686 experienced 4 lockouts on the feeder. They accounted for 76% of the total customers interrupted (2,151 out of 2,846) and 81% of the total customer-hours interrupted (8,569 out of 10,605).
  - The first interruption occurred on January 12, 2018, coded as a cause of unknown (PSC cause code 10). This event accounted for 19% of the total customers interrupted (538 of 2,846), and 7% of the total customer-hours interrupted (699 of 10,605).
  - The interruptions that occurred on May 04 and December 28, 2018, coded as a cause of tree fell and the one that occurred on August 6, 2018, coded as a cause of tree – broken limb (PSC cause code 02). These events accounted for 57% of the total customers interrupted (1,613 of 2,846), and 74% of the total customer-hours interrupted (7,870 of 10,605).

**Action Taken:**

- Distribution Forestry completed Ash tree removals on the feeder in FY2018.
- Distribution Forestry cycle pruned the feeder in FY2018.

**Action Plan:**

- The I&M inspection (foot patrol) of the feeder will be conducted 2019.
- Convert County Route 8 and create feeder tie; in FY2023.

## 19. CONSTANTIA 1923 - 4.16kV

*Profile: 739 Customers, 26.2 Circuit Miles*  
*Indices: CAIDI = 2.00, SAIFI = 2.86*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	10	62.50%	1,134	53.62%	2,025	47.94%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	18.75%	755	35.70%	1,313	31.09%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	3	18.75%	226	10.69%	886	20.97%
Totals		16	100.00%	2,115	100.00%	4,225	100.00%

### Problem Analysis:

- There were 16 interruptions on the Constantia 1923 in 2018.
- There were 2 transmission interruptions.
  - The first lockout occurred on March 31, 2018, coded as a cause of tree limb (PSC cause code 02). This lockout accounted for 35% of the total customers interrupted (742 of 2,115), and 16% of the total customer-hours interrupted (695 of 4,225). This event was on the 34.5kV subtransmission line that serve the substation.
  - The second lockout occurred on May 4, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 35% of the total customers interrupted (740 of 2,115), and 29% of the total customer-hours interrupted (1,221 of 4,225). This event was due to a down conductor on the 115kV transmission line that feeds the subtransmission system in the area.
- There were no substation interruptions.
- The remaining 14 events occurred at the distribution level.
- The distribution circuit breaker for the Constantia 1923 experienced 7 momentary operations in 2018.
- The distribution circuit breaker for the Constantia 1923 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Constantia 1923 in 2018, accounting for 63% of total interruptions (10 of 16). Equipment Failures were the 2nd leading cause of interruptions, accounting for 19% of total interruptions (3 of 16). Unknown were the 3rd leading cause of interruptions, accounting for 19% of total interruptions (3 of 16).

- Trees were the leading cause of customers interrupted (CI) on the Constantia 1923 in 2018, accounting for 54% of total customers interrupted (1,134 of 2,115). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 36% of total customers interrupted (755 of 2,115). Unknown were the 3rd leading cause of customers interrupted, accounting for 11% of total customers interrupted (226 of 2,115).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Constantia 1923 in 2018, accounting for 48% of total customer-hours interrupted (2,025 of 4,225). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 31% of total customer-hours interrupted (1,313 of 4,225). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 21% of total customer-hours interrupted (886 of 4,225).
- Of the 16 interruptions on this circuit, 3 affected 10 customers or less, with 2 being single customer outages.
- The fuses on pole 6, Kibby Lake Rd experienced 5 interruptions in 2018. These interruptions accounted for 19% of the total amount of customers interrupted (407 out of 2,115) and 27% of the total amount of the customer-hours interrupted (1,136 out of 4,225).
  - The interruption that occurred on March 2, 2018, coded as a cause of unknown (PSC cause code 10). This interruption accounted for 4% of the total customers interrupted (81 of 2,115), and 4% of the total customer-hours interrupted (176 of 4,225).
  - The interruptions that occurred on March 2, July 2, August 29 and October 15, 2018, coded as a cause of tree fell (PSC cause code 02). These interruptions accounted for 15% of the total customers interrupted (326 of 2,115), and 23% of the total customer-hours interrupted (960 of 4,225).

**Action Taken:**

- Completed all level 2 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by January 2018.
- Distribution Forestry cycle pruned the feeder in FY2018.
- Distribution Forestry completed hazard tree removal on the feeder in FY2018.
- Transmission forestry cycle pruned the 34.5kV subtransmission line in 2017.
- Transmission forestry removed Ash trees on the 34.5kV subtransmission line in 2017.
- 

**Action Plan:**

- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by January 2020.

**20. BARTELL RD 32554 - 13.2kV**

*Profile: 2,742 Customers, 46.7 Circuit Miles*  
*Indices: CAIDI = 2.50, SAIFI = 2.09*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	1	7.14%	1	0.02%	4	0.02%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	42.86%	2,899	50.60%	10,599	73.96%
6	ACCIDENTS	5	35.71%	2,767	48.30%	3,392	23.67%
7	PREARRANGED	2	14.29%	62	1.08%	336	2.34%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	0	0.00%	0	0.00%	0	0.00%
Totals		14	100.00%	5,729	100.00%	14,330	100.00%

**Problem Analysis:**

- There were 14 interruptions on the Bartell Rd 32554 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This event occurred on June 22, 2018, coded as a cause of Animal (PSC cause code 06). This event accounted for 47% of the total customers interrupted (2,741 of 5,729), and 23% of the total customer-hours interrupted (3,335 of 14,330).
- The remaining 23 events occurred at the distribution level.
- The remaining 13 events occurred at the distribution level.
- The distribution circuit breaker for the Bartell Rd 32554 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the Bartell Rd 32554 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 48% of the total amount of customers interrupted (2,739 out of 5,729) and 70% of the total amount of the customer-hours interrupted (10,062 out of 14,330).
  - This lockout occurred on March 02, 2018, coded as a cause of deterioration (PSC cause code 05). This lockout accounted for 48% of the total customers interrupted (2,739 of 5,729), and 70% of the total customer-hours interrupted (10,062 of 14,330). This was due to a cable fault in the riser pole.
- Equipment Failures were the leading cause of interruptions on the Bartell Rd 32554 in 2018, accounting for 43% of total interruptions (6 of 14). Accidents were the 2nd leading cause of interruptions, accounting for 36% of total interruptions (5 of 14). Prearranged were the 3rd leading cause of interruptions, accounting for 14% of total interruptions (2 of 14).



- Equipment Failures were the leading cause of customers interrupted (CI) on the Bartell Rd 32554 in 2018, accounting for 51% of total customers interrupted (2,899 of 5,729). Accidents were the 2nd leading cause of customers interrupted, accounting for 48% of total customers interrupted (2,767 of 5,729). Prearranged were the 3rd leading cause of customers interrupted, accounting for 1% of total customers interrupted (62 of 5,729).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Bartell Rd 32554 in 2018, accounting for 74% of total customer-hours interrupted (10,599 of 14,330). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 24% of total customer-hours interrupted (3,392 of 14,330). Prearranged were the 3rd leading cause of customer-hours interrupted, accounting for 2% of total customer-hours interrupted (336 of 14,330).
- Of the 14 interruptions on this circuit, 7 affected 10 customers or less, with 4 being single customer outages.
- The Green Acres URD experienced 4 interruptions in 2018. These interruptions were on June 27 (cable fault), December 11 (cable fault), December 13 (planned to replace switchgear) and December 27 (planned to bring second feed in). These interruptions accounted for 3% of the total amount of customers interrupted (170 out of 5,729) and 6% of the total amount of the customer-hours interrupted (804 out of 14,330).

**Action Taken:**

- The I&M inspection (foot patrol) of the feeder was completed in December 2018.
- Distribution Forestry completed hazard tree removal on the feeder in FY2014.
- Distribution Forestry completed Ash tree removals on the feeder in FY2018.
- Animal fence was installed in the Substation in September 2018.
- Second feed to Green Acres URD and switchgear replacement completed December 2018.

**Action Plan:**

- Routine tree trimming/pruning to be completed in FY2020.
- Complete all level 2 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by December 2019.
- Complete all level 3 maintenance work that was identified by the I&M inspection (foot patrol) on the feeder by December 2021.

### 3. ACTION PLAN SUMMARIES

#### a. SUMMARY OF ACTION PLANS FOR 2018 WORST PERFORMING CIRCUITS

Station	Feeder	Year	Action plan	Compl. Date	Est. Cost	Comments
Lighthouse Hill	6144	2020	Rebuild N Osceola Rd	03/2020	\$192,000	
Lighthouse Hill	6144	2020	Rebuild County Route 47	03/2020	\$349,000	
Lighthouse Hill	6144	2019	Routine trimming	03/2020		
Lighthouse Hill	6144	2019	Forestry to perform hazard tree removals	03/2020		
Lighthouse Hill	6144	2019	Install Trip Savers	06/2019	\$50,000	
West Monroe	27451	2019	Level 2 maintenance	03/2019	\$600	
West Monroe	27451	2021	Level 3 maintenance	03/2021	\$268,400	
West Monroe	27451	2021	Routine trimming	03/2021		
West Monroe	27451	2021	Forestry to perform hazard tree removals	03/2021		
West Monroe	27451	2019	Forestry to review feeder	12/2019		
West Monroe	27451	2019	Install Trip Savers	06/2019	\$10,000	
Gilbert Mills	24751	2020	Level 3 maintenance	06/2020	\$175,200	
Gilbert Mills	24751	2019	Forestry to perform hazard/ash tree removals	12/2019		
Tully Center	27851	2020	Routine trimming	03/2020		
Tully Center	27851	2019	Forestry to perform hazard/ash tree removals	03/2019		
Tully Center	27851	2018	Level 2 maintenance	01/2019		
Tully Center	27851	2020	Level 3 maintenance	01/2021	\$107,000	
Tully Center	27853	2020	Routine trimming	03/2020		
Tully Center	27853	2019	Forestry to perform hazard/ash tree removals	03/2019		
Bartell Road	23555	2020	Routine trimming	03/2020		
Bartell Road	23555	2019	Replace getaway cable	06/2019		
Bartell Road	23555	2019	Level 2 maintenance	12/2019	\$200	
Bartell Road	23555	2021	Level 3 maintenance	12/2021	\$6,600	
Whitaker	29653	2019	Routine trimming	03/2019		
Whitaker	29653	2019	Maintenance Patrol	12/2019		
Whitaker	29653	2019	Forestry to perform hazard/ash tree removals	03/2019		
Whitaker	29653	2019	Reconductor Beech St	12/2019	\$75,000	
Lighthouse Hill	6141	2022	Routine trimming	03/2022		
Lighthouse Hill	6141	2019	Forestry to review feeder	12/2019		
Lighthouse Hill	6141	2019	Level 3 maintenance	08/2019	\$245,100	
West Cleveland	32651	2019	Forestry to review feeder	12/2019		
New Haven	25653	2019	Forestry to perform hazard tree removals	03/2019		
New Haven	25653	2019	Routine trimming	03/2019		
New Haven	25653	2019	Level 2 maintenance	04/2019	\$1,300	
New Haven	25653	2021	Level 2 maintenance	04/2021	\$241,900	
Sorrell Hill	26952	2019	Level 2 maintenance	07/2019	\$11,200	
Sorrell Hill	26952	2021	Level 3 maintenance	07/2021	\$109,200	
Sorrell Hill	26952	2021	Routine trimming	03/2021		
Paloma	25456	2019	Install recloser	12/2019	\$75,000	
Paloma	25456	2019	Forestry to review feeder	12/2019		
Temple	24347	2021	Maintenance Patrol	12/2019		
Temple	24347	2020	Level 3 maintenance	04/2020	\$109,600	
Niles	29451	2020	Rebuild Dolphin Point Rd	02/2020	\$300,00	
Niles	29451	2019	Maintenance Patrol	12/2019		Cost dependent on field conditions
Niles	29451	2019	Forestry to review feeder	12/2019		
Sandy Creek	6651	2019	Level 3 maintenance	09/2019	\$180,700	
Sandy Creek	6651	2020	Routine trimming	03/2020		
Sandy Creek	6651	2020	Forestry to perform hazard/ash tree removals	03/2020		
Phoenix	5164	2019	Forestry to review feeder	12/2019		

Station	Feeder	Year	Action plan	Compl. Date	Est. Cost	Comments
Phoenix	5164	2019	Transmission forestry to perform routine trimming on subtransmission	12/2019		
Colosse	32151	2019	Install Trip Savers	06/2019	\$20,000	
Colosse	32151	2019	Forestry to perform hazard/ash tree removals	03/2019		
Colosse	32151	2019	Routine trimming	03/2019		
Colosse	32151	2019	Level 3 maintenance	09/2019	\$167,700	
Granby Center	29351	2019	Maintenance Patrol	12/2019		Cost dependent on field conditions
Granby Center	29351	2022	Convert CR 8 and create tie	03/2023	\$680,000	
Constantia	1923	2019	Level 3 maintenance	12/2020	\$56,600	
Bartell Road	23554	2020	Routine trimming	03/2020		
Bartell Road	23554	2019	Level 2 maintenance	12/2019	\$400	
Bartell Road	23554	2021	Level 3 maintenance	12/2021	\$53,300	

b. STATUS OF ACTION PLANS FOR 2017 WORST PERFORMING CIRCUITS

Station	Feeder	Year	Action plan	Actual Compl. Date	Actual Cost	Comments
Tully Center	27853	2018	Level 3 maintenance	08/2018	\$463,400	
Tully Center	27853	2019	Routine trimming	03/2020		
Tully Center	27853	2019	Replace station transformer	06/2019	\$1,761,750	
West Cleveland	32651	2018	Level 3 maintenance	08/2018	\$61,000	
West Cleveland	32651	2017	Forestry to perform hazard tree removals	03/2019		
Lighthouse Hill	6144	2018	Level 3 maintenance	06/2018	\$517,000	
Lighthouse Hill	6144	2019	Rebuild N Osceola Rd	03/2020	\$192,000	
Lighthouse Hill	6144	2019	Rebuild County Route 47	03/2020	\$349,000	
Lighthouse Hill	6144	2019	Routine trimming	03/2019		
Lighthouse Hill	6144	2018	Investigate installing Trip Savers	06/2018	\$60,000	5 to 6 locations identified for installation
Lords Hill	15067	2019	Level 3 maintenance	02/2019	\$247,100	
Lords Hill	15067	2018	Forestry to review feeder	12/2018		
Lords Hill	15067	2018	Investigate installing Trip Savers	04/2018	\$10,000	1 location identified
Constantia	1923	2019	Forestry to perform hazard tree removals	03/2019		
McGraw	22869	2018	Level 3 maintenance	05/2018	\$232,400	
Niles	29451	2020	Rebuild Dolphin Point Rd	03/2020	\$300,000	
Niles	29451	2019	Maintenance Patrol	12/2019		
Niles	29451	2018	Forestry to review feeder	12/2018		
Granby Center	29351	2019	Routine trimming	03/2019		
Granby Center	29351	2019	Forestry to perform hazard tree removals	03/2019		
Granby Center	29351	2019	Maintenance Patrol	12/2019		
Granby Center	29351	2022	Convert CR 8 and create tie	03/2023	\$680,000	
Colosse	32151	2018	Forestry to review feeder	12/2018		
Colosse	32151	2019	Level 3 maintenance	09/2019	\$167,700	
Colosse	32151	2018	Fuse coordination	09/2018	\$15,000	Trip Savers to be installed in several locations
Tully Center	27852	2019	Routine trimming	03/2019		
Tully Center	27852	2019	Maintenance Patrol	12/2019		
Tully Center	27852	2019	Replace station transformer	06/2019	\$1,761,750	
Tully Center	27851	2019	Routine trimming	03/2019		
Tully Center	27851	2019	Replace station transformer	06/2019	\$1,761,750	
Tully Center	27851	2018	Level 2 maintenance	12/2018		
Tully Center	27851	2020	Level 3 maintenance	12/2020		
Cleveland	1166	2019	Level 3 maintenance	03/2019	\$151,100	
Cleveland	1166	2019	Forestry to perform hazard tree removals	03/2019		
Gilbert Mills	24753	2018	Repair 115kV Switch	06/2018		
Gilbert Mills	24753	2018	Forestry to review feeder	12/2018		
Gilbert Mills	24753	2019	Maintenance Patrol	12/2019		
Ash Street	22351	2020	Routine trimming	03/2020		
Fabius	5561	2020	Level 3 maintenance	02/2020	\$58,200	
Fabius	5561	2018	Forestry to review feeder	12/2018		
Southwood	24452	2019	Forestry to perform hazard tree removals	03/2019		
Southwood	24452	2019	Level 3 maintenance	10/2018	\$385,400	

<b>Station</b>	<b>Feeder</b>	<b>Year</b>	<b>Action plan</b>	<b>Actual Compl. Date</b>	<b>Actual Cost</b>	<b>Comments</b>
Jewett Road	29155	2018	Forestry to review feeder	12/2018		
Jewett Road	29155	2019	Maintenance Patrol	12/2019		
Delphi	26251	2018	Maintenance Patrol	12/2018		
Duguid	26555	2018	Level 2 maintenance	04/2018	\$33,500	
Duguid	26555	2020	Level 3 maintenance	04/2020	\$298,300	
Duguid	26555	2018	Fuse coordination	12/2018	\$5000	
Whitaker	29652	2019	Routine trimming	03/2019		
Whitaker	29652	2019	Maintenance Patrol	12/2019		
Whitaker	29652	2018	Investigate installing Trip Savers	04/2018	\$1,000	No additional locations identified

## E. FRONTIER REGION

### 1. OPERATING REGIONAL PERFORMANCE

#### a. HISTORIC CAIDI AND SAIFI INDICES

IDS Info:

	2018	2017	2016	2015	2014	2013
CAIDI (Target 1.869)	1.61	1.79	1.85	1.73	1.74	1.74
SAIFI (Target 0.480)	0.48	0.43	0.47	0.46	0.44	0.45
SAIDI	0.77	0.77	0.86	0.80	0.77	0.78
Interruptions	1,480	1,541	1,413	1,527	1,481	1,582
Customers Interrupted	156,487	138,537	149,808	148,020	141,217	142,492
Customer-Hours Interrupted	252,020	248,544	276,669	255,499	245,553	248,147
Customers Served	326,422	324,315	320,995	320,700	320,191	319,694
Customers Per Interruption	105.73	89.90	106.02	96.94	95.35	90.07
Availability Index	99.9912	99.9913	99.9902	99.9909	99.9912	99.9911
Interruptions/1000 customers	4.53	4.75	4.40	4.76	4.63	4.95

#### b. DISCUSSION OF REGIONAL PERFORMANCE

In 2018, the Frontier Region met its CAIDI reliability target and met its SAIFI reliability target as set forth by the New York Public Service Commission (PSC). The final System Average Interruption Frequency Index (SAIFI) result was 0.48 interruptions, equal to the PSC goal of 0.480 interruptions. As shown in the table above, the Customer Average Interruption Duration index (CAIDI) was 1.61 in 2018, 14% below the PSC's regional target of 1.869 hours.

The 2018 CAIDI result was 10% below the 2017 result of 1.79 hours, and 9% below the previous 5-year average of 1.77 hours. The 2018 SAIFI was 12% above the 2017 result of 0.43 interruptions, and 7% above the previous 5-year average of 0.45 interruptions.

In 2018, excluding major storms, the Frontier Region experienced 17 transmission interruptions. These interruptions accounted for 1% of the region's total interruptions (17 of 1,480), 22% of the region's total customers interrupted (CI), (35,032 of 156,487), and 20% (50,148 of 252,019) of the region's total customer-hours interrupted (CHI). Overall, transmission interruptions had a CAIDI of 1.43 hours, and a SAIFI of 0.11 interruptions.



The number of transmission-related interruptions increased from 13 in 2017 to 17 in 2018 (an increase of 31%). The number of customers interrupted increased from 8,068 in 2017, to 35,032 in 2018 (an increase of 334%), while the customer-hours interrupted increased from 10,028 in 2017, to 50,148 in 2018 (an increase of 400%).

In 2018, excluding major storms, the Frontier Region experienced 11 substation interruptions. These interruptions accounted for 1% of the region's total interruptions (11 of 1,480), 3% of the region's total customers interrupted, (4,509 of 156,487), and 3% (7,461 of 252,019) of the region's total customer-hours interrupted. Overall, substation interruptions had a CAIDI of 1.65 hours, and a SAIFI of 0.01 interruptions.

The number of substation-related interruptions increased from 9 to 11 from 2017 to 2018 (an increase of 22%). The number of customers interrupted decreased from 6,587 in 2017, to 4,509 in 2018 (a decrease of 32%), while the customer-hours interrupted increased from 5,314 in 2017, to 7,461 in 2018 (an increase of 40%).

In 2018, excluding major storms, the Frontier Region experienced 1,452 distribution interruptions. These interruptions accounted for 98% of the region's total interruptions (1,452 of 1,480), 75% of the region's total customers interrupted, (116,946 of 156,487), and 77% (194,410 of 252,019) of the region's total customer-hours interrupted. Overall, distribution interruptions had a CAIDI of 1.66 hours, and a SAIFI of 0.36 interruptions.

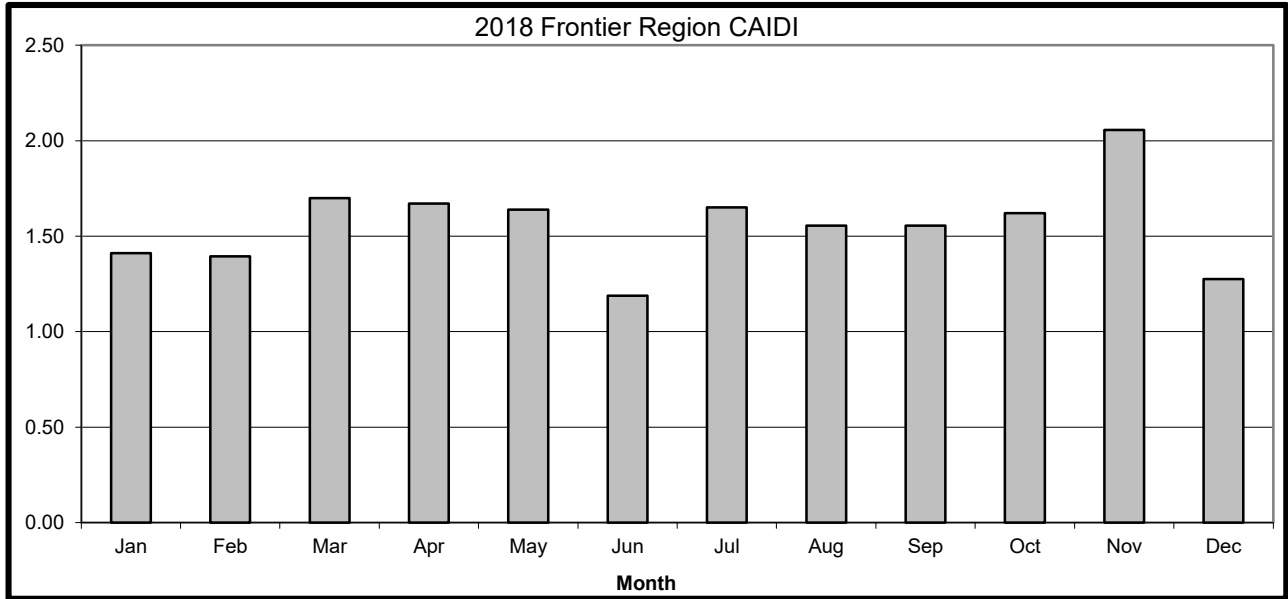
The number of distribution-related interruptions decreased from 1,519 to 1,452 from 2017 to 2018 (a decrease of 4%). The number of customers interrupted decreased from 123,882 in 2017, to 116,946 in 2018 (a decrease of 6%), while the customer-hours interrupted decreased from 233,201 in 2017, to 194,410 in 2018 (a decrease of 17%).

c. MONTHLY CAIDI AND SAIFI GRAPHS

The graphs on the following page show the monthly CAIDI and SAIFI for the Frontier Region for 2018. The months of April (0.10), May (0.05), July (0.07) and September (0.06) were the highest contributors to SAIFI for 2018, with 58% of the Frontier Region's SAIFI occurring during these four months. The best four months for SAIFI were January (0.02), February (0.02), March (0.01), and December (0.01). The interruptions that occurred during these four months contributed 13% of the Frontier Region's SAIFI.

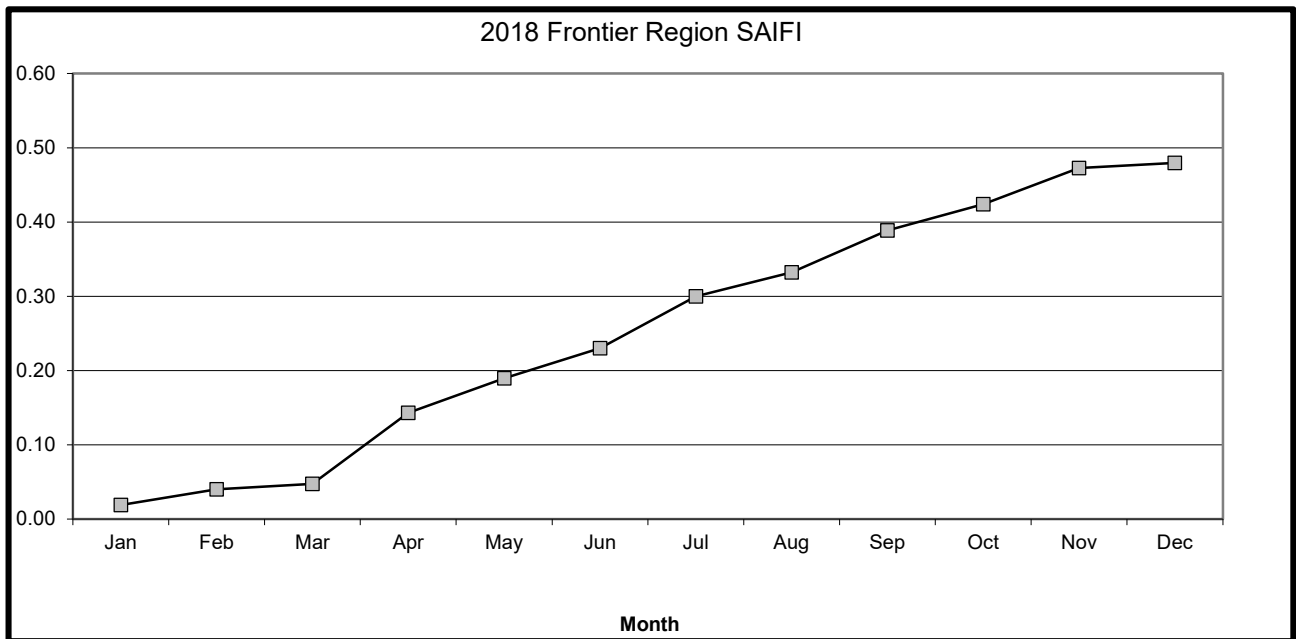
During eleven months, CAIDI was at or below the 2018 PSC minimum goal of 1.869, with the best three months being February (1.40), June (1.19) and December (1.28). The one month that exceeded the goal was November (2.06).

GRAPH OF MONTHLY CAIDI AND SAIFI FOR FRONTIER REGION



PSC CAIDI Goal:	
Minimum	1.869
2018 Actual	1.61

PSC SAIFI Goal:	
Minimum	0.480
2018 Actual	0.48



d. PSC CAUSE CODES

1) Number of Events by Cause – Historical

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	413	263	0	0	0	984
<b>02</b> Tree Contacts	366	444	308	276	339	321
<b>03</b> Overloads	65	17	27	30	9	54
<b>04</b> Operator Error	10	17	17	30	18	18
<b>05</b> Equipment	628	591	588	717	672	769
<b>06</b> Accidents	206	191	222	206	205	167
<b>07</b> Prearranged	67	94	70	73	51	74
<b>08</b> Customer Equip.	0	0	0	0	0	0
<b>09</b> Lightning	20	55	52	75	63	46
<b>10</b> Unknown	118	132	129	120	124	133
<b>Total</b>	<b>1,893</b>	<b>1,804</b>	<b>1,413</b>	<b>1,527</b>	<b>1,481</b>	<b>2,566</b>

2) Customers Interrupted by Cause – Historical

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	60,452	35,972	0	0	0	150,825
<b>02</b> Tree Contacts	32,818	32,670	20,087	28,088	30,894	26,110
<b>03</b> Overloads	1,848	889	685	1,110	227	1,343
<b>04</b> Operator Error	3,485	2,135	4,388	6,672	984	5,140
<b>05</b> Equipment	75,854	47,618	57,700	60,836	55,759	66,771
<b>06</b> Accidents	16,446	18,326	42,524	16,231	17,137	19,158
<b>07</b> Prearranged	8,870	12,591	4,677	13,089	6,633	6,222
<b>08</b> Customer Equip.	0	0	0	0	0	0
<b>09</b> Lightning	2,416	10,314	9,228	9,060	5,221	7,772
<b>10</b> Unknown	14,750	13,994	10,519	12,934	24,362	9,976
<b>Total</b>	<b>216,939</b>	<b>174,509</b>	<b>149,808</b>	<b>148,020</b>	<b>141,217</b>	<b>293,317</b>

3) Customer-Hours Interrupted by Cause – Historical

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	305,750	405,150	0	0	0	1,087,267
<b>02</b> Tree Contacts	64,681	77,062	43,979	52,970	69,493	45,776
<b>03</b> Overloads	3,978	1,454	1,184	1,770	630	2,840
<b>04</b> Operator Error	2,075	1,968	5,374	1,881	1,029	6,077
<b>05</b> Equipment	127,747	85,377	115,715	123,702	105,612	120,275
<b>06</b> Accidents	25,821	35,892	75,974	20,924	26,560	35,148
<b>07</b> Prearranged	4,602	9,552	7,485	10,919	9,251	7,176
<b>08</b> Customer Equip.	0	0	0	0	0	0
<b>09</b> Lightning	6,384	11,715	9,811	25,403	10,148	16,756
<b>10</b> Unknown	16,730	25,524	17,147	17,932	22,829	14,095
Total	557,769	653,694	276,670	255,501	245,551	1,335,411

4) Interruptions, Customers Interrupted, and Customer-Hours Interrupted – 2018

<b>Cause Code</b>	<b>Interruptions</b>		<b>Customers Interrupted</b>		<b>Customer-Hours Interrupted</b>	
	<b>Number</b>	<b>% Total</b>	<b>Number</b>	<b>% Total</b>	<b>Number</b>	<b>% Total</b>
<b>01</b> Major Storms	413	21.8%	60,452	27.9%	305,750	54.8%
<b>02</b> Tree Contacts	366	19.3%	32,818	15.1%	64,681	11.6%
<b>03</b> Overloads	65	3.4%	1,848	0.9%	3,978	0.7%
<b>04</b> Operator Error	10	0.5%	3,485	1.6%	2,075	0.4%
<b>05</b> Equipment	628	33.2%	75,854	35.0%	127,747	22.9%
<b>06</b> Accidents	206	10.9%	16,446	7.6%	25,821	4.6%
<b>07</b> Prearranged	67	3.5%	8,870	4.1%	4,602	0.8%
<b>08</b> Customer Equip.	0	0.0%	0	0.0%	0	0.0%
<b>09</b> Lightning	20	1.1%	2,416	1.1%	6,384	1.1%
<b>10</b> Unknown	118	6.2%	14,750	6.8%	16,730	3.0%
Total	1,893	100.0%	216,939	100.0%	557,768	100.0%

e. **INTERRUPTION REVIEW BY PSC CAUSE CODES**

**Cause Code 01 - Major Storms**

In 2018, Major Storms accounted for 22% of interruptions, 28% of customers interrupted, and 55% of Customer-Hours Interrupted.

Interruptions due to Major Storm were up 57% from 2017, and up 66% over the 5 year average. Customers interrupted due to Major Storms were up 68% from 2017, and up 62% over the 5 year average. Customer-Hours interrupted were down 25% from 2017 and up 2% over the 5 year average.

The remaining PSC code descriptions do not include Major Storms in the percentages.

**Cause Code 02 - Tree Contacts**

In 2018, Tree Contacts accounted for 25% of interruptions, 21% of customers interrupted, and 26% of Customer-Hours Interrupted.

Interruptions due to Tree Contacts were down 18% from 2017, and up 8% over the 5 year average. Customers interrupted due to Tree Contacts were up 0% from 2017, and up 19% over the 5 year average. Customer-Hours interrupted were down 16% from 2017 and up 12% over the 5 year average.

Tree Contacts were the 2nd largest cause of interruptions in 2018.

**Cause Code 03 - Overloads**

In 2018, Overloads accounted for 4% of interruptions, 1% of customers interrupted, and 2% of Customer-Hours Interrupted.

Interruptions due to Overloads were up 282% from 2017, and up 141% over the 5 year average. Customers interrupted due to Overloads were up 108% from 2017, and up 117% over the 5 year average. Customer-Hours interrupted were up 174% from 2017 and up 152% over the 5 year average.

Overloads were the 6th largest cause of interruptions in 2018.

**Cause Code 04 - Operator Error**

In 2018, Operator Error accounted for 1% of interruptions, 2% of customers interrupted, and 1% of Customer-Hours Interrupted.

Interruptions due to Operator Error were down 41% from 2017, and down 50% over the 5 year average. Customers interrupted due to Operator Error were up 63% from 2017, and down 10% over the 5 year average. Customer-Hours interrupted were up 5% from 2017 and down 36% over the 5 year average.

Operator Error was the 8th largest cause of interruptions in 2018.

### **Cause Code 05 - Equipment Failure**

In 2018, Equipment Failures accounted for 42% of interruptions, 48% of customers interrupted, and 51% of Customer-Hours Interrupted.

Interruptions due to Equipment Failure were up 6% from 2017, and down 6% over the 5 year average. Customers interrupted due to Equipment Failure were up 59% from 2017, and up 31% over the 5 year average. Customer-Hours interrupted were up 50% from 2017 and up 16% over the 5 year average.

Equipment Failures were the largest cause of interruptions in 2018.

### **Cause Code 06 - Accidents**

In 2018, Accidents accounted for 14% of interruptions, 11% of customers interrupted, and 10% of Customer-Hours Interrupted.

Interruptions due to Accidents were up 8% from 2017, and up 4% over the 5 year average. Customers interrupted due to Accidents were down 10% from 2017, and down 27% over the 5 year average. Customer-Hours interrupted were down 28% from 2017 and down 34% over the 5 year average.

Accidents were the 3rd largest cause of interruptions in 2018.

### **Cause Code 07 - Prearranged**

In 2018, Prearranged accounted for 5% of interruptions, 6% of customers interrupted, and 2% of Customer-Hours Interrupted.

Interruptions due to Prearranged were down 29% from 2017, and down 7% over the 5 year average. Customers interrupted due to Prearranged were down 30% from 2017, and up 3% over the 5 year average. Customer-Hours interrupted were down 52% from 2017 and down 48% over the 5 year average.

Prearranged was the 5th largest cause of interruptions in 2018.

### **Cause Code 08 - Customer Equipment**

There were no Customer Equipment interruptions in 2018.

### **Cause Code 09 - Lightning**

In 2018, Lightning accounted for 1% of interruptions, 2% of customers interrupted, and 3% of Customer-Hours Interrupted.

Interruptions due to Lightning were down 64% from 2017, and down 66% over the 5 year average. Customers interrupted due to Lightning were down 77% from 2017, and down 71% over the 5 year average. Customer-Hours interrupted were down 46% from 2017 and down 57% over the 5 year average.

Lightning was the 7th largest cause of interruptions in 2018.

### **Cause Code 10 - Unknown**

In 2018, Unknown causes accounted for 8% of interruptions, 9% of customers interrupted, and 7% of Customer-Hours Interrupted.

Interruptions due to Unknown causes were down 11% from 2017, and down 8% over the 5 year average. Customers interrupted due to Unknown causes were up 5% from 2017, and up 3% over the 5 year average. Customer-Hours interrupted were down 34% from 2017 and down 14% over the 5 year average.

Unknown causes were the 4th largest cause of interruptions in 2018.



f. DISCUSSION OF REGIONAL CAPEX PROJECTS WITH 2018/19 SPENDS:

The Company continues to work on capital-related projects in the Frontier Region to maintain customer satisfaction and future reliability. Some specific projects that were constructed in 2018 or will be constructed in 2019 are discussed below. An additional table of major infrastructure projects completed in 2018 follows. This includes distribution, sub-transmission, and transmission-related projects.

A number of ongoing projects are related to the program for reconstructing indoor Buffalo substations. This work is being done to upgrade the aging infrastructure within the Buffalo system, much of which is made up of 1920-30's vintage equipment that is at or beyond the end of its expected lifecycle. This effort is in place to maintain reliability and maintain the ability to serve our customers in the City of Buffalo. Reconstruction of Substation 37 is complete, while efforts continue to rebuild substation numbers 32, 53 and 59. These efforts represent projects completed in recent years, those now in progress, and those planned to start in the upcoming year or are in design phase.

A project is underway to reconstruct open air station 56. This effort is in place to maintain reliability and the ability to serve our customers in that area. That is expected for completion during 1<sup>st</sup> quarter of FY20.

There are also numerous distribution projects to rebuild or reconductor lines. These projects are the result of reliability reviews, responses to QRS inquiries, the result of implementing an asset strategy, or load-related issues.

Some specific reliability-related projects in the Frontier Region follow below:

**Frankhauser Substation**

The installation of a new 115kV/13.2kV substation located in Amherst, NY was completed in 2014. This substation will provide relief for various thermal overloads projected for feeders in the Amherst area. Frankhauser Substation will provide relief to the following substations: Buffalo Substation 21, Buffalo Substation 54, Buffalo Substation 58, Buffalo Substation 124, Buffalo Substation 130, Buffalo Substation 140, and Sweet Home Road Substation 224. Two additional feeders from the station are expected to be in service during the 2<sup>nd</sup> quarter of 2019.

### **Refurbish Lines 25H, 27H, 33H, 36H Phase 2**

This project will replace 58 poles on lines that originate from Sawyer Station throughout Tonawanda area. Many poles are 60+ years old and this project will increase the resiliency of the system in this area of Tonawanda. This project is expected to be completed by the 4<sup>th</sup> quarter of FY20.

### **Reconductor Seneca Cables 1S, 2S, 3S, 19S & 31S**

This project will replace approximately 40,000 circuit feet with larger cable between Seneca Terminal Station, Station 44 & Station 46. The cables in this area could be operating at 95% of emergency ratings under contingency conditions. They also feed substations which have been rebuilt to point that supply cables are now limiting elements. This project was completed in 2018.

### **Create feeder tie between Two Mile Creek 101151 and Riverwalk 68451**

These 2 single feeder stations have now available 13.2kV feeder ties. Construction of approximately 7,500 feet of OH lines is currently under construction to create a full tie. Project is expected to be completed by 2<sup>nd</sup> quarter of FY20.

### **Two Mile Creek Substation**

The installation of a new 115kV/13.2kV substation with 4 feeders located in Tonawanda is currently in progress. This substation will provide relief for the two temporary stations built at Two Mile Creek and Riverwalk. It will create added capacity to serve customer growth areas in North Youngman Commercial Park and the Riverwalk Solar Park. It will also provide relief for area stations 56, 74 and 126. Project is expected to be completed by 1<sup>st</sup> quarter of FY21.

**Major Capital Projects for Frontier Region:**

<b>Region</b>	<b>Project Name</b>	<b>Project Type</b>	<b>Fin Sys Proj. No.</b>	<b>Finish</b>	<b>Total Spend</b>
Frontier	Buffalo Station 37 Rebuild-Station	D Sub	C033474	7/26/18	\$7,874,000
Frontier	ELM STREET RELIEG_ADD FOURTH TRANSFOMER (#3)	Tran Sub	C049594	5/25/18	\$18,700,000
Frontier	Grdvll-Bffl Rvr146 2nd Tap Ohio Sta	Trans	C054713	9/7/18	\$1,789,087

g. DISCUSSION OF REGIONAL PERFORMANCE OF LVAC NETWORK DISTRIBUTION SYSTEM(S)

**Buffalo LVAC Network**

Background

The Elm Street 230/23 kV Station that serves Buffalo’s network area has twenty 23kV cables, which supply 148 general network vaults, 136 spot network vaults, nine primary commercial customers, three National Grid distribution stations and has the ability to serve five additional distribution stations via normally open tie switches. General network vaults supply the low voltage network which serves approximately 1,167 National Grid customers. Spot network vaults serve 346 commercial customers. Elm Street station peaked at 115 MVA during 2018.

Performance

The table below lists the breaker operations at Elm Street in 2018 that were a result of a fault or a failure on either the primary cable or a piece of network equipment (transformer, high voltage switch or protector):

<b>2017 ELM ST 23KVNETWORK PERFORMANCE</b>					
<b>STATION</b>	<b>CABLE</b>	<b>BKR</b>	<b>BKR</b>	<b># OF OPERATIONS DUE TO FAILURES</b>	<b>CUSTOMERS AFFECTED</b>
ELM	1E	R122	R125	1	0
ELM	2E	R222	R225	0	0
ELM	3E	R335	R338	0	0
ELM	4E	R435	R438	0	0
ELM	5E	R145	R148	3	0
ELM	6E	R332	R335	1	0
ELM	7E	R125	R128	0	0
ELM	8E	R225	R228	1	0
ELM	9E	R325	R238	0	0
ELM	10E	R432	R435	1	0
ELM	11E	R322	R325	0	0
ELM	12E	R325	R328	0	0
ELM	14E	R422	R425	0	0
ELM	15E	R425	R428	0	0
ELM	16E	R142	R145	1	0
ELM	17E	R242	R245	0	0
ELM	18E	R232	R235	0	0
ELM	23E	R248	R245	2	0
ELM	27E	R132	R135	2	0
ELM	35E	R138	R135	0	0

## Improvements

In 2018 New York West replaced the high voltage switches, network transformers and network protectors in the following vaults; 18-52, 8-121, 6-121, 23-120, 5-72, 35-158, 23-123, 27-52, 35-49 and 4-112. All of this equipment was either identified as being in need of replacement via the I&M process or it failed in service. At this time the I&M process has identified 12 additional vaults requiring equipment change-outs that are planned for future years. Approximately 16,000 feet of LVAC cable was replaced in 2018. A project to replace approximately 20,000 feet of LVAC secondary cable per year is expected to be continued in 2019.

One new spot network vault was completed at 620 Delaware Street, consisting of (2) 1000kVA transformers with protectors, NMVI switches and link boxes to serve a 3000A service.

## 2. OPERATING CIRCUIT LISTS

The next three tables will provide the following information for the Frontier Region.

- a. Worst Performing Circuit List
- b. Worst Performing Circuits with 3 Year History for CAIDI and SAIFI Indices
- c. Worst Performing Circuits by # of Momentary Interruptions

a. NATIONAL GRID WORST PERFORMING CIRCUIT LIST

FRONTIER REGION

	A	B	C	D				
FEEDER #	CUST. SERVED	TOTAL INTER.	#CUST. INTER.	CUST. HRS. INTER.	C/A SAIFI	D/A SAIDI	D/C CAIDI	NUMBER OF MOMENTARIES
The Frontier Region did not have any circuits that made the Worst Performing Feeder List.								

Regional Goals:  
 CAIDI Min. 1.869  
 SAIFI Min. 0.48

b. NATIONAL GRID WORST CIRCUIT PERFORMING CIRCUITS WITH A 3 YEAR HISTORY FOR CAIDI AND SAIFI INDICES

FRONTIER REGION

FEEDER #	2018 CAIDI	2017 CAIDI	2016 CAIDI	2015 CAIDI	2018 SAIFI	2017 SAIFI	2016 SAIFI	2015 SAIFI
The Frontier Region did not have any circuits that made the Worst Performing Feeder List.								

Regional Goals:  
 CAIDI Min. 1.869  
 SAIFI Min. 0.48



c. NATIONAL GRID WORST PERFORMING CIRCUITS BY # OF MOMENTARY INTERRUPTIONS

FRONTIER REGION

Feeders			Customer Momentaries				Ranks		
Volts (kV)	Station Name	Circuit/F No.	Substation	Transmission	Distribution	Total	Within Region	Within System	Reliability Ranking
No circuits experienced 10 or more momentary interruptions in 2018.									

d. WORST PERFORMING CIRCUIT ANALYSIS

This year, the Frontier Region did not have any circuits that made the Worst Performing Feeder List.

The PSC minimum goals for the Central Region are 1.869 hours for CAIDI and 0.48 interruptions for SAIFI.

3. ACTION PLAN SUMMARIES

a. SUMMARY OF ACTION PLANS FOR 2018 WORST PERFORMING CIRCUITS

<b>Station</b>	<b>Feeder</b>	<b>Report Year</b>	<b>Action Plan</b>	<b>Projected Completion Date</b>	<b>Cost</b>	<b>Comments</b>
This year, the Frontier Region did not have any circuits that made the Worst Performing Feeder List.						

b. SUMMARY OF ACTION PLANS FOR 2017 WORST PERFORMING CIRCUITS

<b>Station</b>	<b>Feeder</b>	<b>Report Year</b>	<b>Action Plan</b>	<b>Actual Completion Date</b>	<b>Actual Cost</b>	<b>Comments</b>
Buffalo 34	3462	2018	Complete I&M Level 3 Work	2018	168,000	Complete
Buffalo 34	3462	2018	Complete fusing study & installations	2018	10,000	Complete
Shawnee	7655	2018	I&M Level 2 Items	2019	TBD	
Shawnee	7655	2018	I&M Level 3 Items	2020	TBD	

## F. GENESEE REGION

### 1. OPERATING REGIONAL PERFORMANCE

#### a. HISTORIC CAIDI AND SAIFI INDICES

IDS Info:

	2018	2017	2016	2015	2014	2013
CAIDI (Target 2.049)	2.06	1.76	1.62	1.98	1.96	1.96
SAIFI (Target 1.037)	1.23	0.76	0.70	1.11	0.96	1.01
SAIDI	2.53	1.34	1.14	2.19	1.87	1.97
Interruptions	886	980	939	971	980	1,115
Customers Interrupted	122,045	75,171	68,897	108,060	93,313	98,101
Customer-Hours Interrupted	251,608	131,985	111,862	213,627	182,527	192,406
Customers Served	99,272	98,834	98,282	97,540	97,376	97,512
Customers Per Interruption	137.75	76.71	73.37	111.29	95.22	87.98
Availability Index	99.9711	99.9848	99.9870	99.9750	99.9786	99.9775
Interruptions/1000Customers	8.93	9.92	9.55	9.95	10.06	11.43

#### b. DISCUSSION OF REGIONAL PERFORMANCE

In 2018, the Genesee Region did not meet its CAIDI reliability target and did not meet its SAIFI reliability target as set forth by the New York Public Service Commission (PSC). The final System Average Interruption Frequency Index (SAIFI) result was 1.23 interruptions, 19% above the PSC goal of 1.037 interruptions. As shown in the table above, the Customer Average Interruption Duration index (CAIDI) was 2.06 in 2018, 1% above the PSC's regional target of 2.049 hours.

The 2018 CAIDI result was 17% above the 2017 result of 1.76 hours, and 10% above the previous 5-year average of 1.88 hours. The 2018 SAIFI was 62% above the 2017 result of 0.76 interruptions, and 35% above the previous 5-year average of 0.91 interruptions.

In 2018, excluding major storms, the Genesee Region experienced 10 transmission interruptions. These interruptions accounted for 1% of the region's total interruptions (10 of 886), 29% of the region's total customers interrupted (CI), (34,939 of 122,045), and 47% (117,768 of 251,609) of the region's total customer-hours interrupted (CHI). Overall, transmission interruptions had a CAIDI of 3.37 hours, and a SAIFI of 0.35 interruptions.

The number of transmission-related interruptions increased from 6 in 2017 to 10 in 2018 (an increase of 67%). The number of customers interrupted increased from 6,300 in 2017, to 34,939 in 2018 (an increase of 455%), while the customer-hours interrupted increased from 9,512 in 2017, to 117,768 in 2018 (an increase of 1,138%).

In 2018, excluding major storms, the Genesee Region experienced 5 substation interruptions. These interruptions accounted for 1% of the region's total interruptions (5 of 886), 5% of the region's total customers interrupted, (5,841 of 122,045), and 4% (10,486 of 251,609) of the region's total customer-hours interrupted. Overall, substation interruptions had a CAIDI of 1.8 hours, and a SAIFI of 0.06 interruptions.

The number of substation-related interruptions increased from 3 to 5 from 2017 to 2018 (an increase of 67%). The number of customers interrupted increased from 3,273 in 2017, to 5,841 in 2018 (an increase of 78%), while the customer-hours interrupted increased from 4,021 in 2017, to 10,486 in 2018 (an increase of 161%).

In 2018, excluding major storms, the Genesee Region experienced 871 distribution interruptions. These interruptions accounted for 98% of the region's total interruptions (871 of 886), 67% of the region's total customers interrupted, (81,265 of 122,045), and 49% (123,355 of 251,609) of the region's total customer-hours interrupted. Overall, distribution interruptions had a CAIDI of 1.52 hours, and a SAIFI of 0.82 interruptions.

The number of distribution-related interruptions decreased from 971 to 871 from 2017 to 2018 (a decrease of 10%). The number of customers interrupted increased from 65,598 in 2017, to 81,265 in 2018 (an increase of 24%), while the customer-hours interrupted increased from 118,451 in 2017, to 123,355 in 2018 (an increase of 4%).

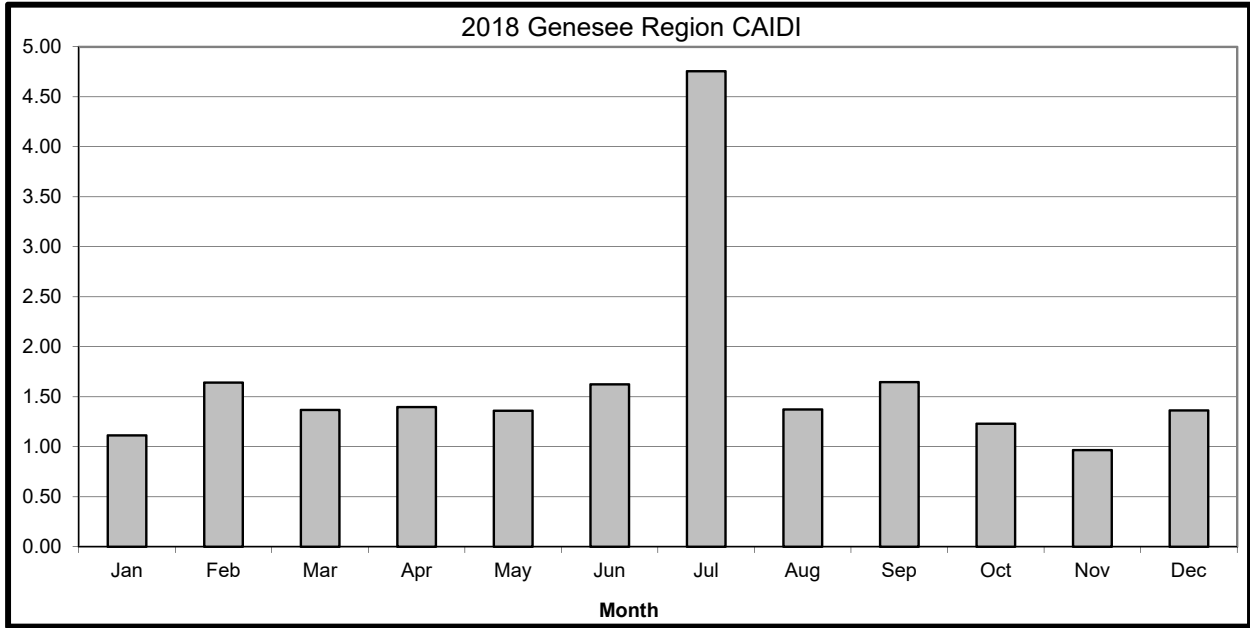
c. MONTHLY CAIDI AND SAIFI GRAPHS

The graphs on the following page show the monthly CAIDI and SAIFI for the Genesee Region for 2018.

CAIDI was above the PSC minimum goal of 2.049 for one month in 2018. The one month that exceeded the goal was in July (4.76).

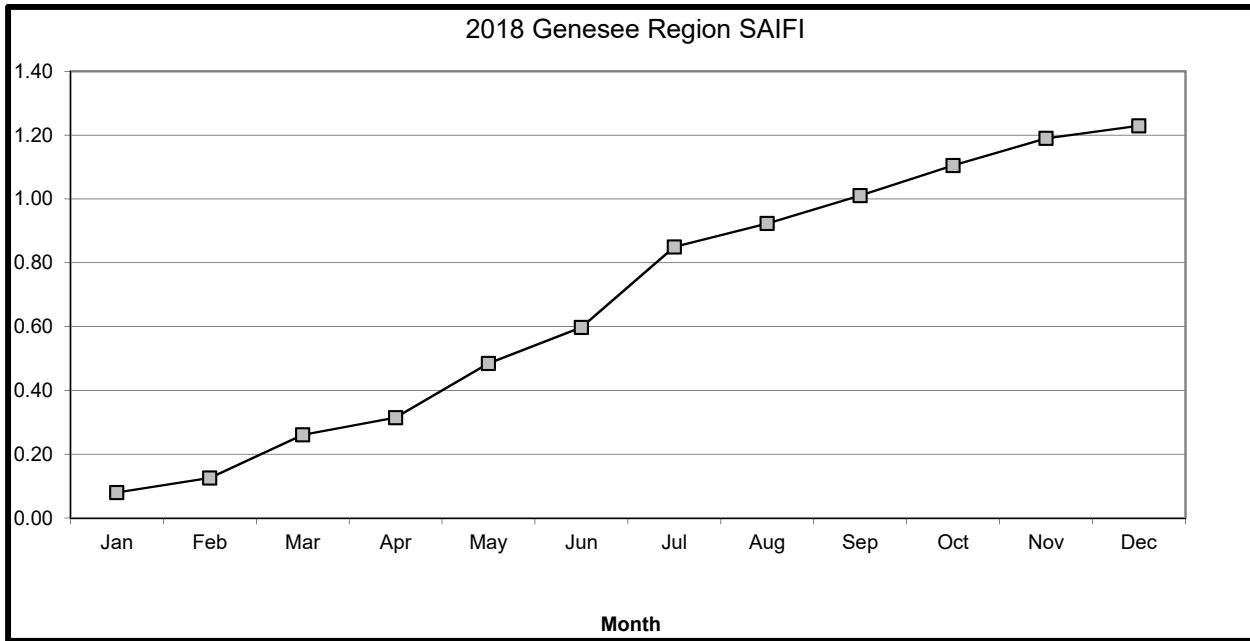
SAIFI was above the PSC minimum goal of 1.037 in 2018 and showed the greatest increase during the months of March (0.14), May (0.17), June (0.11) and July (0.25). These four months accounted for 54% of Genesee Region's annual SAIFI metric. In contrast, the months of February (0.05), April (0.05) and December (0.04) were the best three months and contributed only 11% to the Region's SAIFI.

GRAPH OF MONTHLY CAIDI AND SAIFI FOR THE GENESSEE REGION



PSC CAIDI Goal:	
Minimum	2.049
2018 Actual	2.06

PSC SAIFI Goal:	
Minimum	1.037
2018 Actual	1.23





d. PSC CAUSE CODES

1) Number of Events by Cause – Historical

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	503	1,033	0	0	52	361
<b>02</b> Tree Contacts	184	235	192	248	190	227
<b>03</b> Overloads	9	3	4	2	9	9
<b>04</b> Operator Error	6	9	7	6	2	5
<b>05</b> Equipment	275	275	270	289	311	338
<b>06</b> Accidents	226	198	231	200	206	193
<b>07</b> Prearranged	28	41	32	16	20	15
<b>08</b> Customer Equip.	0	0	0	0	0	0
<b>09</b> Lightning	29	91	65	85	102	90
<b>10</b> Unknown	129	128	138	125	140	238
<b>Total</b>	<b>1,389</b>	<b>2,013</b>	<b>939</b>	<b>971</b>	<b>1,032</b>	<b>1,476</b>

2) Customers Interrupted by Cause – Historical

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	47,213	97,630	0	0	10,068	41,836
<b>02</b> Tree Contacts	20,717	23,637	11,050	21,597	19,227	20,243
<b>03</b> Overloads	164	16	5	43	26	1,326
<b>04</b> Operator Error	1,826	1,183	309	422	702	7,405
<b>05</b> Equipment	40,661	21,379	20,972	41,535	43,653	30,205
<b>06</b> Accidents	34,508	14,130	12,882	14,298	13,023	18,639
<b>07</b> Prearranged	4,058	4,976	2,022	1,382	1,282	2,288
<b>08</b> Customer Equip.	0	0	0	0	0	0
<b>09</b> Lightning	4,333	4,187	2,032	11,842	5,545	5,190
<b>10</b> Unknown	15,778	5,663	19,625	16,941	9,855	12,805
<b>Total</b>	<b>169,258</b>	<b>172,801</b>	<b>68,897</b>	<b>108,060</b>	<b>103,381</b>	<b>139,937</b>

3) Customer-Hours Interrupted by Cause – Historical

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	363,920	1,904,793	0	0	129,105	433,724
<b>02</b> Tree Contacts	32,897	44,076	24,567	51,784	44,894	48,537
<b>03</b> Overloads	567	125	10	78	84	1,069
<b>04</b> Operator Error	1,630	825	309	673	1,041	5,111
<b>05</b> Equipment	141,295	31,952	29,921	82,719	83,918	55,476
<b>06</b> Accidents	39,642	25,598	18,892	29,206	21,768	38,920
<b>07</b> Prearranged	5,580	4,688	1,568	1,536	1,009	1,966
<b>08</b> Customer Equip.	0	0	0	0	0	0
<b>09</b> Lightning	9,473	10,678	4,840	15,404	13,075	17,506
<b>10</b> Unknown	20,525	14,043	31,755	32,228	16,739	23,819
Total	615,528	2,036,778	111,861	213,627	311,633	626,128

4) Interruptions, Customers Interrupted and Customer-Hours Interrupted – 2018

<b>Cause Code</b>	<b>Interruptions</b>		<b>Customers Interrupted</b>		<b>Customer Hours Interrupted</b>	
	<b>Number</b>	<b>% Total</b>	<b>Number</b>	<b>% Total</b>	<b>Number</b>	<b>% Total</b>
<b>01</b> Major Storms	503	36.2%	47,213	27.9%	363,920	59.1%
<b>02</b> Tree Contacts	184	13.2%	20,717	12.2%	32,897	5.3%
<b>03</b> Overloads	9	0.6%	164	0.1%	567	0.1%
<b>04</b> Operator Error	6	0.4%	1,826	1.1%	1,630	0.3%
<b>05</b> Equipment	275	19.8%	40,661	24.0%	141,295	23.0%
<b>06</b> Accidents	226	16.3%	34,508	20.4%	39,642	6.4%
<b>07</b> Prearranged	28	2.0%	4,058	2.4%	5,580	0.9%
<b>08</b> Customer Equip.	0	0.0%	0	0.0%	0	0.0%
<b>09</b> Lightning	29	2.1%	4,333	2.6%	9,473	1.5%
<b>10</b> Unknown	129	9.3%	15,778	9.3%	20,525	3.3%
Total	1,389	100.0%	169,258	100.0%	615,529	100.0%

e. **INTERRUPTION REVIEW BY PSC CAUSE CODES**

**Cause Code 01 - Major Storms**

In 2018, Major Storms accounted for 36% of interruptions, 28% of customers interrupted, and 59% of Customer-Hours Interrupted.

Interruptions due to Major Storm were down 51% from 2017, and up 74% over the 5 year average. Customers interrupted due to Major Storms were down 52% from 2017, and up 58% over the 5 year average. Customer-Hours interrupted were down 81% from 2017 and down 26% over the 5 year average.

The remaining PSC code descriptions do not include Major Storms in the percentages.

**Cause Code 02 - Tree Contacts**

In 2018, Tree Contacts accounted for 21% of interruptions, 17% of customers interrupted, and 13% of Customer-Hours Interrupted.

Interruptions due to Tree Contacts were down 22% from 2017, and down 16% over the 5 year average. Customers interrupted due to Tree Contacts were down 12% from 2017, and up 8% over the 5 year average. Customer-Hours interrupted were down 25% from 2017 and down 23% over the 5 year average.

Tree Contacts were the 3rd largest cause of interruptions in 2018.

**Cause Code 03 - Overloads**

In 2018, Overloads accounted for 1% of interruptions, 0% of customers interrupted, and 0% of Customer-Hours Interrupted.

Interruptions due to Overloads were up 200% from 2017, and up 80% over the 5 year average. Customers interrupted due to Overloads were up 925% from 2017, and down 42% over the 5 year average. Customer-Hours interrupted were up 354% from 2017 and up 108% over the 5 year average.

Overloads were the 7th largest cause of interruptions in 2018.

**Cause Code 04 - Operator Error**

In 2018, Operator Error accounted for 1% of interruptions, 1% of customers interrupted, and 1% of Customer-Hours Interrupted.

Interruptions due to Operator Error were down 33% from 2017, and flat at 0% over the 5 year average. Customers interrupted due to Operator Error were up 54% from 2017, and down 9% over the 5 year average. Customer-Hours interrupted were up 98% from 2017 and up 2% over the 5 year average.

Operator Error was the 8th largest cause of interruptions in 2018.

### **Cause Code 05 - Equipment Failure**

In 2018, Equipment Failures accounted for 31% of interruptions, 33% of customers interrupted, and 56% of Customer-Hours Interrupted.

Interruptions due to Equipment Failure were flat at 0% from 2017, and down 7% over the 5 year average. Customers interrupted due to Equipment Failure were up 90% from 2017, and up 29% over the 5 year average. Customer-Hours interrupted were up 342% from 2017 and up 149% over the 5 year average.

Equipment Failures were the largest cause of interruptions in 2018.

### **Cause Code 06 - Accidents**

In 2018, Accidents accounted for 26% of interruptions, 28% of customers interrupted, and 16% of Customer-Hours Interrupted.

Interruptions due to Accidents were up 14% from 2017, and up 10% over the 5 year average. Customers interrupted due to Accidents were up 144% from 2017, and up 136% over the 5 year average. Customer-Hours interrupted were up 55% from 2017 and up 47% over the 5 year average.

Accidents were the 2nd largest cause of interruptions in 2018.

### **Cause Code 07 - Prearranged**

In 2018, Prearranged accounted for 3% of interruptions, 3% of customers interrupted, and 2% of Customer-Hours Interrupted.

Interruptions due to Prearranged were down 32% from 2017, and up 12% over the 5 year average. Customers interrupted due to Prearranged were down 18% from 2017, and up 70% over the 5 year average. Customer-Hours interrupted were up 19% from 2017 and up 159% over the 5 year average.

Prearranged was the 6th largest cause of interruptions in 2018.

### **Cause Code 08 - Customer Equipment**

There were no Customer Equipment interruptions in 2018.

### **Cause Code 09 - Lightning**

In 2018, Lightning accounted for 3% of interruptions, 4% of customers interrupted, and 4% of Customer-Hours Interrupted.

Interruptions due to Lightning were down 68% from 2017, and down 67% over the 5 year average. Customers interrupted due to Lightning were up 3% from 2017, and down 25% over the 5 year average. Customer-Hours interrupted were down 11% from 2017 and down 23% over the 5 year average.

Lightning was the 5th largest cause of interruptions in 2018.

**Cause Code 10 - Unknown**

In 2018, Unknown causes accounted for 15% of interruptions, 13% of customers interrupted, and 8% of Customer-Hours Interrupted.

Interruptions due to Unknown causes were up 1% from 2017, and down 16% over the 5 year average. Customers interrupted due to Unknown causes were up 179% from 2017, and up 22% over the 5 year average. Customer-Hours interrupted were up 46% from 2017 and down 13% over the 5 year average.

Unknown causes were the 4th largest cause of interruptions in 2018.

f. DISCUSSION OF REGIONAL CAPEX PROJECTS WITH 2018/19 SPENDS:

The Company continues to work on capital projects in the Genesee Region to maintain customer satisfaction and maintain future reliability. Some specific projects that were either constructed in 2018 or planned for construction in 2019 are discussed below. An additional table of major infrastructure projects completed in 2018 follows. This includes distribution, transmission, and substation-related projects.

Some projects on the list or discussed below are substation-related projects located throughout the Region to address loading concerns or equipment condition issues, including West Hamlin 82.

There are numerous distribution projects to rebuild or re-conductor lines. These projects are the result of reliability reviews, response to a QRS inquiry, the result of implementing an asset strategy, or load-related issues.

Some specific reliability-related projects in the Genesee Region follow below:

**West Hamlin Substation 82**

West Hamlin Substation is a 115kV/13.2kV substation that originally had a single transformer bank serving over 7,100 customers. As a result of a load relief study in the Genesee North area, a second transformer bank was added in 2017 and two new feeders are currently under construction. The additional bank and two new feeders will relieve contingency overloading at Brockport Substation 74 and provide load relief for the surrounding area. This will improve reliability and service by providing load relief, the ability for future feeder ties, and operational flexibility. The two new feeders are expected to be completed in 2020.

**Sonora Way Substation 4381**

Sonora Way Substation is a 115kV/13.2kV substation installed in 2015 with two new feeders to allow for the removal of Mobile 7W and to provided load relief for Lakeville Substation 40 and Geneseo Substation 55. Overall, the plan is to install three new feeders from Sonora way substation to retire Lakeville Substation 40 and provide relief for Livonia Substation 37. The new feeders will also improve reliability and service by providing load relief, future feeder ties, and operational flexibility. The three new feeders are expected to be completed by the end of FY2023.

### **Sub-Transmission Infrastructure Projects**

The 34.5kV system in the Genesee Region consists of several very long loops which traverse rural territory in the Western Division. A number of the projects which were completed in 2018 or which are planned for 2019/2020 will maintain and upgrade the system, including projects to install Reclosers on sub-transmission lines (301) and (312) in the Genesee Region in FY21. The Reclosers will improve reliability by sectionalizing portions of the lines during interruptions.

**Major Capital Projects for Genesee Region:**

<b>Region</b>	<b>Project Name</b>	<b>Project Type</b>	<b>Fin Sys Proj No.</b>	<b>Finish</b>	<b>Total Spend</b>
Genesee	Batavia #01 – Replace TB #1 (D/F)	Dist. Sub.	C081010	12/19/2018	\$3,037,000



## 2. OPERATING CIRCUIT LISTS

The next three tables will provide the following information for the Genesee Region.

- a. Worst Performing Circuit List
- b. Worst Performing Circuits with 3 Year History for CAIDI and SAIFI Indices
- c. Worst Performing Circuits by # of Momentary Interruptions

a. NATIONAL GRID WORST PERFORMING CIRCUIT LIST

GENESEE REGION

<b>FEEDER #</b>	<b>A CUST. SERVED</b>	<b>B TOTAL INTER.</b>	<b>C # CUST. INTER.</b>	<b>D CUST. HRS. INTER.</b>	<b>C/A SAIFI</b>	<b>D/A SAIDI</b>	<b>D/C CAIDI</b>	<b>NUMBER OF MOMENTARIES</b>
BROCKPORT 7459	1,798	26	4,472	10,160	2.49	5.65	2.27	5
W HAMLIN 8254	1,865	20	3,864	35,653	2.07	19.12	9.23	0
BROCKPORT 7452	2,140	27	4,434	11,038	2.07	5.16	2.49	3
BROCKPORT 7458	2,211	18	6,107	11,581	2.76	5.24	1.90	5
CONESUS 5261	1,305	11	4,932	11,580	3.78	8.87	2.35	2
W HAMLIN 8253	2,341	23	3,631	12,441	1.55	5.31	3.43	0

Regional Goals:  
 CAIDI Min. 2.049  
 SAIFI Min. 1.037

b. NATIONAL GRID WORST PERFORMING CIRCUITS WITH A 3 YEAR HISTORY FOR CAIDI AND SAIFI INDICES

GENESEE REGION

<b>FEEDER #</b>	<b>2018 CAIDI</b>	<b>2017 CAIDI</b>	<b>2016 CAIDI</b>	<b>2015 CAIDI</b>	<b>2018 SAIFI</b>	<b>2017 SAIFI</b>	<b>2016 SAIFI</b>	<b>2015 SAIFI</b>
BROCKPORT 7459	2.27	1.76	3.70	2.14	2.49	0.77	0.09	1.56
W HAMLIN 8254	9.23	2.68	1.66	2.57	2.07	0.86	1.49	1.18
BROCKPORT 7452	2.49	3.81	1.76	2.18	2.07	0.12	0.40	0.30
BROCKPORT 7458	1.90	2.04	1.59	3.28	2.76	0.32	0.43	0.45
CONESUS 5261	2.35	1.99	1.79	1.31	3.78	0.53	1.78	1.57
W HAMLIN 8253	3.43	1.49	2.56	2.84	1.55	2.83	0.63	1.30

Regional Goals:  
 CAIDI Min. 2.049  
 SAIFI Min. 1.037

c. NATIONAL GRID WORST PERFORMING CIRCUITS BY # OF MOMENTARY INTERRUPTIONS

GENESEE REGION

Feeders			Customer Momentaries				Ranks		
Volts (kV)	Station Name	Ckt/F No.	Substation	Transmission	Distribution	Total	Within Region	Within System	Reliability Ranking
No circuits experienced 10 or more momentary interruptions in 2018.									

d. WORST PERFORMING CIRCUIT ANALYSIS

For 2018, the Company is reporting on the six worst performing feeders in the Genesee Region. The list consists of five 13.2kV feeders and one 4.8kV feeder.

For the Genesee Region, the PSC minimum CAIDI is 2.049 and the PSC minimum SAIFI is 1.037.

## 1. BROCKPORT 7459 – 13.2kV

Profile: 1,798 Customers, 69.7 Circuit Miles  
 Indices: CAIDI = 2.27, SAIFI = 2.49

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	26.92%	173	3.87%	577	5.68%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	10	38.46%	3,720	83.18%	9,049	89.07%
6	ACCIDENTS	6	23.08%	550	12.30%	483	4.75%
7	PREARRANGED	1	3.85%	8	0.18%	14	0.13%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	2	7.69%	21	0.47%	37	0.36%
Totals		26	100.00%	4,472	100.00%	10,160	100.00%

### Problem Analysis:

- There were 26 interruptions on the Brockport 7459 in 2018.
- There was 1 transmission interruption.
  - This Transmission interruption occurred on July 16, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 41% of the total customers interrupted (1,829 of 4,472), and 68% of the total customer-hours interrupted (6,889 of 10,160).
- There were no substation interruptions.
- The remaining 25 events occurred at the distribution level.
- The distribution circuit breaker for the Brockport 7459 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Brockport 7459 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 39% of the total amount of customers interrupted (1,766 out of 4,472) and 18% of the total amount of the customer-hours interrupted (1,792 out of 10,160).
  - This lockout occurred on June 18, 2018, coded as a cause of deterioration (PSC cause code 05). This lockout accounted for 39% of the total customers interrupted (1,766 of 4,472), and 18% of the total customer-hours interrupted (1,792 of 10,160). This interruption was due to a conductor that fell down causing a single-phase condition, which resulted in the feeder being de-energized for up to 1.11 hours to make repairs.

- Equipment Failures were the leading cause of interruptions on the Brockport 7459 in 2018, accounting for 38% of total interruptions (10 of 26). Trees were the 2nd leading cause of interruptions, accounting for 27% of total interruptions (7 of 26). Accidents were the 3rd leading cause of interruptions, accounting for 23% of total interruptions (6 of 26).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Brockport 7459 in 2018, accounting for 83% of total customers interrupted (3,720 of 4,472). Accidents were the 2nd leading cause of customers interrupted, accounting for 12% of total customers interrupted (550 of 4,472). Trees were the 3rd leading cause of customers interrupted, accounting for 4% of total customers interrupted (173 of 4,472).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Brockport 7459 in 2018, accounting for 89% of total customer-hours interrupted (9,049 of 10,160). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 6% of total customer-hours interrupted (577 of 10,160). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 5% of total customer-hours interrupted (483 of 10,160).
- Of the 26 interruptions on this circuit, 15 affected 10 customers or less, with 9 being single customer outages.

**Action Taken:**

- A distribution line inspection was completed in March 2016. All Level 1, 2 and 3 maintenance has been completed.
- A distribution cycle tree trimming was completed in FY 2015.

**Action Plan:**

- A distribution cycle tree trimming is scheduled for FY 2020.

## 2. W HAMLIN 8254 - 13.2kV

Profile: 1,865 Customers, 101.0 Circuit Miles  
 Indices: CAIDI = 9.23, SAIFI = 2.07

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	2	10.00%	36	0.93%	30	0.08%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	30.00%	2,159	55.87%	33,569	94.15%
6	ACCIDENTS	6	30.00%	1,493	38.64%	1,718	4.82%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	6	30.00%	176	4.55%	337	0.94%
Totals		20	100.00%	3,864	100.00%	35,653	100.00%

### Problem Analysis:

- There were 20 interruptions on the W Hamlin 8254 in 2018.
- There was 1 transmission interruption.
  - This transmission interruption occurred on July 16, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 48% of the total customers interrupted (1,868 of 3,864), and 92% of the total customer-hours interrupted (32,690 of 35,653).
- There were no substation interruptions.
- The remaining 19 events occurred at the distribution level.
- The distribution circuit breaker for the W Hamlin 8254 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the W Hamlin 8254 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the W Hamlin 8254 in 2018, accounting for 30% of total interruptions (6 of 20). Accidents were the 2nd leading cause of interruptions, accounting for 30% of total interruptions (6 of 20). Unknown were the 3rd leading cause of interruptions, accounting for 30% of total interruptions (6 of 20).



- Equipment Failures were the leading cause of customers interrupted (CI) on the W Hamlin 8254 in 2018, accounting for 56% of total customers interrupted (2,159 of 3,864). Accidents were the 2nd leading cause of customers interrupted, accounting for 39% of total customers interrupted (1,493 of 3,864). Unknown were the 3rd leading cause of customers interrupted, accounting for 5% of total customers interrupted (176 of 3,864).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the W Hamlin 8254 in 2018, accounting for 94% of total customer-hours interrupted (33,569 of 35,653). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 5% of total customer-hours interrupted (1,718 of 35,653). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (337 of 35,653).
- Of the 20 interruptions on this circuit, 8 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- A distribution line inspection was completed in October 2018. All Level 1 maintenance has been completed.
- Distribution cycle tree trimming was completed in FY2018.

**Action Plan:**

- A distribution line inspection was last completed in October 2018. Level 2 work is scheduled for completion by 2020 and Level 3 work scheduled for completion by 2021.
- Distribution cycle tree trimming will be due again in FY 2023.

### 3. BROCKPORT 7452 – 13.2kV

*Profile:* 2,140 Customers, 113.9 Circuit Miles  
*Indices:* CAIDI = 2.49, SAIFI = 2.07

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	25.93%	384	8.66%	544	4.93%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	2	7.41%	105	2.37%	443	4.01%
5	EQUIPMENT	10	37.04%	3,730	84.12%	9,633	87.27%
6	ACCIDENTS	6	22.22%	70	1.58%	323	2.92%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	2	7.41%	145	3.27%	95	0.86%
Totals		27	100.00%	4,434	100.00%	11,038	100.00%

**Problem Analysis:**

- There were 27 interruptions on the Brockport 7452 in 2018.
- There was 1 transmission interruption.
  - This transmission interruption occurred on July 16, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 48% of the total customers interrupted (2,143 of 4,434), and 73% of the total customer-hours interrupted (8,072 of 11,038).
- There were no substation interruptions.
- The remaining 26 events occurred at the distribution level.
- The distribution circuit breaker for the Brockport 7452 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Brockport 7452 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Brockport 7452 in 2018, accounting for 37% of total interruptions (10 of 27). Trees were the 2nd leading cause of interruptions, accounting for 26% of total interruptions (7 of 27). Accidents were the 3rd leading cause of interruptions, accounting for 22% of total interruptions (6 of 27).

- Equipment Failures were the leading cause of customers interrupted (CI) on the Brockport 7452 in 2018, accounting for 84% of total customers interrupted (3,730 of 4,434). Trees were the 2nd leading cause of customers interrupted, accounting for 9% of total customers interrupted (384 of 4,434). Unknown were the 3rd leading cause of customers interrupted, accounting for 3% of total customers interrupted (145 of 4,434).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Brockport 7452 in 2018, accounting for 87% of total customer-hours interrupted (9,633 of 11,038). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 5% of total customer-hours interrupted (544 of 11,038). Operators Errors were the 3rd leading cause of customer-hours interrupted, accounting for 4% of total customer-hours interrupted (443 of 11,038).
- Of the 27 interruptions on this circuit, 9 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- A distribution line inspection was completed in October 2018. All Level 1 maintenance has been completed.
- Distribution hazard tree removal was completed in FY2014
- Distribution cycle tree trimming was completed in FY 2015.

**Action Plan:**

- Distribution cycle tree trimming is scheduled for FY 2020.
- A distribution line inspection was last completed in October 2018. Level 2 work is scheduled for completion by 2020 and Level 3 work scheduled for completion by 2021.

#### 4. BROCKPORT STA 7458 - 13.2kV

Profile: 2,211 Customers, 69.2 Circuit Miles  
 Indices: CAIDI = 1.90, SAIFI = 2.76

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	0	0.00%	0	0.00%	0	0.00%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	7	38.89%	2,827	46.29%	9,467	81.75%
6	ACCIDENTS	7	38.89%	3,125	51.17%	1,781	15.38%
7	PREARRANGED	1	5.56%	27	0.44%	30	0.26%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	5.56%	1	0.02%	1	0.01%
10	UNKNOWN	2	11.11%	127	2.08%	302	2.61%
Totals		18	100.00%	6,107	100.00%	11,581	100.00%

**Problem Analysis:**

- There were 18 interruptions on the Brockport 7458 in 2018.
- There was 1 transmission interruption.
  - This transmission interruption occurred on July 16, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 37% of the total customers interrupted (2,266 of 6,107), and 74% of the total customer-hours interrupted (8,535 of 11,581).
- There were no substation interruptions.
- The remaining 17 events occurred at the distribution level.
- The distribution circuit breaker for the Brockport 7458 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Brockport 7458 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 36% of the total amount of customers interrupted (2,171 out of 6,107) and 3% of the total amount of the customer-hours interrupted (398 out of 11,581).
  - This lockout occurred on January 08, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 36% of the total customers interrupted (2,171 of 6,107), and 3% of the total customer-hours interrupted (398 of 11,581). This was due to a motor vehicle accident causing a feeder trip while a non-reclosing assurance was applied, which resulted in an 11 minute outage.

- Equipment Failures were the leading cause of interruptions on the Brockport 7458 in 2018, accounting for 39% of total interruptions (7 of 18). Accidents were the 2nd leading cause of interruptions, accounting for 39% of total interruptions (7 of 18). Unknown were the 3rd leading cause of interruptions, accounting for 11% of total interruptions (2 of 18).
- Accidents were the leading cause of customers interrupted (CI) on the Brockport 7458 in 2018, accounting for 51% of total customers interrupted (3,125 of 6,107). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 46% of total customers interrupted (2,827 of 6,107). Unknown were the 3rd leading cause of customers interrupted, accounting for 2% of total customers interrupted (127 of 6,107).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Brockport 7458 in 2018, accounting for 82% of total customer-hours interrupted (9,467 of 11,581). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 15% of total customer-hours interrupted (1,781 of 11,581). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 3% of total customer-hours interrupted (302 of 11,581).
- Of the 18 interruptions on this circuit, 10 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- A distribution line inspection was completed in October 2015. All Level 1, 2 and 3 maintenance has been completed.
- Distribution hazard tree removal was completed in FY2013.
- Distribution cycle tree trimming was completed in FY 2015.

**Action Plan:**

- A distribution line inspection will be due in FY 2020.
- Distribution cycle tree trimming is scheduled for FY 2020.

## 5. CONESUS 5261 - 4.8kV

*Profile: 1,305 Customers, 56.9 Circuit Miles*  
*Indices: CAIDI = 2.35, SAIFI = 3.78*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	2	18.18%	96	1.95%	197	1.70%
3	OVERLOADS	1	9.09%	10	0.20%	28	0.24%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	45.45%	3,514	71.25%	7,857	67.85%
6	ACCIDENTS	1	9.09%	1	0.02%	1	0.01%
7	PREARRANGED	1	9.09%	1,309	26.54%	3,491	30.15%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	9.09%	2	0.04%	6	0.05%
10	UNKNOWN	0	0.00%	0	0.00%	0	0.00%
Totals		11	100.00%	4,932	100.00%	11,580	100.00%

### Problem Analysis:

- There were 11 interruptions on the Conesus 5261 in 2018.
- There were no transmission interruptions.
- There were 4 substation interruptions.
  - The first substation interruption occurred on May 29, 2018, coded as a cause of unknown (PSC cause code 07). This lockout accounted for 27% of the total customers interrupted (1,309 of 4,932), and 30% of the total customer-hours interrupted (3,491 of 11,580).
  - The second substation interruption occurred on May 29, 2018, coded as a cause of deterioration (PSC cause code 05). This lockout accounted for 27% of the total customers interrupted (1,309 of 4,932), and 22% of the total customer-hours interrupted (2,596 of 11,580).
  - The first substation interruption occurred on July 01, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 9% of the total customers interrupted (456 of 4,932), and 5% of the total customer-hours interrupted (606 of 11,580).
  - The fourth substation interruption occurred on July 01, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 27% of the total customers interrupted (1,311 of 4,932), and 20% of the total customer-hours interrupted (2,360 of 11,580).
- The remaining 7 events occurred at the distribution level.

- The distribution circuit breaker for the Conesus 5261 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the Conesus 5261 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Conesus 5261 in 2018, accounting for 45% of total interruptions (5 of 11). Trees were the 2nd leading cause of interruptions, accounting for 18% of total interruptions (2 of 11). Overloads were the 3rd leading cause of interruptions, accounting for 9% of total interruptions (1 of 11).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Conesus 5261 in 2018, accounting for 71% of total customers interrupted (3,514 of 4,932). Prearranged were the 2nd leading cause of customers interrupted, accounting for 27% of total customers interrupted (1,309 of 4,932). Trees were the 3rd leading cause of customers interrupted, accounting for 2% of total customers interrupted (96 of 4,932).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Conesus 5261 in 2018, accounting for 68% of total customer-hours interrupted (7,857 of 11,580). Prearranged were the 2nd leading cause of customer-hours interrupted, accounting for 30% of total customer-hours interrupted (3,491 of 11,580). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 2% of total customer-hours interrupted (197 of 11,580).
- Of the 11 interruptions on this circuit, 4 affected 10 customers or less, with 2 being single customer outages.

**Action Taken:**

- A distribution line inspection was completed in July 2018. All Level 1 maintenance has been completed.
- Distribution cycle tree trimming was completed in FY2013.
- Distribution ash tree removal was completed in FY2018.

**Action Plan:**

- A distribution line inspection was last completed in July 2018. Level 2 work is scheduled for completion by 2020, and Level 3 work scheduled for completion by 2021.

## 6. W HAMLIN 8253 - 13.2kV

*Profile:* 2,341 Customers, 95.4 Circuit Miles  
*Indices:* CAIDI = 3.43, SAIFI = 1.55

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	4	17.39%	197	5.43%	202	1.62%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	7	30.43%	2,587	71.25%	10,315	82.91%
6	ACCIDENTS	5	21.74%	531	14.62%	1,253	10.08%
7	PREARRANGED	1	4.35%	1	0.03%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	6	26.09%	315	8.68%	670	5.39%
Totals		23	100.00%	3,631	100.00%	12,441	100.00%

### Problem Analysis:

- There were 23 interruptions on the W Hamlin 8253 in 2018.
- There was 1 transmission interruption.
  - This transmission interruption occurred on July 16, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 65% of the total customers interrupted (2,343 of 3,631), and 78% of the total customer-hours interrupted (9,684 of 12,441).
- There were no substation interruptions.
- The remaining 22 events occurred at the distribution level.
- The distribution circuit breaker for the W Hamlin 8253 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the W Hamlin 8253 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the W Hamlin 8253 in 2018, accounting for 30% of total interruptions (7 of 23). Unknown were the 2nd leading cause of interruptions, accounting for 26% of total interruptions (6 of 23). Accidents were the 3rd leading cause of interruptions, accounting for 22% of total interruptions (5 of 23).



- Equipment Failures were the leading cause of customers interrupted (CI) on the W Hamlin 8253 in 2018, accounting for 71% of total customers interrupted (2,587 of 3,631). Accidents were the 2nd leading cause of customers interrupted, accounting for 15% of total customers interrupted (531 of 3,631). Unknown were the 3rd leading cause of customers interrupted, accounting for 9% of total customers interrupted (315 of 3,631).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the W Hamlin 8253 in 2018, accounting for 83% of total customer-hours interrupted (10,315 of 12,441). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 10% of total customer-hours interrupted (1,253 of 12,441). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 5% of total customer-hours interrupted (670 of 12,441).
- Of the 23 interruptions on this circuit, 12 affected 10 customers or less, with 5 being single customer outages.

**Action Taken:**

- A distribution line inspection was completed in May 2016. All Level 1, 2 and 3 maintenance has been completed.
- Distribution hazard tree removal was completed in FY2014
- Distribution cycle tree trimming was completed in FY2018.

**Action Plan:**

- Distribution cycle tree trimming will be due again in FY 2023.

3. ACTION PLAN SUMMARIES

a. SUMMARY OF ACTION PLANS FOR 2018 WORST PERFORMING CIRCUITS

<b>Station</b>	<b>Feeder</b>	<b>Report Year</b>	<b>Action Plan</b>	<b>Projected Completion Date</b>	<b>Cost</b>	<b>Comments</b>
Brockport	7459	2018	Distribution Cycle Tree Trimming	2020	TBD	
West Hamlin	8254	2018	Complete Level 2 work	2020	TBD	
Brockport	7452	2018	Distribution Cycle Tree Trimming	2020	TBD	
Brockport	7452	2018	Complete Level 2 work	2020	TBD	
Brockport	7458	2018	Distribution Line Inspection	2020	TBD	
Brockport	7458	2018	Distribution Cycle Tree Trimming	2020	TBD	
Conesus	5261	2018	Complete Level 2 work	2020	TBD	

b. STATUS OF ACTION PLANS FOR 2017 WORST PERFORMING CIRCUITS

<b>Station</b>	<b>Feeder</b>	<b>Report Year</b>	<b>Action Plan</b>	<b>Actual Completion Date</b>	<b>Actual Cost</b>	<b>Comments</b>
East Golah	5155	2018	Distribution Line Inspection	2018	TBD	Completed November 2018
West Hamlin	8253	2018	Complete Level 2 work	2018	TBD	Completed April 2017
West Hamlin	8253	2018	Complete Level 3 work	2019	TBD	Completed August 2017

#### 4. OPERATING REGION PERFORMANCE BELOW MINIMUM

##### a. MAINTENANCE HISTORY AND ANALYSIS OF FACTORS WHICH CAUSED THE BELOW MINIMUM PERFORMANCE

In 2018, the Genesee Region did not meet the PSC minimum goal for CAIDI of 2.049 hours, ending the year with a total CAIDI of 2.06 hours. This was an increase over the CAIDI of 1.76 hours in 2017. This indicates that the average length of time to restore the region's customers increased in 2018.

Additionally, the Genesee Region did not meet the PSC minimum goal for SAIFI of 1.037 interruptions, ending the year with a total SAIFI of 1.23 interruptions. This was an increase over the SAIFI of 0.47 interruptions per customer in 2017. This indicates that the frequency or number of times the region's customers experienced an interruption increased from the previous year.

The 2018 data indicates that the number of customers interrupted was 38% above the 5-year average, and that the number of customer-hours interrupted was 51% above the 5-year average. As compared to 2017, the number of customers interrupted increased by 46,874 (62%) and the number of customer-hours interrupted increased by 119,623 (91%).

There were 10 events on the transmission system during 2018 which were responsible for a significant portion of the reliability performance. These events caused 29% of the customer interruptions that occurred as well as 47% of the total customer-hours interrupted.

The 2018 CAIDI result was significantly influenced by a single event categorized as an Apparatus or Equipment Failure. This event occurred on July 16<sup>th</sup>, when a 115kV Transmission Structure broke on Line 111 / 113 causing an outage to Brockport Station 74 and West Hamlin Station 84. This event resulted in 17,245 customers interrupted, a total of 96,019 customer-hours interrupted and represented 38% of customer-hours interrupted in the Genesee Region in 2018. The CAIDI for this single event was 3.47 hours, contributing 0.78 hours to the region's CAIDI of 2.06. This event was a large contributor to the Genesee Region not meeting the PSC target for CAIDI.

Reviewing the 2018 CAIDI and SAIFI data by facility type:

The 2018 CAIDI for transmission facilities was 1.32 hours above the PSC target value of 2.049 hours for the Region. This consisted of 10 interruptions, which made up 29% of total customers interrupted and 47% of total customer-hours interrupted. The 2018 SAIFI for transmission facilities contributed 0.35 interruptions (28%) of the 2018 total SAIFI for the Region of 1.23 interruptions.

The 2018 CAIDI for substation facilities was 1.8 hours, below the PSC target value of 2.049 hours. This consisted of 5 outages and resulted in 5% of the total number of customers interrupted for the year with 5,841 customers being interrupted by these outages. The 2018 SAIFI for substation facilities contributed 0.06 interruptions (5%) of the 2018 total SAIFI for the Region of 1.23 interruptions.

The 2018 CAIDI for distribution facilities was 1.52 hours, below the PSC target of 2.049 hours. This consisted of 871 interruptions, which resulted in 67% of the total number of customers interrupted and 49% customer-hours interrupted. The 2018 SAIFI for distribution facilities contributed 0.82 interruptions (67%) to the 2018 total SAIFI for the Region of 1.23 interruptions.

Reviewing the 2018 CAIDI data by cause codes which had a CAIDI greater than the Region's PSC target:

**(03) Overload**

The overload CAIDI was 3.45 hours, above the 2.049 hour target. Overload-related outages contributed less than 1% of the total number of customer-hours interrupted for the Region. The most significant overload event occurred on July 1<sup>st</sup>, when a primary conductor burned open on Batavia Feeder 0155 on Main Street due to overload. This caused an interruption to 88 customers for 3.73 hours. The event contributed a total of 313 customer-hours interrupted, which was 55% of the total customer-hours interrupted due to overloads in 2018.

#### **(05) Apparatus or Equipment Failure**

The Apparatus or Equipment Failure CAIDI was 3.47 hours, above the 2.049 hour target. These interruptions contributed 56% of the total number of customer-hours interrupted for the Region, which suggests that equipment failure outages were a large factor in determining why the Region did not meet the PSC target for CAIDI. There was one event that had a major impact on the Apparatus or Equipment Failure CAIDI for 2018. On July 16<sup>th</sup> a 115kV Transmission Structure broke on Line 111 / 113 causing an outage to Brockport Station 74 and West Hamlin Station 84. There were 17,245 customers interrupted for times ranging from 3.78 hours to 17.52 hours until the broken structure was isolated, and Line 113 was re-energized. This contributed 96,019 customer-hours interrupted in 2018, representing 68% of customer-hours interrupted from equipment failure.

#### **(09) Lightning**

The Lightning CAIDI was 2.19 hours, above the 2.049 hour target. Outages with a cause of Lightning contributed 4% of the total number of customer-hours interrupted for the Region. There was one major interruption that had a significant impact on the CAIDI in the Region for 2018 due to lightning. On September 26<sup>th</sup>, lightning struck Sub-Transmission Line 225 on Alleghany Road causing an outage to Darien Station 16 and Corfu Station 22 during a heavy thunder storm. This resulted in an interruption to 1,937 customers for up to 3.15 hours, contributing 5,430 customer-hours interrupted and 57% of the total customer-hours interrupted due to lightning in 2018.



b. **PLANNED PROGRAMS OR PLANNED CORRECTIVE ACTIONS AND PROPOSED IMPROVEMENTS TO THE PERFORMANCE INDICES**

The Company is continuing its efforts to improve reliability in the Frontier Region. This includes distribution patrols, maintenance programs, line recloser installations, Cutout Mounted Recloser (Tripsaver) installations, protection coordination studies, lightning protection installations, and a tree trimming program. All of these programs and corrective actions will not only reduce the number of outages and/or customers interrupted, but will also reduce the restoration times. The Operations Department plans to continue the use of One Person Crews for coverage during off-hours, the prearrangement of crews for pending storm events, and the posting of CAIDI results at work locations to give visibility to the field personnel.

The Company's ongoing substation inspection and maintenance program is an effort to keep those facilities operating at a high level. This program will help minimize the likelihood of a substation outage resulting in a significant interruption to customers.

In 2018, the substation maintenance team in New York West performed 367 circuit breaker diagnostic tests and 77 circuit breaker mechanism checks. Dissolved gas analysis was performed on 280 load tap changer units and 468 transformers. Transformer diagnostic tests were performed on 0 units. Thermographic inspections were performed at 263 substations. There were 1678 substation inspections performed. Battery and charger diagnostic tests were performed on 171 installations. The relay groups in New York West completed calibration/inspections on 489 relay packages (102 Distribution Substations and 387 on Transmission) and 343 relay scheme tests (all on Transmission). Any problems that were identified were repaired as soon as possible, preventing these problems from resulting in interruptions to customers.

A similar number of maintenance activities will be performed in 2019. This work will be identified, prioritized, and tracked in the Company's Cascade Equipment maintenance database, as discussed in the summary of this report. These ongoing maintenance activities on substations will help to minimize the likelihood of a substation outage resulting in a significant interruption to customers.

**Miscellaneous:**

**Sub-Transmission Improvements**

There are a number of projects to maintain and upgrade the sub-transmission system in the Genesee Region. One project in particular, is the reconductoring of Line 217 (Golah – Avon) in FY2020.

There are several other circuits scheduled to be upgraded in FY2020. This is a process wherein circuits are rebuilt and reconducted, replacing dated poles and wires that could tentatively fail and cause an outage with newer, more resilient equipment.

Furthermore, installation of Reclosers on Lines 301 and 312 in the Genesee Region will take place in FY2020 / 2021. The Reclosers will improve reliability by sectionalizing portions of the lines during interruptions.

### **Transmission Improvements**

There is a project to install new 115kV remotely controlled / motor operated switches on the Hamlin Tap of Lines 111/113 in 2019. This will increase reliability and provide operational flexibility. This would allow the 115kV Hamlin Tap to the West Hamlin Substation 82 to be sectionalized or isolated from the system during a failure on the tap. This would have reduced the number of customers interrupted during the July 16<sup>th</sup> outage on Line 111/113, which contributed to the CAIDI target for the Genesee Region to be missed in 2018.

## G. MOHAWK VALLEY REGION

### 1. OPERATING REGIONAL PERFORMANCE

#### a. HISTORIC CAIDI AND SAIFI INDICES

IDS info:

	2018	2017	2016	2015	2014	2013
CAIDI (Target 2.150)	2.29	1.57	1.94	1.87	2.21	1.93
SAIFI (Target 1.483)	1.29	1.52	2.03	1.24	1.12	1.24
SAIDI	2.94	2.40	3.94	2.32	2.48	2.39
Interruptions	1,331	1,209	1,346	1,149	1,181	1,327
Customers Interrupted	177,829	209,763	277,767	168,459	152,330	168,438
Customer-Hours Interrupted	406,526	329,832	538,746	315,796	336,451	324,437
Customers Served	138,080	137,634	136,729	135,883	135,510	135,967
Customers Per Interruption	133.61	173.50	206.36	146.61	128.98	126.93
Availability Index	99.9664	99.9726	99.9551	99.9735	99.9717	99.9728
Interruptions/1000 Customers	9.64	8.78	9.84	8.46	8.72	9.76

#### b. DISCUSSION OF REGIONAL PERFORMANCE

In 2018, the Mohawk Valley Region did not meet its CAIDI reliability target and met its SAIFI reliability target as set forth by the New York Public Service Commission (PSC). The final System Average Interruption Frequency Index (SAIFI) result was 1.29 interruptions, 13% below the PSC goal of 1.483 interruptions. As shown in the table above, the Customer Average Interruption Duration index (CAIDI) was 2.29 in 2018, 7% above the PSC's regional target of 2.150 hours.

The 2018 CAIDI result was 46% above the 2017 result of 1.57 hours, and 20% above the previous 5-year average of 1.90 hours. The 2018 SAIFI was 15% below the 2017 result of 1.52 interruptions, and 10% below the previous 5-year average of 1.43 interruptions.

In 2018, excluding major storms, the Mohawk Valley Region experienced 9 transmission interruptions. These interruptions accounted for 1% of the region's total interruptions (9 of 1,331), 21% of the region's total customers interrupted (CI), (37,387 of 177,829), and 28% (114,450 of 406,526) of the region's total customer-hours interrupted (CHI). Overall, transmission interruptions had a CAIDI of 3.06 hours, and a SAIFI of 0.27 interruptions.

The number of transmission-related interruptions decreased from 20 in 2017 to 9 in 2018 (a decrease of 55%). The number of customers interrupted decreased from 70,578 in 2017, to 37,387 in 2018 (a decrease of 47%), while the customer-hours interrupted increased from 114,181 in 2017, to 114,450 in 2018 (an increase of 0.2%).

In 2018, excluding major storms, the Mohawk Valley Region experienced 8 substation interruptions. These interruptions accounted for 1% of the region's total interruptions (8 of 1,331), 15% of the region's total customers interrupted, (27,283 of 177,829), and 15% (61,735 of 406,526) of the region's total customer-hours interrupted. Overall, substation interruptions had a CAIDI of 2.26 hours, and a SAIFI of 0.2 interruptions.

The number of substation-related interruptions decreased from 11 to 8 from 2017 to 2018 (a decrease of 27%). The number of customers interrupted decreased from 45,151 in 2017, to 27,283 in 2018 (a decrease of 40%), while the customer-hours interrupted increased from 26,162 in 2017, to 61,735 in 2018 (an increase of 136%).

In 2018, excluding major storms, the Mohawk Valley Region experienced 1,314 distribution interruptions. These interruptions accounted for 99% of the region's total interruptions (1,314 of 1,331), 64% of the region's total customers interrupted, (113,159 of 177,829), and 57% (230,341 of 406,526) of the region's total customer-hours interrupted. Overall, distribution interruptions had a CAIDI of 2.04 hours, and a SAIFI of 0.82 interruptions.

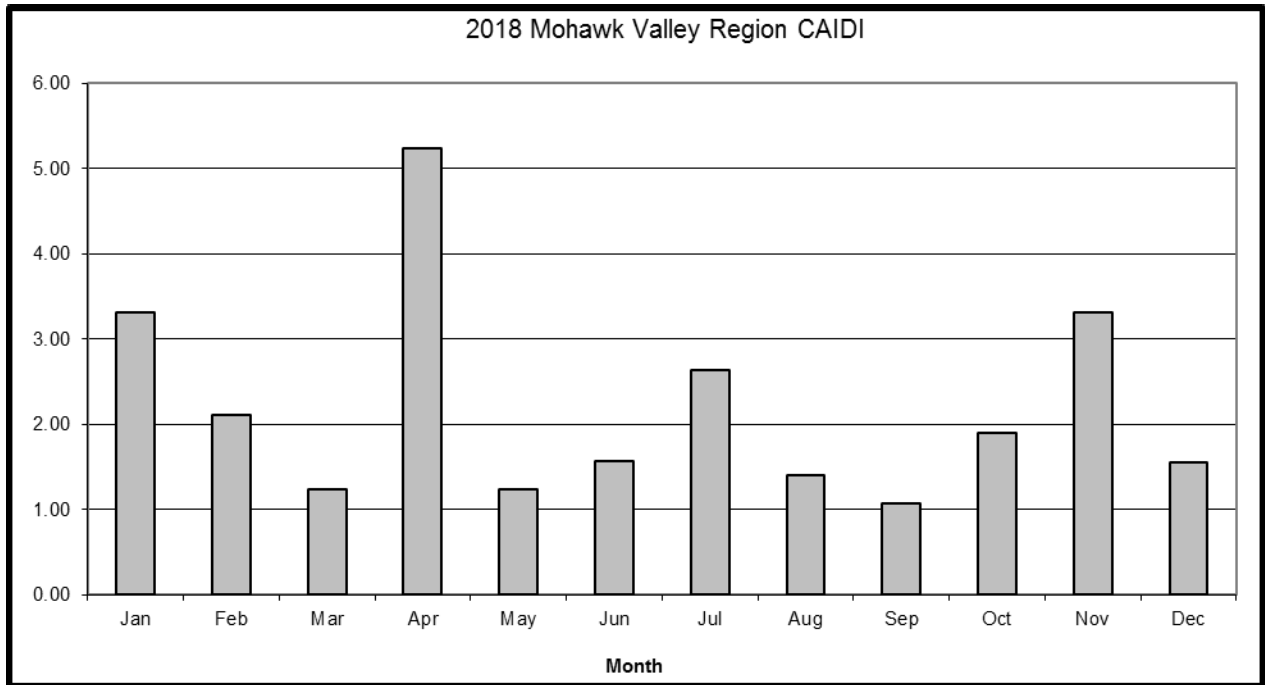
The number of distribution-related interruptions increased from 1,178 to 1,314 from 2017 to 2018 (an increase of 12%). The number of customers interrupted increased from 94,034 in 2017, to 113,159 in 2018 (an increase of 20%), while the customer-hours interrupted increased from 189,489 in 2017, to 230,341 in 2018 (an increase of 22%).

c. MONTHLY CAIDI AND SAIFI GRAPHS

The graphs on the following page show the monthly CAIDI and SAIFI for the Mohawk Valley Region for 2018 (Excluding Major Storms).

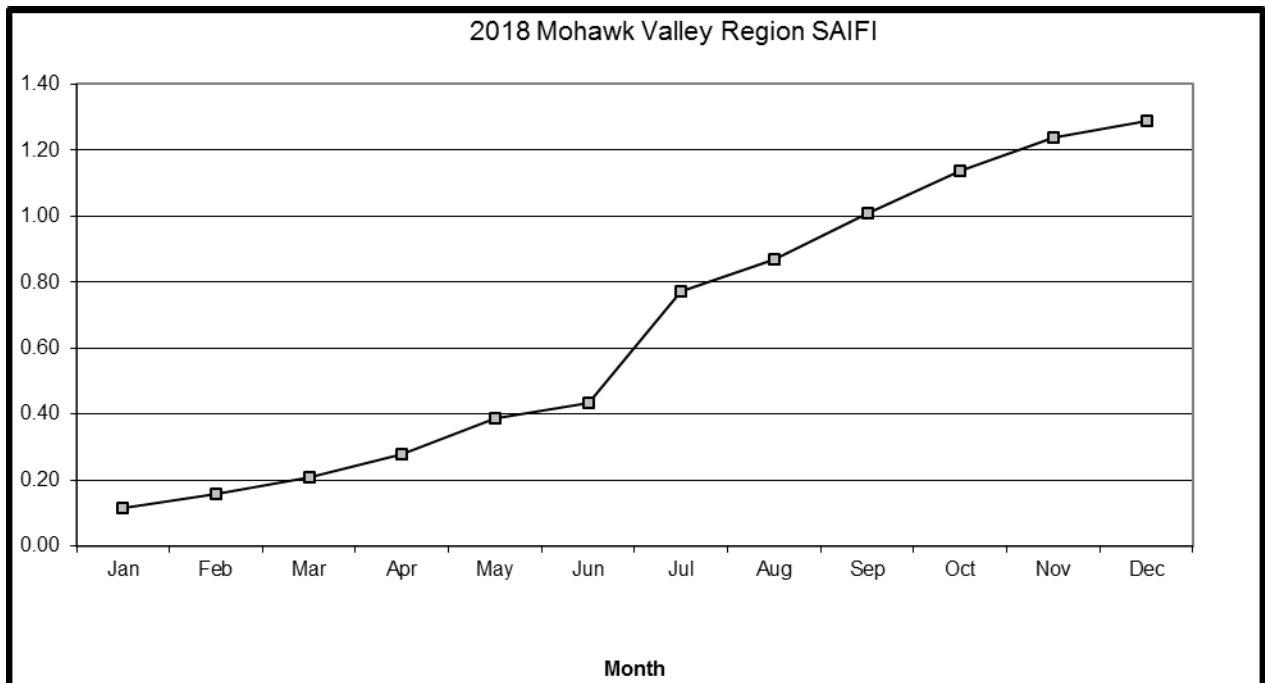
- The CAIDI graph shows the individual CAIDI by month. The Mohawk Valley Region was below the PSC minimum CAIDI of 2.150 hours for eight months of the year, with April being the highest month with a CAIDI of 5.24 hours, accounting for 5% of the number of interruptions (66 of 1,331), 5% of the total number of customers interrupted (9,764 of 177,829) and 13% of the total customer-hours interrupted (51,180 of 406,526). The Mohawk Valley Region ended the year with an overall CAIDI of 2.29.
- The SAIFI graph shows the cumulative SAIFI by month for 2018. The Mohawk Valley Region was above the minimum SAIFI goal of 1.483. July was the worst performing month with regard to customers interrupted with a SAIFI of 0.34, accounting for 24% of the number of interruptions (321 of 1,331), 26% of the total number of customers interrupted (46,992 of 177,829), and 37% of the total customer-hours interrupted (123,618 of 329,832). The Mohawk Valley Region ended the year with a SAIFI of 1.29.

GRAPH OF MONTHLY CAIDI AND SAIFI INDICES FOR THE MOHAWK VALLEY



PSC CAIDI Goal:	
Minimum	2.150
2018 Actual	2.29

PSC SAIFI Goal:	
Minimum	1.483
2018 Actual	1.29



d. PSC CAUSE CODES

1) Number of Events by Cause – Historical

IDS info:

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	965	442	360	57	386	362
<b>02</b> Tree Contacts	458	467	490	375	357	504
<b>03</b> Overloads	26	5	14	10	6	15
<b>04</b> Operator Error	4	0	3	7	4	5
<b>05</b> Equipment	365	318	375	340	386	384
<b>06</b> Accidents	201	196	199	192	171	160
<b>07</b> Prearranged	37	20	40	22	17	27
<b>08</b> Customer Equip.	0	0	0	0	0	0
<b>09</b> Lightning	51	36	45	51	61	94
<b>10</b> Unknown	189	167	180	152	179	138
<b>Total</b>	<b>2,296</b>	<b>1,651</b>	<b>1,706</b>	<b>1,206</b>	<b>1,567</b>	<b>1,689</b>

2) Customers Interrupted by Cause – Historical

IDS info:

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	136,049	69,505	40,140	2,514	68,648	52,242
<b>02</b> Tree Contacts	45,181	68,831	70,991	36,270	29,262	53,207
<b>03</b> Overloads	895	5,156	181	1,317	629	238
<b>04</b> Operator Error	46	0	1,036	5,727	5,562	7,365
<b>05</b> Equipment	77,836	43,625	120,816	64,356	66,929	72,992
<b>06</b> Accidents	36,339	39,054	28,403	19,967	24,868	14,467
<b>07</b> Prearranged	5,393	27,491	32,315	26,930	663	1,559
<b>08</b> Customer Equip.	0	0	0	0	0	0
<b>09</b> Lightning	3,573	8,813	5,578	4,936	6,763	10,300
<b>10</b> Unknown	8,566	16,793	18,447	8,956	17,654	8,310
<b>Total</b>	<b>313,878</b>	<b>279,268</b>	<b>317,907</b>	<b>170,973</b>	<b>220,978</b>	<b>220,680</b>

3) Customer-Hours Interrupted by Cause – Historical

IDS info:

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	838,451	320,893	254,438	10,721	431,524	263,352
<b>02</b> Tree Contacts	117,146	144,131	177,297	79,833	79,150	140,082
<b>03</b> Overloads	2,021	2,550	485	847	443	621
<b>04</b> Operator Error	31	0	211	1,352	4,882	4,161
<b>05</b> Equipment	183,190	85,689	239,291	160,144	159,704	124,309
<b>06</b> Accidents	73,199	49,038	66,573	33,379	43,736	23,573
<b>07</b> Prearranged	4,133	7,050	22,706	12,184	581	3,119
<b>08</b> Customer Equip.	0	0	0	0	0	0
<b>09</b> Lightning	8,550	17,255	10,686	12,549	14,751	14,930
<b>10</b> Unknown	18,255	24,120	21,497	15,511	33,203	13,643
<b>Total</b>	<b>1,244,977</b>	<b>650,726</b>	<b>793,183</b>	<b>326,518</b>	<b>767,974</b>	<b>587,790</b>

4) Interruptions, Customers Interrupted, and Customer-Hours Interrupted – 2018

<b>Cause Code</b>	<b>Interruptions</b>		<b>Customers Interrupted</b>		<b>Customer-Hours Interrupted</b>	
	<b>Number</b>	<b>% Total</b>	<b>Number</b>	<b>% Total</b>	<b>Number</b>	<b>% Total</b>
<b>01</b> Major Storms	965	42.0%	136,049	43.3%	838,451	67.3%
<b>02</b> Tree Contacts	458	19.9%	45,181	14.4%	117,146	9.4%
<b>03</b> Overloads	26	1.1%	895	0.3%	2,021	0.2%
<b>04</b> Operator Error	4	0.2%	46	0.0%	31	0.0%
<b>05</b> Equipment	365	15.9%	77,836	24.8%	183,190	14.7%
<b>06</b> Accidents	201	8.8%	36,339	11.6%	73,199	5.9%
<b>07</b> Prearranged	37	1.6%	5,393	1.7%	4,133	0.3%
<b>08</b> Customer Equip.	0	0.0%	0	0.0%	0	0.0%
<b>09</b> Lightning	51	2.2%	3,573	1.1%	8,550	0.7%
<b>10</b> Unknown	189	8.2%	8,566	2.7%	18,255	1.5%
<b>Total</b>	<b>2,296</b>	<b>100.0%</b>	<b>313,878</b>	<b>100.0%</b>	<b>1,244,976</b>	<b>100.0%</b>



e. **INTERRUPTION REVIEW BY PSC CAUSE CODES**

**Cause Code 01 - Major Storms**

In 2018, Major Storms accounted for 42% of interruptions, 43% of customers interrupted, and 67% of Customer-Hours Interrupted.

Interruptions due to Major Storm were up 118% from 2017, and up 201% over the 5 year average. Customers interrupted due to Major Storms were up 96% from 2017, and up 192% over the 5 year average. Customer-Hours interrupted were up 161% from 2017 and up 227% over the 5 year average.

The remaining PSC code descriptions do not include Major Storms in the percentages.

**Cause Code 02 - Tree Contacts**

In 2018, Tree Contacts accounted for 34% of interruptions, 25% of customers interrupted, and 29% of Customer-Hours Interrupted.

Interruptions due to Tree Contacts were down 2% from 2017, and up 4% over the 5 year average. Customers interrupted due to Tree Contacts were down 34% from 2017, and down 13% over the 5 year average. Customer-Hours interrupted were down 19% from 2017 and down 6% over the 5 year average.

Tree Contacts were the largest cause of interruptions in 2018.

**Cause Code 03 - Overloads**

In 2018, Overloads accounted for 2% of interruptions, 1% of customers interrupted, and 0% of Customer-Hours Interrupted.

Interruptions due to Overloads were up 420% from 2017, and up 160% over the 5 year average. Customers interrupted due to Overloads were down 83% from 2017, and down 40% over the 5 year average. Customer-Hours interrupted were down 21% from 2017 and up 104% over the 5 year average.

Overloads were the 7th largest cause of interruptions in 2018.

**Cause Code 04 - Operator Error**

In 2018, Operator Error accounted for 0% of interruptions, 0% of customers interrupted, and 0% of Customer-Hours Interrupted.

Interruptions due to Operator Error were - from 2017, and flat at 0% over the 5 year average. Customers interrupted due to Operator Error were - from 2017, and down 99% over the 5 year average. Customer-Hours interrupted were - from 2017 and down 99% over the 5 year average.

Operator Error was the 8th largest cause of interruptions in 2018.

### **Cause Code 05 - Equipment Failure**

In 2018, Equipment Failures accounted for 27% of interruptions, 44% of customers interrupted, and 45% of Customer-Hours Interrupted.

Interruptions due to Equipment Failure were up 15% from 2017, and up 1% over the 5 year average. Customers interrupted due to Equipment Failure were up 78% from 2017, and up 6% over the 5 year average. Customer-Hours interrupted were up 114% from 2017 and up 19% over the 5 year average.

Equipment Failures were the 2nd largest cause of interruptions in 2018.

### **Cause Code 06 - Accidents**

In 2018, Accidents accounted for 15% of interruptions, 20% of customers interrupted, and 18% of Customer-Hours Interrupted.

Interruptions due to Accidents were up 3% from 2017, and up 9% over the 5 year average. Customers interrupted due to Accidents were down 7% from 2017, and up 43% over the 5 year average. Customer-Hours interrupted were up 49% from 2017 and up 69% over the 5 year average.

Accidents were the 3rd largest cause of interruptions in 2018.

### **Cause Code 07 - Prearranged**

In 2018, Prearranged accounted for 3% of interruptions, 3% of customers interrupted, and 1% of Customer-Hours Interrupted.

Interruptions due to Prearranged were up 85% from 2017, and up 48% over the 5 year average. Customers interrupted due to Prearranged were down 80% from 2017, and down 70% over the 5 year average. Customer-Hours interrupted were down 41% from 2017 and down 55% over the 5 year average.

Prearranged was the 6th largest cause of interruptions in 2018.

### **Cause Code 08 - Customer Equipment**

There were no Customer Equipment interruptions in 2018.

### **Cause Code 09 - Lightning**

In 2018, Lightning accounted for 4% of interruptions, 2% of customers interrupted, and 2% of Customer-Hours Interrupted.

Interruptions due to Lightning were up 42% from 2017, and down 11% over the 5 year average. Customers interrupted due to Lightning were down 59% from 2017, and down 51% over the 5 year average. Customer-Hours interrupted were down 50% from 2017 and down 39% over the 5 year average.

Lightning was the 5th largest cause of interruptions in 2018.

### **Cause Code 10 - Unknown**

In 2018, Unknown causes accounted for 14% of interruptions, 5% of customers interrupted, and 4% of Customer-Hours Interrupted.

Interruptions due to Unknown causes were up 13% from 2017, and up 16% over the 5 year average. Customers interrupted due to Unknown causes were down 49% from 2017, and down 39% over the 5 year average. Customer-Hours interrupted were down 24% from 2017 and down 15% over the 5 year average.

Unknown causes were the 4th largest cause of interruptions in 2018.

f. DISCUSSION OF REGIONAL CAPEX PROJECTS WITH 2018/19 SPENDS:

The Mohawk Valley Region continues to work on capital-related projects in order to maintain customer satisfaction and future reliability. Some specific projects that were constructed in either CY18 or will be constructed in CY19 are listed below. A list of major infrastructure projects follows.

**Boonville-Raquette Lake 46kV**

The 46kV Boonville-Raquette Lake sub-transmission line is a radial source to all of the stations northeast of Boonville. This line has experienced 7 interruptions in 2018. Six of the seventeen worst performing feeders were affected by interruptions on this 46kV supply line. This project will address asset condition issues with protective devices, bypass switches, and single pin angle structures that have experienced insulator failures due to side loading. Future projects will replace sections of bare overhead conductor with covered Hendrix conductor in areas that are repeatedly damaged by fallen trees in the Adirondack Park where trimming rights are severely limited. Traditional and non-wires alternatives are also being evaluated at this time that will supply distribution load when the 46kV is interrupted.

Completion – May 2019

**Poland 62258 Route 8 Rebuild – Phase 2**

Phase 2 of the Route 8 Rebuild will re-conductor approximately 2 miles of bare overhead conductor with covered Tree Wire conductor in an area that is repeatedly damaged by fallen trees. Phase 1 of this project was completed in late summer of 2015 and Phase 3 is expected to be completed in FY23.

Completion – Fall 2019

**Lehigh Second Transformer**

Add a second transformer at Lehigh Station to increase feeder tie capability and station capacity. This project will allow switching of all feeders to the remaining transformer under an N-1 transformer contingency.

Completion – March 2019

**Major Capital Projects for Mohawk Valley Region:**

<b>Region</b>	<b>Project Name</b>	<b>Project Type</b>	<b>Fin Sys Proj No.</b>	<b>Finish</b>	<b>Total Spend</b>
Mohawk Valley	Schuyler - Replace Oil Circuit Breakers	Substation	C049562	FY19	\$779,000
Mohawk Valley	Yahnundasis - Mobile Disconnects replacement	Substation	C049564	FY21	\$274,000
Mohawk Valley	Terminal Station metal clad and feeder getaway replacement	Substation	C076242	FY22	\$5,900,000
Mohawk Valley	Lehigh Station – 2 <sup>nd</sup> transformer	Substation/ D Line	C074607	FY19	\$4,910,000
Mohawk Valley	BOONVILLE-RACQUETTE LAKE 46 KV improvements	T Line	C072528	FY22	\$240,000
Mohawk Valley	DEERFIELD-SCHUYLER 22-46KV rebuild	T Line	C050288	FY19	\$1,254,000
Mohawk Valley	ALDER CREEK-ADD EMS	Substation	C075024	FY20	\$793,000
Mohawk Valley	BOONVILLE-ALDER CREEK 21 46 KV	T Line	C077028	FY21	\$1,745,000
Mohawk Valley	ALDER CREEK-OLD FORGE #23, 46kV Install Hendrix conductor	T Line	C074002	FY19	\$900,000
Mohawk Valley	OLD FORGE-RACQUETTE LAKE 22 46kV	T Line	C074003	FY23	\$5,895,000
Mohawk Valley	RAQUETTE LAKE TRANSFORMER UPGRADE	Substation	CD01139	FY20	\$700,000
Mohawk Valley	TRENTON-WHITESBORO 25, 46KV REBUILD	T Line	C058579	FY21	\$2,050,000
Mohawk Valley	TURIN 65355 & 56 TIE CREATION	D Line	C050002	FY21	\$1,400,000
Mohawk Valley	Wooden Enclosure and Cable Replacement Program – Raquette Lake	D Line	C026977	FY23	\$2,000,000
Mohawk Valley	YAHNUNDASIS-CLINTON 27, 46KV REBUILD	T Line	C055143	FY23	\$470,000
Mohawk Valley	TRENTON-PROSPECT 23-46KV	T Line	C046448	FY21	\$469,000
Mohawk Valley	MV-LEHIGH 51 & 54 TIE CREATION	D Line	C050004	FY21	\$328,000
Mohawk Valley	MV-ROME 54-LAUTHER RD - RECONDUCTOR	D Line	C050086	FY21	\$433,000
Mohawk Valley	MV-ROME 54 -HOGSBACK RD RECONDUCTOR	D Line	C050097	FY22	\$260,000
Mohawk Valley	MV-ROME 54-OSWEGO RD RECONDUCTORING	D Line	C050098	FY23	\$320,000
Mohawk Valley	YAHNUNDASIS-CLINTON 24 -46KV REBUILD	T Line	C046449	FY23	\$1,178,000
Mohawk Valley	DEERFIELD-WHITESBORO 26-46KV REBUILD	T Line	C046459	FY22	\$2,510,000
Mohawk Valley	MV-ROME 76254-HWY 49 RECONDUCTOR	D Line	C050005	FY22	\$640,000
Mohawk Valley	MV-POLAND 62258 ROUTE 8 RECONDUCTOR	D Line	C046605	FY23	\$1,125,000
Mohawk Valley	ROCK CITY STATION 623 – TRANSFORMER	Substation	C046671	FY21	\$1,350,000
Mohawk Valley	MV-SALISBURY 57/MIDDLEVILLE 71 TIE	D Line	C049966	FY19	\$3,200,000

g. DISCUSSION OF REGIONAL PERFORMANCE OF LVAC (LOW VOLTAGE AC) NETWORK DISTRIBUTION SYSTEM(S):

**City Of Utica – Terminal Street LVAC Network**

The Utica LVAC Network serves the downtown area, mainly Genesee Street and Lafayette Street. This network is supplied by 4 – 13.2kV feeders that originate from the Terminal Substation. This system serves approximately 664 customer accounts and experienced a peak load of approximately 7.728 MVA in 2018.

The table below lists the breaker operations in 2018 that were a result of a fault and/or failure.

<b>Substation</b>	<b>Feeder Number</b>	<b>Breaker Number</b>	<b>Breaker Number</b>	<b># Breaker Operations from Failures</b>
Terminal	65144	R440	R815	0
Terminal	65145	R450	R825	0
Terminal	65146	R460	R825	0
Terminal	65147	R470	R845	0

As shown above the Utica LVAC Network experienced zero feeder outage in 2018. There were no customer interruptions and at no time was this network operated beyond its single contingency (N-1) design criteria.

There were no major events in 2018.

Annual maintenance consisted of manhole and vault inspections, network protector and transformer inspections, and network protector operation checks.

Equipment maintenance in 2018 consisted of manhole and vault inspections, network protector and transformer inspections, and network protector operation checks.

There is one major project that has been installed, is being designed and/or is being installed:

**Replace Lead-Covered Feeder Cable**

The paper-insulated, lead-covered cable replacement began in 2012 and was concluded in FY2018.

Due to the Harbor Point Area contamination, the cables in this area will be delayed until Terminal Station ES651 is relocated and/or replaced. At the time, the new rubber insulated cables will be installed in a non-hazardous location and the existing paper-insulated, lead-covered cable removed.

## 2. OPERATING CIRCUIT LIST

The next three tables will provide the following information for the Mohawk Valley Region.

- a. Worst Performing Circuit List
- b. Worst Performing Circuits with 3 Year History for CAIDI and SAIFI Indices
- c. Worst Performing Circuits by number of Momentary Interruptions

a. NATIONAL GRID WORST PERFORMING CIRCUIT LIST

MOHAWK VALLEY REGION

FEEDER #	A CUST. SERVED	B TOTAL INTER.	C # CUST. INTER.	D CUST. HRS. INTER.	C/A SAIFI	D/A SAIDI	D/C CAIDI	NUMBER OF MOMENTARIES
EAGLE BAY 38272	1,119	31	8,106	28,444	7.24	25.42	3.51	5
LEHIGH 66952	1,973	30	7,835	38,180	3.97	19.35	4.87	1
OLD FORGE 38361	612	25	4,026	17,647	6.58	28.83	4.38	3
OLD FORGE 38362	731	27	3,296	17,878	4.51	24.46	5.42	3
POLAND - UTICA 62258	1,585	58	4,894	21,667	3.09	13.67	4.43	5
SHERMAN 33351	1,448	30	6,779	12,414	4.68	8.57	1.83	5
EAGLE BAY 38271	892	20	7,449	25,661	8.35	28.77	3.44	5
LEHIGH 66954	2,157	77	5,713	15,369	2.65	7.13	2.69	0
ALDER CREEK 70161	978	28	3,116	8,703	3.19	8.90	2.79	0
RAQUETTE LAKE 39861	494	14	3,220	12,211	6.52	24.72	3.79	5
OLD FORGE 38364	796	12	3,496	17,711	4.39	22.25	5.07	3
PETERBORO 51453	2,076	28	3,350	15,405	1.61	7.42	4.60	2
STITTVILLE 67053	1,064	21	3,169	6,604	2.98	6.21	2.08	0
SHERMAN 33352	1,469	21	4,129	8,006	2.81	5.45	1.94	4
LEHIGH 66953	737	20	1,268	10,138	1.72	13.76	8.00	0
SALISBURY 67857	1,012	22	2,853	5,083	2.82	5.02	1.78	0
ONEIDA 50151	1,823	13	5,333	7,966	2.93	4.37	1.49	3

Regional Goals:  
CAIDI Min. 2.15  
SAIFI Min. 1.483



b. NATIONAL GRID WORST PERFORMING CIRCUITS WITH 3 YEAR HISTORY FOR CAIDI & SAIFI INDICES

MOHAWK VALLEY REGION

<b>FEEDER #</b>	<b>2018 CAIDI</b>	<b>2017 CAIDI</b>	<b>2016 CAIDI</b>	<b>2015 CAIDI</b>	<b>2018 SAIFI</b>	<b>2017 SAIFI</b>	<b>2016 SAIFI</b>	<b>2015 SAIFI</b>
EAGLE BAY 38272	3.51	2.13	2.21	2.81	7.24	6.58	11.69	5.57
LEHIGH 66952	4.87	1.54	1.42	2.00	3.97	2.44	2.49	1.63
OLD FORGE 38361	4.38	1.86	1.90	3.32	6.58	6.41	12.68	5.77
OLD FORGE 38362	5.42	1.91	2.04	2.90	4.51	6.16	12.97	6.17
POLAND - UTICA 62258	4.43	2.14	2.05	2.98	3.09	6.20	4.87	4.26
SHERMAN 33351	1.83	2.16	1.34	2.31	4.68	3.17	3.82	4.77
EAGLE BAY 38271	3.44	1.92	2.82	2.11	8.35	6.09	12.65	6.78
LEHIGH 66954	2.69	1.66	3.14	3.03	2.65	1.66	1.63	1.80
ALDER CREEK 70161	2.79	2.24	1.61	2.66	3.19	4.01	10.36	0.40
RAQUETTE LAKE 39861	3.79	3.57	3.62	3.39	6.52	7.66	14.88	7.11
OLD FORGE 38364	5.07	1.65	1.66	2.67	4.39	8.03	13.08	5.12
PETERBORO 51453	4.60	0.99	4.46	1.72	1.61	1.34	0.44	0.19
STITTVILLE 67053	2.08	2.38	2.36	1.26	2.98	0.81	0.45	1.18
SHERMAN 33352	1.94	1.82	1.52	2.75	2.81	1.56	2.75	3.44
LEHIGH 66953	8.00	2.32	3.01	2.47	1.72	2.13	1.30	0.35
SALISBURY 67857	1.78	3.41	2.32	3.48	2.82	2.71	3.75	0.94
ONEIDA 50151	1.49	1.63	2.37	1.93	2.93	0.80	2.37	0.17

Regional Goals:  
 CAIDI Min. 2.15  
 SAIFI Min. 1.483

c. NATIONAL GRID WORST PERFORMING CIRCUITS BY # OF MOMENTARY INTERRUPTIONS

MOHAWK VALLEY REGION

Feeders			Customer Momentaries				Ranks		
Volts (kV)	Station Name	Ckt/F No.	Substation	Transmission	Distribution	Total	Within Region	Within System	Reliability Ranking
No circuits experienced 10 or more momentary interruptions in 2018.									

This list consists of circuits that have ten or more momentaries.

d. WORST PERFORMING CIRCUIT ANALYSIS

For 2018, the Mohawk Valley Region is required to analyze and report on 17 of the worst performing circuits. The list consists of ten 13.2kV, and seven 4.8kV circuits.

The PSC minimum goals for the Mohawk Valley Region are 2.15 for CAIDI and 1.483 for SAIFI.

**1. EAGLE BAY 38272 - 4.8kV**

*Profile: 1,119 Customers, 48.2 Circuit Miles*

*Indices: CAIDI = 3.51, SAIFI = 7.24*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	15	48.39%	229	2.83%	949	3.33%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	11	35.48%	5,527	68.18%	16,793	59.04%
6	ACCIDENTS	2	6.45%	2,271	28.02%	10,556	37.11%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	3	9.68%	79	0.97%	146	0.51%
Totals		31	100.00%	8,106	100.00%	28,444	100.00%

**Problem Analysis:**

- There were 31 interruptions on the Eagle Bay 38272 in 2018.
- There were 7 transmission interruptions. The transmission interruptions accounted for 95% of customers interrupted and 95% of customer hours interrupted.
  - The first Transmission interruption occurred on March 22, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 14% of the total customers interrupted (1,136 of 8,106), and 2% of the total customer-hours interrupted (682 of 28,444).
  - The second Transmission interruption occurred on April 06, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 14% of the total customers interrupted (1,135 of 8,106), and 35% of the total customer-hours interrupted (9,875 of 28,444).
  - The third Transmission interruption occurred on July 12, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 14% of the total customers interrupted (1,148 of 8,106), and 27% of the total customer-hours interrupted (7,749 of 28,444).
  - The fourth Transmission interruption occurred on July 31, 2018, coded as a cause of deterioration (PSC cause code 05). This lockout accounted for 14% of the total customers interrupted (1,152 of 8,106), and 1% of the total customer-hours interrupted (422 of 28,444).
  - The fifth Transmission interruption occurred on October 29, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 13% of the total customers interrupted (1,052 of 8,106), and 1% of the total customer-hours interrupted (316 of 28,444).

- The sixth Transmission interruption occurred on November 09, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 13% of the total customers interrupted (1,056 of 8,106), and 19% of the total customer-hours interrupted (5,368 of 28,444).
- The seventh Transmission interruption occurred on November 23, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 13% of the total customers interrupted (1,048 of 8,106), and 9% of the total customer-hours interrupted (2,533 of 28,444).
- There were no substation interruptions.
- The remaining 24 events occurred at the distribution level.
- The distribution circuit breaker for the Eagle Bay 38272 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Eagle Bay 38272 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Eagle Bay 38272 in 2018, accounting for 48% of total interruptions (15 of 31). Equipment Failures were the 2nd leading cause of interruptions, accounting for 35% of total interruptions (11 of 31). Unknown were the 3rd leading cause of interruptions, accounting for 10% of total interruptions (3 of 31).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Eagle Bay 38272 in 2018, accounting for 68% of total customers interrupted (5,527 of 8,106). Accidents were the 2nd leading cause of customers interrupted, accounting for 28% of total customers interrupted (2,271 of 8,106). Trees were the 3rd leading cause of customers interrupted, accounting for 3% of total customers interrupted (229 of 8,106).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Eagle Bay 38272 in 2018, accounting for 59% of total customer-hours interrupted (16,793 of 28,444). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 37% of total customer-hours interrupted (10,556 of 28,444). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 3% of total customer-hours interrupted (949 of 28,444).
- Of the 31 interruptions on this circuit, 11 affected 10 customers or less, with 3 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 10/30/2017.
- Level 2 I&M maintenance was completed by 10/30/2018.
- Hazard tree removal was completed in FY16.
- Cycle tree pruning was completed in FY18.

**Action Plan:**

- Complete Level 3 I&M maintenance by October 2020.
- Complete cycle tree pruning in FY24.

## 2. LEHIGH 66952 - 13.2kV

Profile: 1,973 Customers, 87.6 Circuit Miles  
 Indices: CAIDI = 4.87, SAIFI = 3.97

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	15	50.00%	729	9.30%	2,111	5.53%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	1	3.33%	1	0.01%	1	0.00%
5	EQUIPMENT	8	26.67%	4,272	54.52%	34,493	90.34%
6	ACCIDENTS	1	3.33%	708	9.04%	153	0.40%
7	PREARRANGED	1	3.33%	1,975	25.21%	1,020	2.67%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	3	10.00%	15	0.19%	181	0.47%
10	UNKNOWN	1	3.33%	135	1.72%	221	0.58%
Totals		30	100.00%	7,835	100.00%	38,180	100.00%

### **Problem Analysis:**

- There were 30 interruptions on the Lehigh 66952 in 2018.
- There were no transmission interruptions.
- There were 2 substation interruptions.
  - The first Substation interruption occurred on January 22, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 25% of the total customers interrupted (1,974 of 7,835), and 84% of the total customer-hours interrupted (32,249 of 38,180).
  - The second Substation interruption occurred on February 22, 2018, coded as a cause of unknown (PSC cause code 07). This lockout accounted for 25% of the total customers interrupted (1,975 of 7,835), and 3% of the total customer-hours interrupted (1,020 of 38,180).
- The remaining 28 events occurred at the distribution level.
- The distribution circuit breaker for the Lehigh 66952 experienced 1 momentary operation in 2018.
- The distribution circuit breaker for the Lehigh 66952 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 25% of the total amount of customers interrupted (1,970 out of 7,835) and 4% of the total amount of the customer-hours interrupted (1,407 out of 38,180).
  - This lockout occurred on November 13, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 25% of the total customers interrupted (1,970 of 7,835), and 4% of the total customer-hours interrupted (1,407 of 38,180). This interruption occurred when an insulator on Pole 86 on Route 13 failed.

- Trees were the leading cause of interruptions on the Lehigh 66952 in 2018, accounting for 50% of total interruptions (15 of 30). Equipment Failures were the 2nd leading cause of interruptions, accounting for 27% of total interruptions (8 of 30). Lightning were the 3rd leading cause of interruptions, accounting for 10% of total interruptions (3 of 30).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Lehigh 66952 in 2018, accounting for 55% of total customers interrupted (4,272 of 7,835). Prearranged were the 2nd leading cause of customers interrupted, accounting for 25% of total customers interrupted (1,975 of 7,835). Trees were the 3rd leading cause of customers interrupted, accounting for 9% of total customers interrupted (729 of 7,835).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Lehigh 66952 in 2018, accounting for 90% of total customer-hours interrupted (34,493 of 38,180). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 6% of total customer-hours interrupted (2,111 of 38,180). Prearranged were the 3rd leading cause of customer-hours interrupted, accounting for 3% of total customer-hours interrupted (1,020 of 38,180).
- Of the 30 interruptions on this circuit, 10 affected 10 customers or less, with 5 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 9/21/2018.
- Hazard tree removal was completed in FY10.
- Cycle tree pruning completed in FY14.

**Action Plan:**

- Complete Level 2 I&M maintenance by September 2019.
- Complete Level 3 I&M maintenance by September 2021.
- Complete cycle tree pruning in FY20.

### 3. OLD FORGE 38361 - 4.8kV

Profile: 612 Customers, 33.5 Circuit Miles  
 Indices: CAIDI = 4.38, SAIFI = 6.58

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	13	52.00%	743	18.46%	2,677	15.17%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	7	28.00%	2,574	63.93%	9,345	52.96%
6	ACCIDENTS	1	4.00%	613	15.23%	5,333	30.22%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	4.00%	47	1.17%	103	0.59%
10	UNKNOWN	3	12.00%	49	1.22%	188	1.06%
Totals		25	100.00%	4,026	100.00%	17,647	100.00%

**Problem Analysis:**

- There were 25 interruptions on the Old Forge 38361 in 2018.
- There were 4 transmission interruptions. The transmission interruptions accounted for 60% of customers interrupted and 72% of customer hours interrupted.
  - The first Transmission interruption occurred on April 06, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 15% of the total customers interrupted (613 of 4,026), and 30% of the total customer-hours interrupted (5,333 of 17,647).
  - The second Transmission interruption occurred on July 12, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 15% of the total customers interrupted (616 of 4,026), and 24% of the total customer-hours interrupted (4,158 of 17,647).
  - The third Transmission interruption occurred on October 29, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 15% of the total customers interrupted (609 of 4,026), and 1% of the total customer-hours interrupted (183 of 17,647).
  - The fourth Transmission interruption occurred on November 09, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 15% of the total customers interrupted (604 of 4,026), and 17% of the total customer-hours interrupted (3,070 of 17,647).
- There were no substation interruptions.
- The remaining 21 events occurred at the distribution level.
- The distribution circuit breaker for the Old Forge 38361 experienced 3 momentary operations in 2018.



- The distribution circuit breaker for the Old Forge 38361 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Old Forge 38361 in 2018, accounting for 52% of total interruptions (13 of 25). Equipment Failures were the 2nd leading cause of interruptions, accounting for 28% of total interruptions (7 of 25). Unknown were the 3rd leading cause of interruptions, accounting for 12% of total interruptions (3 of 25).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Old Forge 38361 in 2018, accounting for 64% of total customers interrupted (2,574 of 4,026). Trees were the 2nd leading cause of customers interrupted, accounting for 18% of total customers interrupted (743 of 4,026). Accidents were the 3rd leading cause of customers interrupted, accounting for 15% of total customers interrupted (613 of 4,026).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Old Forge 38361 in 2018, accounting for 53% of total customer-hours interrupted (9,345 of 17,647). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 30% of total customer-hours interrupted (5,333 of 17,647). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 15% of total customer-hours interrupted (2,677 of 17,647).
- Of the 25 interruptions on this circuit, 4 affected 10 customers or less, with 1 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 08/31/2016.
- Level 2 I&M maintenance was completed by 8/31/2017.
- Hazard tree removal was completed in FY14.
- Cycle tree pruning was completed in FY18.

**Action Plan:**

- Complete Level 3 I&M maintenance by August 2019.
- Complete cycle tree pruning in FY24.
- Review for potential installation of reclosing fuses.

#### 4. OLD FORGE 38362 - 4.8kV

Profile: 731 Customers, 37.7 Circuit Miles  
 Indices: CAIDI = 5.42, SAIFI = 4.51

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	9	33.33%	222	6.74%	1,435	8.03%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	11	40.74%	2,281	69.21%	9,827	54.97%
6	ACCIDENTS	2	7.41%	754	22.88%	6,348	35.51%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	5	18.52%	39	1.18%	268	1.50%
Totals		27	100.00%	3,296	100.00%	17,878	100.00%

**Problem Analysis:**

- There were 27 interruptions on the Old Forge 38362 in 2018.
- There were 4 transmission interruptions. The transmission interruptions accounted for 89% of customers interrupted and 85% of customer hours interrupted.
  - The first Transmission interruption occurred on April 06, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 22% of the total customers interrupted (727 of 3,296), and 35% of the total customer-hours interrupted (6,325 of 17,878).
  - The second Transmission interruption occurred on July 12, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 22% of the total customers interrupted (738 of 3,296), and 28% of the total customer-hours interrupted (4,982 of 17,878).
  - The third Transmission interruption occurred on October 29, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 22% of the total customers interrupted (731 of 3,296), and 1% of the total customer-hours interrupted (219 of 17,878).
  - The fourth Transmission interruption occurred on November 09, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 22% of the total customers interrupted (722 of 3,296), and 21% of the total customer-hours interrupted (3,670 of 17,878).
- There were no substation interruptions.
- The remaining 23 events occurred at the distribution level.
- The distribution circuit breaker for the Old Forge 38362 experienced 3 momentary operations in 2018.

- The distribution circuit breaker for the Old Forge 38362 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Old Forge 38362 in 2018, accounting for 41% of total interruptions (11 of 27). Trees were the 2nd leading cause of interruptions, accounting for 33% of total interruptions (9 of 27). Unknown were the 3rd leading cause of interruptions, accounting for 19% of total interruptions (5 of 27).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Old Forge 38362 in 2018, accounting for 69% of total customers interrupted (2,281 of 3,296). Accidents were the 2nd leading cause of customers interrupted, accounting for 23% of total customers interrupted (754 of 3,296). Trees were the 3rd leading cause of customers interrupted, accounting for 7% of total customers interrupted (222 of 3,296).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Old Forge 38362 in 2018, accounting for 55% of total customer-hours interrupted (9,827 of 17,878). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 36% of total customer-hours interrupted (6,348 of 17,878). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (1,435 of 17,878).
- Of the 27 interruptions on this circuit, 10 affected 10 customers or less, with 1 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 7/28/2016.
- Level 2 I&M maintenance was completed by 07/28/2017.
- Hazard tree removal was completed in FY14.
- Cycle tree pruning was completed in FY18.

**Action Plan:**

- Complete Level 3 I&M maintenance by July 2019.
- Complete cycle tree pruning in FY24.

## 5. POLAND - UTICA 62258 - 13.2kV

Profile: 1,585 Customers, 133.3 Circuit Miles  
 Indices: CAIDI = 4.43, SAIFI = 3.09

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	33	56.90%	2,371	48.45%	13,277	61.28%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	2	3.45%	44	0.90%	29	0.13%
5	EQUIPMENT	7	12.07%	770	15.73%	5,179	23.90%
6	ACCIDENTS	4	6.90%	390	7.97%	1,631	7.53%
7	PREARRANGED	7	12.07%	1,113	22.74%	573	2.64%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	1.72%	48	0.98%	211	0.97%
10	UNKNOWN	4	6.90%	158	3.23%	767	3.54%
Totals		58	100.00%	4,894	100.00%	21,667	100.00%

### **Problem Analysis:**

- There were 58 interruptions on the Poland - Utica 62258 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 58 events occurred at the distribution level.
- The distribution circuit breaker for the Poland - Utica 62258 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Poland - Utica 62258 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Poland - Utica 62258 in 2018, accounting for 57% of total interruptions (33 of 58). Equipment Failures were the 2nd leading cause of interruptions, accounting for 12% of total interruptions (7 of 58). Prearranged were the 3rd leading cause of interruptions, accounting for 12% of total interruptions (7 of 58).
- Trees were the leading cause of customers interrupted (CI) on the Poland - Utica 62258 in 2018, accounting for 48% of total customers interrupted (2,371 of 4,894). Prearranged were the 2nd leading cause of customers interrupted, accounting for 23% of total customers interrupted (1,113 of 4,894). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 16% of total customers interrupted (770 of 4,894).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Poland - Utica 62258 in 2018, accounting for 61% of total customer-hours interrupted (13,277 of 21,667). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 24% of total customer-hours interrupted (5,179 of 21,667). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (1,631 of 21,667).

- Of the 58 interruptions on this circuit, 17 affected 10 customers or less, with 3 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 10/26/2015.
- Level 2 I&M maintenance was completed by 10/26/2016.
- Level 3 I&M maintenance was completed by 10/26/2018.
- Hazard tree removal was completed in FY18.
- Cycle tree pruning was completed in FY17.
- Phase 1 of the Route 8 Rebuild was completed in late summer 2015.

**Action Plan:**

- Complete an I&M foot patrol by October 2020.
- Complete cycle tree pruning in FY22.
- Phase 2 rebuild along Route 8 will be completed in FY19.
- Phase 3 rebuild along Route 8 is scheduled for FY23.
- Installation of reclosing fuses will be completed in FY19.

## 6. SHERMAN 33351 - 13.2kV

Profile: 1,448 Customers, 98.9 Circuit Miles  
 Indices: CAIDI = 1.83, SAIFI = 4.68

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	22	73.33%	3,614	53.31%	7,503	60.44%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	4	13.33%	1,558	22.98%	2,921	23.53%
6	ACCIDENTS	2	6.67%	1,587	23.41%	1,919	15.46%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	3.33%	6	0.09%	23	0.19%
10	UNKNOWN	1	3.33%	14	0.21%	48	0.39%
Totals		30	100.00%	6,779	100.00%	12,414	100.00%

### **Problem Analysis:**

- There were 30 interruptions on the Sherman 33351 in 2018.
- There were no transmission interruptions.
- There were 2 substation interruptions.
  - The first Substation interruption occurred on July 15, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 23% of the total customers interrupted (1,555 of 6,779), and 23% of the total customer-hours interrupted (2,904 of 12,415).
  - The second Substation interruption occurred on July 16, 2018, coded as a cause of animal (PSC cause code 06). This lockout accounted for 21% of the total customers interrupted (1,450 of 6,779), and 15% of the total customer-hours interrupted (1,885 of 12,415).
- The remaining 28 events occurred at the distribution level.
- The distribution circuit breaker for the Sherman 33351 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Sherman 33351 experienced 2 sustained operations (lockouts) in 2018. These interruptions accounted for 60% of the total amount of customers interrupted (3,119 out of 6,779) and 63% of the total amount of the customer-hours interrupted (5,949 out of 12,414).
  - The first lockout occurred on July 22, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 21% of the total customers interrupted (1,450 of 6,779), and 35% of the total customer-hours interrupted (4,310 of 12,414).
  - The second lockout occurred on August 22, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 25% of the total customers interrupted (1,669 of 6,779), and 13% of the total customer-hours interrupted (1,639 of 12,414).

- Trees were the leading cause of interruptions on the Sherman 33351 in 2018, accounting for 73% of total interruptions (22 of 30). Equipment Failures were the 2nd leading cause of interruptions, accounting for 13% of total interruptions (4 of 30). Accidents were the 3rd leading cause of interruptions, accounting for 7% of total interruptions (2 of 30).
- Trees were the leading cause of customers interrupted (CI) on the Sherman 33351 in 2018, accounting for 53% of total customers interrupted (3,614 of 6,779). Accidents were the 2nd leading cause of customers interrupted, accounting for 23% of total customers interrupted (1,587 of 6,779). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 23% of total customers interrupted (1,558 of 6,779).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Sherman 33351 in 2018, accounting for 60% of total customer-hours interrupted (7,503 of 12,414). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 24% of total customer-hours interrupted (2,921 of 12,414). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 15% of total customer-hours interrupted (1,919 of 12,414).
- Of the 30 interruptions on this circuit, 12 affected 10 customers or less, with 8 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 8/10/2018.
- Cycle tree pruning was completed in FY14.

**Action Plan:**

- Complete Level 2 I&M maintenance by August 2019.
- Complete Level 3 I&M maintenance by August 2021.
- Complete hazard tree removal in FY19.
- Complete cycle tree pruning in FY20.
- Installation of reclosing fuses will be completed in FY19.

## 7. EAGLE BAY 38271 – 4.8kV

*Profile:* 892 Customers, 28.8 Circuit Miles  
*Indices:* CAIDI = 3.44, SAIFI = 8.35

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	35.00%	27	0.36%	144	0.56%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	10	50.00%	4,744	63.69%	14,735	57.42%
6	ACCIDENTS	2	10.00%	1,768	23.73%	8,213	32.01%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	1	5.00%	910	12.22%	2,570	10.01%
Totals		20	100.00%	7,449	100.00%	25,661	100.00%

### **Problem Analysis:**

- There were 20 interruptions on the Eagle Bay 38271 in 2018.
- There were 7 transmission interruptions. The transmission interruptions accounted for 80% of customers interrupted and 79% of customer hours interrupted.
  - The first Transmission interruption occurred on March 22, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 12% of the total customers interrupted (885 of 7,449), and 2% of the total customer-hours interrupted (531 of 25,661).
  - The second Transmission interruption occurred on April 06, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 12% of the total customers interrupted (883 of 7,449), and 30% of the total customer-hours interrupted (7,682 of 25,661).
  - The third Transmission interruption occurred on July 12, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 12% of the total customers interrupted (908 of 7,449), and 24% of the total customer-hours interrupted (6,129 of 25,661).
  - The fourth Transmission interruption occurred on July 31, 2018, coded as a cause of deterioration (PSC cause code 05). This lockout accounted for 12% of the total customers interrupted (911 of 7,449), and 1% of the total customer-hours interrupted (334 of 25,661).
  - The fifth Transmission interruption occurred on October 29, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 12% of the total customers interrupted (889 of 7,449), and 1% of the total customer-hours interrupted (267 of 25,661).



- The sixth Transmission interruption occurred on November 09, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 8% of the total customers interrupted (617 of 7,449), and 12% of the total customer-hours interrupted (3,136 of 25,661).
- The seventh Transmission interruption occurred on November 23, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 12% of the total customers interrupted (888 of 7,449), and 8% of the total customer-hours interrupted (2,146 of 25,661).
- There were no substation interruptions.
- The remaining 13 events occurred at the distribution level.
- The distribution circuit breaker for the Eagle Bay 38271 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Eagle Bay 38271 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 12% of the total amount of customers interrupted (910 out of 7,449) and 10% of the total amount of the customer-hours interrupted (2,570 out of 25,661).
  - This lockout occurred on December 21, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 12% of the total customers interrupted (910 of 7,449), and 10% of the total customer-hours interrupted (2,570 of 25,661). The circuit was sectionalized at Pole 157 South Shore Rd. and the breaker was successfully closed. No cause was found.
- Equipment Failures were the leading cause of interruptions on the Eagle Bay 38271 in 2018, accounting for 50% of total interruptions (10 of 20). Trees were the 2nd leading cause of interruptions, accounting for 35% of total interruptions (7 of 20). Accidents were the 3rd leading cause of interruptions, accounting for 10% of total interruptions (2 of 20).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Eagle Bay 38271 in 2018, accounting for 64% of total customers interrupted (4,744 of 7,449). Accidents were the 2nd leading cause of customers interrupted, accounting for 24% of total customers interrupted (1,768 of 7,449). Unknown were the 3rd leading cause of customers interrupted, accounting for 12% of total customers interrupted (910 of 7,449).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Eagle Bay 38271 in 2018, accounting for 57% of total customer-hours interrupted (14,735 of 25,661). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 32% of total customer-hours interrupted (8,213 of 25,661). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 10% of total customer-hours interrupted (2,570 of 25,661).
- Of the 20 interruptions on this circuit, 8 affected 10 customers or less, with 2 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 8/17/2017.
- Level 2 I&M maintenance was completed by 8/17/2018.
- Hazard tree removal was completed in FY16.
- Cycle tree pruning was completed in FY18.

**Action Plan:**

- Complete Level 3 I&M maintenance by August 2020.
- Complete cycle tree pruning in FY24.

## 8. LEHIGH 66954 - 13.2kV

Profile: 2,157 Customers, 117.4 Circuit Miles  
 Indices: CAIDI = 2.69, SAIFI = 2.65

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	39	50.65%	2,321	40.63%	9,537	62.05%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	15	19.48%	2,676	46.84%	4,507	29.32%
6	ACCIDENTS	3	3.90%	38	0.67%	43	0.28%
7	PREARRANGED	2	2.60%	574	10.05%	1,011	6.58%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	4	5.19%	12	0.21%	57	0.37%
10	UNKNOWN	14	18.18%	92	1.61%	215	1.40%
Totals		77	100.00%	5,713	100.00%	15,369	100.00%

### **Problem Analysis:**

- There were 77 interruptions on the Lehigh 66954 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This Substation interruption occurred on January 22, 2018, coded as a cause of deterioration (PSC cause code 05). This lockout accounted for 37% of the total customers interrupted (2,134 of 5,713), and 19% of the total customer-hours interrupted (2,916 of 15,369).
- The remaining 76 events occurred at the distribution level.
- The distribution circuit breaker for the Lehigh 66954 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the Lehigh 66954 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Lehigh 66954 in 2018, accounting for 51% of total interruptions (39 of 77). Equipment Failures were the 2nd leading cause of interruptions, accounting for 19% of total interruptions (15 of 77). Unknown were the 3rd leading cause of interruptions, accounting for 18% of total interruptions (14 of 77).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Lehigh 66954 in 2018, accounting for 47% of total customers interrupted (2,676 of 5,713). Trees were the 2nd leading cause of customers interrupted, accounting for 41% of total customers interrupted (2,321 of 5,713). Prearranged were the 3rd leading cause of customers interrupted, accounting for 10% of total customers interrupted (574 of 5,713).

- Trees were the leading cause of customer-hours interrupted (CHI) on the Lehigh 66954 in 2018, accounting for 62% of total customer-hours interrupted (9,537 of 15,369). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 29% of total customer-hours interrupted (4,507 of 15,369). Prearranged were the 3rd leading cause of customer-hours interrupted, accounting for 7% of total customer-hours interrupted (1,011 of 15,369).
- Of the 77 interruptions on this circuit, 33 affected 10 customers or less, with 19 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 9/23/2014.
- I&M Level 2 maintenance was completed by 9/23/2015.
- I&M Level 3 maintenance was completed by 9/23/2017.
- Hazard tree removal was completed in FY17.
- Cycle tree pruning was completed in FY14.

**Action Plan:**

- Complete I&M foot patrol in FY19.
- Complete I&M Level 2 maintenance in FY20.
- Complete cycle tree pruning in FY20.

**9. ALDER CREEK 70161 – 4.8kV**

*Profile: 978 Customers, 59.6 Circuit Miles*  
*Indices: CAIDI = 2.79, SAIFI = 3.19*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	16	57.14%	1,339	42.97%	6,010	69.06%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	9	32.14%	1,643	52.73%	2,420	27.80%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	3	10.71%	134	4.30%	273	3.13%
Totals		28	100.00%	3,116	100.00%	8,703	100.00%

**Problem Analysis:**

- There were 28 interruptions on the Alder Creek 70161 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 28 events occurred at the distribution level.
- The distribution circuit breaker for the Alder Creek 70161 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the Alder Creek 70161 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Alder Creek 70161 in 2018, accounting for 57% of total interruptions (16 of 28). Equipment Failures were the 2nd leading cause of interruptions, accounting for 32% of total interruptions (9 of 28). Unknown were the 3rd leading cause of interruptions, accounting for 11% of total interruptions (3 of 28).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Alder Creek 70161 in 2018, accounting for 53% of total customers interrupted (1,643 of 3,116). Trees were the 2nd leading cause of customers interrupted, accounting for 43% of total customers interrupted (1,339 of 3,116). Unknown were the 3rd leading cause of customers interrupted, accounting for 4% of total customers interrupted (134 of 3,116).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Alder Creek 70161 in 2018, accounting for 69% of total customer-hours interrupted (6,010 of 8,703). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 28% of total customer-hours interrupted (2,420 of 8,703). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 3% of total customer-hours interrupted (273 of 8,703).

- Of the 28 interruptions on this circuit, 12 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 4/30/2014.
- Level 2 I&M maintenance was completed by 4/30/2015.
- Level 3 I&M maintenance was completed by 4/30/2017.
- Hazard tree removal was completed in FY18.
- Cycle tree pruning was completed in FY13.

**Action Plan:**

- Complete I&M foot patrol in 2019.
- Complete Level 2 I&M maintenance in FY20.
- Complete cycle tree pruning in FY19.
- Review for potential installation of reclosing fuses.

## 10. RAQUETTE LAKE 39861 - 4.8kV

Profile: 494 Customers, 37.2 Circuit Miles  
 Indices: CAIDI = 3.79, SAIFI = 6.52

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	1	7.14%	33	1.02%	116	0.95%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	10	71.43%	2,691	83.57%	11,754	96.26%
6	ACCIDENTS	3	21.43%	496	15.40%	341	2.79%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	0	0.00%	0	0.00%	0	0.00%
Totals		14	100.00%	3,220	100.00%	12,211	100.00%

### **Problem Analysis:**

- There were 14 interruptions on the Raquette Lake 39861 in 2018.
- There were 6 transmission interruptions. The transmission interruptions accounted for 93% of customers interrupted and 83% of customer hours interrupted.
  - The first Transmission interruption occurred on March 22, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 15% of the total customers interrupted (490 of 3,220), and 2% of the total customer-hours interrupted (294 of 12,211).
  - The second Transmission interruption occurred on July 12, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 15% of the total customers interrupted (498 of 3,220), and 28% of the total customer-hours interrupted (3,362 of 12,211).
  - The third Transmission interruption occurred on July 31, 2018, coded as a cause of deterioration (PSC cause code 05). This lockout accounted for 15% of the total customers interrupted (498 of 3,220), and 5% of the total customer-hours interrupted (573 of 12,211).
  - The fourth Transmission interruption occurred on October 29, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 15% of the total customers interrupted (497 of 3,220), and 1% of the total customer-hours interrupted (149 of 12,211).
  - The fifth Transmission interruption occurred on November 09, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 16% of the total customers interrupted (502 of 3,220), and 21% of the total customer-hours interrupted (2,552 of 12,211).

- The sixth Transmission interruption occurred on November 23, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 15% of the total customers interrupted (497 of 3,220), and 26% of the total customer-hours interrupted (3,181 of 12,211).
- There were no substation interruptions.
- The remaining 8 events occurred at the distribution level.
- The distribution circuit breaker for the Raquette Lake 39861 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Raquette Lake 39861 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Raquette Lake 39861 in 2018, accounting for 71% of total interruptions (10 of 14). Accidents were the 2nd leading cause of interruptions, accounting for 21% of total interruptions (3 of 14). Trees were the 3rd leading cause of interruptions, accounting for 7% of total interruptions (1 of 14).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Raquette Lake 39861 in 2018, accounting for 84% of total customers interrupted (2,691 of 3,220). Accidents were the 2nd leading cause of customers interrupted, accounting for 15% of total customers interrupted (496 of 3,220). Trees were the 3rd leading cause of customers interrupted, accounting for 1% of total customers interrupted (33 of 3,220).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Raquette Lake 39861 in 2018, accounting for 96% of total customer-hours interrupted (11,754 of 12,211). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 3% of total customer-hours interrupted (341 of 12,211). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (116 of 12,211).
- Of the 14 interruptions on this circuit, 4 affected 10 customers or less, with 1 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 9/22/2015.
- Level 2 I&M maintenance was completed by 9/22/2016.
- Level 3 I&M maintenance was completed by 9/22/2018.
- Hazard tree removal was completed in FY16.
- Cycle tree pruning was completed in FY18.

**Action Plan:**

- Complete an I&M foot patrol in 2020.
- Complete cycle tree pruning in FY24.
- Review for potential installation of reclosing fuses.

## 11. OLD FORGE 38364 - 4.8kV

Profile: 796 Customers, 25.7 Circuit Miles  
 Indices: CAIDI = 5.07, SAIFI = 4.39

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	0	0.00%	0	0.00%	0	0.00%
3	OVERLOADS	2	16.67%	42	1.20%	208	1.17%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	50.00%	2,651	75.83%	10,639	60.07%
6	ACCIDENTS	1	8.33%	768	21.97%	6,682	37.73%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	2	16.67%	32	0.92%	176	0.99%
10	UNKNOWN	1	8.33%	3	0.09%	7	0.04%
Totals		12	100.00%	3,496	100.00%	17,711	100.00%

### **Problem Analysis:**

- There were 12 interruptions on the Old Forge 38364 in 2018.
- There were 4 transmission interruptions. The transmission interruptions accounted for 97% of customers interrupted and 97% of customer hours interrupted.
  - The first Transmission interruption occurred on April 06, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 22% of the total customers interrupted (768 of 3,496), and 38% of the total customer-hours interrupted (6,682 of 17,711).
  - The second Transmission interruption occurred on July 12, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 22% of the total customers interrupted (776 of 3,496), and 30% of the total customer-hours interrupted (5,238 of 17,711).
  - The third Transmission interruption occurred on October 29, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 25% of the total customers interrupted (865 of 3,496), and 1% of the total customer-hours interrupted (260 of 17,711).
  - The fourth Transmission interruption occurred on November 09, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 29% of the total customers interrupted (999 of 3,496), and 29% of the total customer-hours interrupted (5,078 of 17,711).
- There were no substation interruptions.
- The remaining 8 events occurred at the distribution level.
- There were no substation interruptions.
- The remaining 8 events occurred at the distribution level.



- The distribution circuit breaker for the Old Forge 38364 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Old Forge 38364 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Old Forge 38364 in 2018, accounting for 50% of total interruptions (6 of 12). Overloads were the 2nd leading cause of interruptions, accounting for 17% of total interruptions (2 of 12). Lightning were the 3rd leading cause of interruptions, accounting for 17% of total interruptions (2 of 12).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Old Forge 38364 in 2018, accounting for 76% of total customers interrupted (2,651 of 3,496). Accidents were the 2nd leading cause of customers interrupted, accounting for 22% of total customers interrupted (768 of 3,496). Overloads were the 3rd leading cause of customers interrupted, accounting for 1% of total customers interrupted (42 of 3,496).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Old Forge 38364 in 2018, accounting for 60% of total customer-hours interrupted (10,639 of 17,711). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 38% of total customer-hours interrupted (6,682 of 17,711). Overloads were the 3rd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (208 of 17,711).
- Of the 12 interruptions on this circuit, 4 affected 10 customers or less, with 1 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 9/9/2015.
- Level 2 I&M maintenance was completed by 9/9/2016.
- Level 3 I&M maintenance was completed by 9/9/2018
- Cycle tree pruning was completed in FY18.

**Action Plan:**

- Complete an I&M foot patrol in 2020.
- Complete cycle tree pruning in FY24.

## 12. PETERBORO 51453 - 13.2kV

Profile: 2,076 Customers, 54.4 Circuit Miles  
 Indices: CAIDI = 4.60, SAIFI = 1.61

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	4	14.29%	2,401	71.67%	12,911	83.81%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	17.86%	153	4.57%	953	6.18%
6	ACCIDENTS	11	39.29%	383	11.43%	582	3.78%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	2	7.14%	69	2.06%	387	2.51%
10	UNKNOWN	6	21.43%	344	10.27%	573	3.72%
Totals		28	100.00%	3,350	100.00%	15,405	100.00%

### **Problem Analysis:**

- There were 28 interruptions on the Peterboro 51453 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 28 events occurred at the distribution level.
- The distribution circuit breaker for the Peterboro 51453 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the Peterboro 51453 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 63% of the total amount of customers interrupted (2,101 out of 3,350) and 83% of the total amount of the customer-hours interrupted (12,711 out of 15,405).
  - This lockout occurred on July 22, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 63% of the total customers interrupted (2,101 of 3,350), and 83% of the total customer-hours interrupted (12,711 of 15,405). There were multiple tree issues along Route 31 and Route 13.
- Accidents were the leading cause of interruptions on the Peterboro 51453 in 2018, accounting for 39% of total interruptions (11 of 28). Unknown were the 2nd leading cause of interruptions, accounting for 21% of total interruptions (6 of 28). Equipment Failures were the 3rd leading cause of interruptions, accounting for 18% of total interruptions (5 of 28).
- Trees were the leading cause of customers interrupted (CI) on the Peterboro 51453 in 2018, accounting for 72% of total customers interrupted (2,401 of 3,350). Accidents were the 2nd leading cause of customers interrupted, accounting for 11% of total customers interrupted (383 of 3,350). Unknown were the 3rd leading cause of customers interrupted, accounting for 10% of total customers interrupted (344 of 3,350).

- Trees were the leading cause of customer-hours interrupted (CHI) on the Peterboro 51453 in 2018, accounting for 84% of total customer-hours interrupted (12,911 of 15,405). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 6% of total customer-hours interrupted (953 of 15,405). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 4% of total customer-hours interrupted (582 of 15,405).
- Of the 28 interruptions on this circuit, 5 affected 10 customers or less, with 1 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 6/21/2018.
- Hazard tree removal was completed in FY14.
- Cycle tree pruning was completed in FY15.

**Action Plan:**

- Complete Level 2 I&M maintenance by June 2019.
- Complete Level 3 I&M maintenance by June 2021.
- Complete cycle tree pruning in FY21.
- Review for potential installation of reclosing fuses.

### 13. STITTVILLE 67053 - 13.2kV

Profile: 1,064 Customers, 48.0 Circuit Miles  
 Indices: CAIDI = 2.08, SAIFI = 2.98

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	6	28.57%	571	18.02%	1,063	16.10%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	8	38.10%	1,144	36.10%	1,665	25.21%
6	ACCIDENTS	2	9.52%	167	5.27%	386	5.84%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	4.76%	1,060	33.45%	3,270	49.52%
10	UNKNOWN	4	19.05%	227	7.16%	220	3.33%
Totals		21	100.00%	3,169	100.00%	6,604	100.00%

**Problem Analysis:**

- There were 21 interruptions on the Stittville 67053 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 21 events occurred at the distribution level.
- The distribution circuit breaker for the Stittville 67053 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the Stittville 67053 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 33% of the total amount of customers interrupted (1,060 out of 3,169) and 50% of the total amount of the customer-hours interrupted (3,270 out of 6,604).
  - This lockout occurred on July 16, 2018, coded as a cause of lightning (PSC cause code 09). This lockout accounted for 33% of the total customers interrupted (1,060 of 3,169), and 50% of the total customer-hours interrupted (3,270 of 6,604). Lightning took primary conductor down at Pole 55 and Pole 55-1 Coombs Rd.
- Equipment Failures were the leading cause of interruptions on the Stittville 67053 in 2018, accounting for 38% of total interruptions (8 of 21). Trees were the 2nd leading cause of interruptions, accounting for 29% of total interruptions (6 of 21). Unknown were the 3rd leading cause of interruptions, accounting for 19% of total interruptions (4 of 21).

- Equipment Failures were the leading cause of customers interrupted (CI) on the Stittville 67053 in 2018, accounting for 36% of total customers interrupted (1,144 of 3,169). Lightning were the 2nd leading cause of customers interrupted, accounting for 33% of total customers interrupted (1,060 of 3,169). Trees were the 3rd leading cause of customers interrupted, accounting for 18% of total customers interrupted (571 of 3,169).
- Lightning were the leading cause of customer-hours interrupted (CHI) on the Stittville 67053 in 2018, accounting for 50% of total customer-hours interrupted (3,270 of 6,604). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 25% of total customer-hours interrupted (1,665 of 6,604). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 16% of total customer-hours interrupted (1,063 of 6,604).
- Of the 21 interruptions on this circuit, 8 affected 10 customers or less, with 3 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 10/7/2016.
- Level 2 I&M was completed by 10/7/2017.
- Hazard tree removal completed in FY14.
- Cycle tree pruning completed in FY18.

**Action Plan:**

- Complete Level 3 I&M maintenance by October 2019.
- Complete cycle tree pruning in FY24.

#### 14. SHERMAN 33352 - 13.2kV

Profile: 1,469 Customers, 92.0 Circuit Miles  
 Indices: CAIDI = 1.94, SAIFI = 2.81

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	9	42.86%	1,123	27.20%	3,611	45.10%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	28.57%	1,492	36.13%	2,396	29.93%
6	ACCIDENTS	2	9.52%	1,479	35.82%	1,949	24.35%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	2	9.52%	2	0.05%	10	0.12%
10	UNKNOWN	2	9.52%	33	0.80%	40	0.50%
Totals		21	100.00%	4,129	100.00%	8,006	100.00%

**Problem Analysis:**

- There were 21 interruptions on the Sherman 33352 in 2018.
- There were no transmission interruptions.
- There were 2 substation interruptions.
  - The first Substation interruption occurred on July 15, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 36% of the total customers interrupted (1,477 of 4,129), and 29% of the total customer-hours interrupted (2,314 of 8,006).
  - The second Substation interruption occurred on July 16, 2018, coded as a cause of animal (PSC cause code 06). This lockout accounted for 36% of the total customers interrupted (1,477 of 4,129), and 24% of the total customer-hours interrupted (1,945 of 8,006).
- The remaining 19 events occurred at the distribution level.
- The distribution circuit breaker for the Sherman 33352 experienced 4 momentary operations in 2018.
- The distribution circuit breaker for the Sherman 33352 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Sherman 33352 in 2018, accounting for 43% of total interruptions (9 of 21). Equipment Failures were the 2nd leading cause of interruptions, accounting for 29% of total interruptions (6 of 21). Accidents were the 3rd leading cause of interruptions, accounting for 10% of total interruptions (2 of 21).

- Equipment Failures were the leading cause of customers interrupted (CI) on the Sherman 33352 in 2018, accounting for 36% of total customers interrupted (1,492 of 4,129). Accidents were the 2nd leading cause of customers interrupted, accounting for 36% of total customers interrupted (1,479 of 4,129). Trees were the 3rd leading cause of customers interrupted, accounting for 27% of total customers interrupted (1,123 of 4,129).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Sherman 33352 in 2018, accounting for 45% of total customer-hours interrupted (3,611 of 8,006). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 30% of total customer-hours interrupted (2,396 of 8,006). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 24% of total customer-hours interrupted (1,949 of 8,006).
- Of the 21 interruptions on this circuit, 11 affected 10 customers or less, with 6 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 10/26/2015.
- Level 2 I&M maintenance was completed by 10/26/2016.
- Level 3 I&M maintenance was completed by 10/26/2018.
- Hazard tree removal completed in FY18.
- Cycle tree pruning completed in FY14.

**Action Plan:**

- Complete an I&M foot patrol in 2020.
- Complete cycle tree pruning in FY20.

## 15. LEHIGH 66953 - 13.2kV

Profile: 737 Customers, 66.7 Circuit Miles  
 Indices: CAIDI = 8.00, SAIFI = 1.72

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	4	20.00%	195	15.38%	888	8.76%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	8	40.00%	910	71.77%	8,591	84.74%
6	ACCIDENTS	2	10.00%	24	1.89%	203	2.00%
7	PREARRANGED	1	5.00%	92	7.26%	307	3.02%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	2	10.00%	20	1.58%	46	0.46%
10	UNKNOWN	3	15.00%	27	2.13%	104	1.03%
Totals		20	100.00%	1,268	100.00%	10,138	100.00%

### **Problem Analysis:**

- There were 20 interruptions on the Lehigh 66953 in 2018.
- There were no transmission interruptions.
- There were 2 substation interruptions.
  - The first Substation interruption occurred on January 22, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 58% of the total customers interrupted (730 of 1,268), and 73% of the total customer-hours interrupted (7,434 of 10,138).
  - The second Substation interruption occurred on February 22, 2018, coded as a cause of unknown (PSC cause code 07). This lockout accounted for 7% of the total customers interrupted (92 of 1,268), and 3% of the total customer-hours interrupted (307 of 10,138).
- The remaining 18 events occurred at the distribution level.
- The distribution circuit breaker for the Lehigh 66953 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the Lehigh 66953 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Lehigh 66953 in 2018, accounting for 40% of total interruptions (8 of 20). Trees were the 2nd leading cause of interruptions, accounting for 20% of total interruptions (4 of 20). Unknown were the 3rd leading cause of interruptions, accounting for 15% of total interruptions (3 of 20).



- Equipment Failures were the leading cause of customers interrupted (CI) on the Lehigh 66953 in 2018, accounting for 72% of total customers interrupted (910 of 1,268). Trees were the 2nd leading cause of customers interrupted, accounting for 15% of total customers interrupted (195 of 1,268). Prearranged were the 3rd leading cause of customers interrupted, accounting for 7% of total customers interrupted (92 of 1,268).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Lehigh 66953 in 2018, accounting for 85% of total customer-hours interrupted (8,591 of 10,138). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 9% of total customer-hours interrupted (888 of 10,138). Prearranged were the 3rd leading cause of customer-hours interrupted, accounting for 3% of total customer-hours interrupted (307 of 10,138).
- Of the 20 interruptions on this circuit, 8 affected 10 customers or less, with 2 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 9/16/2014.
- Level 2 I&M maintenance was completed by 9/16/2015.
- Level 3 I&M was completed by 9/16/2017.
- Hazard tree removal was completed FY15.
- Cycle tree pruning was completed in FY14.

**Action Plan:**

- Complete an I&M foot patrol in FY19.
- Complete Level 2 I&M maintenance in FY20.
- Complete cycle tree pruning in FY20.

## 16. SALISBURY 67857 - 13.2kV

Profile: 1,012 Customers, 89.7 Circuit Miles  
 Indices: CAIDI = 1.78, SAIFI = 2.82

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	11	50.00%	1,459	51.14%	3,332	65.55%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	13.64%	41	1.44%	110	2.16%
6	ACCIDENTS	3	13.64%	1,058	37.08%	717	14.10%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	2	9.09%	2	0.07%	3	0.06%
10	UNKNOWN	3	13.64%	293	10.27%	921	18.13%
Totals		22	100.00%	2,853	100.00%	5,083	100.00%

### **Problem Analysis:**

- There were 22 interruptions on the Salisbury 67857 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This Substation interruption occurred on May 14, 2018, coded as a cause of animal (PSC cause code 06). This lockout accounted for 35% of the total customers interrupted (991 of 2,853), and 11% of the total customer-hours interrupted (578 of 5,083).
- The remaining 21 events occurred at the distribution level.
- The distribution circuit breaker for the Salisbury 67857 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the Salisbury 67857 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Salisbury 67857 in 2018, accounting for 50% of total interruptions (11 of 22). Equipment Failures were the 2nd leading cause of interruptions, accounting for 14% of total interruptions (3 of 22). Accidents were the 3rd leading cause of interruptions, accounting for 14% of total interruptions (3 of 22).
- Trees were the leading cause of customers interrupted (CI) on the Salisbury 67857 in 2018, accounting for 51% of total customers interrupted (1,459 of 2,853). Accidents were the 2nd leading cause of customers interrupted, accounting for 37% of total customers interrupted (1,058 of 2,853). Unknown were the 3rd leading cause of customers interrupted, accounting for 10% of total customers interrupted (293 of 2,853).

- Trees were the leading cause of customer-hours interrupted (CHI) on the Salisbury 67857 in 2018, accounting for 66% of total customer-hours interrupted (3,332 of 5,083). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 18% of total customer-hours interrupted (921 of 5,083). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 14% of total customer-hours interrupted (717 of 5,083).
- Of the 22 interruptions on this circuit, 6 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 9/2/2015.
- Level 2 I&M maintenance was completed by 9/2/2016.
- Level 3 I&M maintenance was completed by 9/2/2018.
- Cycle tree pruning was completed in FY17.
- Reclosing fuses have been installed at six locations on Salisbury 67857.

**Action Plan:**

- Complete an I&M foot patrol in 2020.
- Complete cycle tree pruning in 2022.
- Installation of reclosing fuses will be completed by FY19

## 17. ONEIDA 50151 - 13.2kV

Profile: 1,823 Customers, 95.5 Circuit Miles

Indices: CAIDI = 1.49, SAIFI = 2.93

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	6	46.15%	5,230	98.07%	7,731	97.05%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	2	15.38%	19	0.36%	79	1.00%
6	ACCIDENTS	2	15.38%	53	0.99%	109	1.37%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	3	23.08%	31	0.58%	46	0.58%
Totals		13	100.00%	5,333	100.00%	7,966	100.00%

### Problem Analysis:

- There were 13 interruptions on the Oneida 50151 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 13 events occurred at the distribution level.
- The distribution circuit breaker for the Oneida 50151 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Oneida 50151 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 34% of the total amount of customers interrupted (1,817 out of 5,333) and 58% of the total amount of the customer-hours interrupted (4,624 out of 7,966).
  - This lockout occurred on September 21, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 34% of the total customers interrupted (1,817 of 5,333), and 58% of the total customer-hours interrupted (4,624 of 7,966). Vines grew around primary conductor between Pole 6 and Pole 7 on Fairview Ave.
- Trees were the leading cause of interruptions on the Oneida 50151 in 2018, accounting for 46% of total interruptions (6 of 13). Unknown were the 2nd leading cause of interruptions, accounting for 23% of total interruptions (3 of 13). Equipment Failures were the 3rd leading cause of interruptions, accounting for 15% of total interruptions (2 of 13).
- Trees were the leading cause of customers interrupted (CI) on the Oneida 50151 in 2018, accounting for 98% of total customers interrupted (5,230 of 5,333). Accidents were the 2nd leading cause of customers interrupted, accounting for 1% of total customers interrupted (53 of 5,333). Unknown were the 3rd leading cause of customers interrupted, accounting for 1% of total customers interrupted (31 of 5,333).

- Trees were the leading cause of customer-hours interrupted (CHI) on the Oneida 50151 in 2018, accounting for 97% of total customer-hours interrupted (7,731 of 7,966). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (109 of 7,966). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (79 of 7,966).
- Of the 13 interruptions on this circuit, 4 affected 10 customers or less, with 0 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed on 11/15/2018.
- Hazard tree removal was completed FY15.
- Cycle tree pruning was completed in FY15.

**Action Plan:**

- Complete Level 2 I&M maintenance by November 2019.
- Complete Level 3 I&M maintenance by November 2021.
- Complete cycle tree pruning in FY21.

### 3. ACTION PLAN SUMMARIES

#### a. SUMMARY OF ACTION PLANS FOR 2018 WORST PERFORMING CIRCUITS

Station	Feeder	Report Year	Action Plan	Projected Compl. Date	Cost	Comments
Eagle Bay	38272	2018	Complete Level 3 I&M	10/2020		
			Cycle Pruning	FY24		
Lehigh	66952	2018	Complete Level 2 I&M	09/2019		
			Complete Level 3 I&M	09/2021		
			Cycle Pruning	FY20		
Old Forge	38361	2018	Complete Level 3 I&M	08/2019		
			Cycle pruning	FY24		
			Review for reclosing fuse installations	12/2019		
Old Forge	38362	2018	Complete Level 3 I&M	09/2019		
			Cycle Pruning	FY24		
Poland	62258	2018	Complete I&M foot patrol	10/2020		
			Cycle Pruning	FY22		
			Route 8 Phase 2 Rebuild	FY19	\$800,000	
			Route 8 Phase 3 Rebuild	FY23		
			Install Reclosing Fuses	FY19		
Sherman	33351	2018	Complete Level 2 I&M	08/2019		
			Complete Level 3 I&M	08/2021		
			Hazard Tree Removal	FY19		
			Cycle Pruning	FY20		
			Install Reclosing Fuses	FY19		
Eagle Bay	38271	2018	Complete Level 3 I&M	08/2020		
			Cycle Pruning	FY24		
Lehigh	66954	2018	Complete I&M foot patrol	FY19		
			Complete Level 2 I&M	FY20		
			Cycle Pruning	FY20		
Alder Creek	70161	2018	Complete I&M foot patrol	FY19		
			Complete Level 2 I&M	FY20		
			Cycle Pruning	FY19		
Raquette Lake	39861	2018	Complete Level 2 I&M	11/7/2018		
			Cycle Pruning	FY24		
			Install reclosing fuses	FY19		
Old Forge	38364	2018	Complete I&M foot patrol	2020		
			Cycle Pruning	FY24		
Peterboro	51453	2018	Complete Level 2 I&M	06/2019		
			Complete Level 3 I&M	06/2019		
			Cycle Pruning	FY21		
Stittville	67053	2018	Complete Level 3 I&M	10/2019		
			Cycle Pruning	FY24		
Sherman	33352	2018	Complete I&M foot patrol	2020		
			Cycle Pruning	FY20		
Lehigh	66953	2018	Complete I&M foot patrol	FY19		
			Complete Level 2 I&M	FY20		
			Cycle Pruning	FY20		

<b>Station</b>	<b>Feeder</b>	<b>Report Year</b>	<b>Action Plan</b>	<b>Projected Compl. Date</b>	<b>Cost</b>	<b>Comments</b>
Salisbury	67857	2018	Complete I&M foot patrol	2020		
			Cycle Pruning	FY22		
			Install reclosing fuses	FY19		
Oneida	50151	2018	Complete Level 2 I&M	11/2019		
			Complete Level 3 I&M	11/2021		
			Cycle Pruning	FY21		



b. STATUS OF ACTION PLANS FOR 2017 WORST PERFORMING CIRCUITS

Station	Feeder	Report Year	Action Plan	Actual Compl. Date	Actual Cost	Comments
Poland	62258	2017	Complete Level 3 I&M	10/26/2018		Complete
			Hazard Tree Removal	FY18		Complete
			Complete Level 3 I&M	10/2021		On Schedule
			Phase 2 rebuild along Route 8	FY19	\$800,000	On Schedule
Eagle Bay	38272	2017	Complete Level 2 I&M	10/30/2018		Complete
			Complete Level 3 I&M	10/30/2020		On Schedule
Raquette Lake	39861	2017	Complete Level 3 I&M	12/01/2018		Complete
Old Forge	38362	2017	Cycle Pruning	FY18		Complete
Poland	62257	2017	Complete Level 3 I&M	5/5/2019		On Schedule
Eagle Bay	38271	2017	Complete Level 2 I&M	8/17/2019		On Schedule
			Complete Level 3 I&M	8/17/2021		On Schedule
Alder Creek	70161	2017	Cycle pruning	FY19		On Schedule
			Monitor Tree Outages	FY20		On Schedule
Old Forge	38364	2017	Complete Level 3 I&M	9/9/2019		On Schedule
Sherman	33351	2017	Complete I&M Foot patrol	08/10/2018		Complete
White Lake	39963	2017	Complete Level 2 I&M	11/7/2018		Complete
			Complete Level 3 I&M	11/7/2020		On Schedule
Salisbury	67857	2017	Complete Level 3 I&M	9/2/2018		Complete
			Hazard Tree Removal	FY19		On Schedule
Alder Creek	70152	2017	Cycle Prune	FY19		On Schedule
Turin Rd	65356	2017	Complete I&M Foot patrol	FY19		On Schedule
			Hazard Tree Removal	FY20		On Schedule
Old Forge	38361	2017	Cycle Pruning	FY18		Complete
			Complete Level 3 I&M	8/31/2019		On Schedule
Lehigh	66952	2017	Complete I&M foot patrol	9/21/2018		Complete
			Forestry Review	FY19		On Schedule
			Cycle Prune	FY20		On Schedule
Old Forge	38363	2017	Complete Level 3 I&M	4/28/2018		Complete

#### 4. OPERATING REGION PERFORMANCE BELOW MINIMUM

##### a. MAINTENANCE HISTORY AND ANALYSIS OF FACTORS THAT CAUSED THE BELOW MINIMUM PERFORMANCE.

In 2018, the Mohawk Valley Region met the PSC minimum goal for SAIFI of 1.483 interruptions, ending the year with a total SAIFI of 1.29 interruptions. This was a 15% decrease from 2017's SAIFI of 1.52. The 2018 SAIFI was 10% less than the 5-year SAIFI average of 1.43 interruptions.

The Mohawk Valley Region did not meet the PSC minimum goal for CAIDI of 2.15 hours, ending the year with an average interruption duration of 2.29 hours. This was a 46% increase over 2017's CAIDI of 1.57 hours. The 2018 CAIDI was 20% over the 5-year CAIDI average of 1.89 hours.

The 2018 data indicates that the number of interruptions was 7% above the previous 5-year average; the customers interrupted was 9% below the previous 5-year average; and the customer hours interrupted was 10% above the previous 5-year average.

##### 2018 CAIDI and SAIFI Data by Facility Type:

The 2018 CAIDI for transmission facilities was 3.06 hours, above the PSC target value of 2.15 hours for the Region. This consisted of 9 interruptions, which made up 21% of total customers interrupted and 28% of total customer hours interrupted. The 2018 SAIFI for transmission facilities contributed 0.27 interruptions (20.9%) of the 2018 total SAIFI for the Region of 1.29 interruptions. This suggests

The 2018 CAIDI for substation facilities was 2.26 hours, above the PSC target value of 2.15 hours. This consisted of 8 interruptions which resulted in 15% of the total number of customers interrupted and 15% of the customer hours interrupted. The 2018 SAIFI for substation facilities contributed 0.20 interruptions (15.3%) of the 2018 total SAIFI for the Region of 0.95 interruptions.

The 2018 CAIDI for distribution facilities was 2.04 hours, below the PSC target value of 2.15 hours. This consisted of 1,314 interruptions which resulted in 64% of the total number of customers interrupted and 57% of the customer hours interrupted. The 2018 SAIFI for distribution facilities contributed 0.82 interruptions (63.6%) of the 2018 total SAIFI for the Region of 1.29 interruptions.

## 2018 CAIDI and SAIFI Data by Cause Code:

### (02) Tree Contacts

The overall SAIFI for tree contacts was 0.33 interruptions, which is 12.6% below the previous 5-year average of 0.38 interruptions and 34.4% lower than the 2017 SAIFI of 0.50 interruptions. The overall CAIDI for tree contacts was 2.59 hours, which is 6.9% above the previous 5-year average of 2.43 hours and 23.8% above the 2017 CAIDI of 2.09 hours.

Tree-related outages contributed to 25.4% of the total number of customers interrupted (45,181 of 177,829), and 28.8% of the total customer-hours interrupted for the Region (117,145 of 406,526) in 2018. This suggests that tree-related outages were a major factor in why the Region did not meet the PSC target for CAIDI.

### (03) Overloads

The overall SAIFI for overloads was 0.01 interruptions, which is 50% below the previous 5-year average of 0.02 interruptions and 75% below the 2017 SAIFI of 0.04 interruptions. The overall CAIDI for overloads was 2.26 hours, which is 58.3% above the previous 5-year average of 1.43 hours and 356.6% above the 2017 CAIDI of 0.49 hours.

Overload-related outages contributed to 0.5% of the total number of customers interrupted (895 of 177,829), and 0.5% of the total customer hours interrupted for the Region (2,021 of 406,526). This suggests overloads were not a major factor in determining why the Region did not meet the PSC target for CAIDI.

### (04) Operator Error

The overall SAIFI for Operator Error was 0.00 interruptions, which is 98.8% below the previous 5-year average of 0.03 interruptions. The overall CAIDI for Operator Error was 0.68 hours, which is 79.0% above the previous 5-year average of 0.38 hours.

Operator Error outages contributed to 0.03% of the total number of customers interrupted (46 of 177,829), and 0.01% of the total customer hours interrupted for the Region (31 of 406,526). This suggests Operator Error outages were not a major factor in determining why the Region did not meet the PSC target for CAIDI.

### (05) Equipment Failure

The overall SAIFI for equipment failure was 0.56 interruptions, which is 5.5% above the previous 5-year average of 0.53 interruptions and 75.0% above the 2017 SAIFI of 0.32 interruptions. The overall CAIDI for equipment failure was 2.35 hours, which is 11.8% above the previous 5-year average of 2.10 hours and 19.8% above the 2017 CAIDI of 1.96 hours.

Equipment failure outages contributed to 43.77% of the total number of customers interrupted (77,836 of 177,829), and 45.06% of the total customer hours interrupted for the Region (183,190 of 406,526). This suggests equipment failure outages were the largest factor in determining why the Region did not meet the PSC target for CAIDI. Six of the nine Transmission interruptions in the Mohawk Valley Region occurred due to equipment failure. Although the equipment failure CAIDI is not as high as tree-related CAIDI, it has a larger impact due to the number of customers affected.

#### (06) Accidents

The overall SAIFI for accidents was 0.26 interruptions, which is 36.8% above the previous 5-year average of 0.19 interruptions and 7.1% below the 2017 SAIFI of 0.28 interruptions. The overall CAIDI for accidents was 2.01 hours, which is 16.3% above the previous 5-year average of 1.73 hours and 60.4% above the 2017 CAIDI of 1.26 hours.

Accidents contributed to 11.60% of the total number of customers interrupted (36,339 of 177,829), and 5.90% of the total customer hours interrupted for the Region (73,199 of 406,526). This suggests accidents were not a major factor in determining why the Region did not meet the PSC target for CAIDI.

#### (07) Prearranged

The overall SAIFI for prearranged outages was 0.04 interruptions, which is 69.7% below the previous 5-year average of 0.13 interruptions and 80% below the 2017 SAIFI of 0.20 interruptions. The overall CAIDI for prearranged outages was 0.77 hours, which is 10.7% below the previous 5-year average of 0.85 hours and 198.8% above the 2017 CAIDI of 0.26 hours.

Prearranged outages contributed to 1.70% of the total number of customers interrupted (5,393 of 177,829), and 0.30% of the total customer hours interrupted for the Region (4,133 of 406,526). This suggests prearranged outages were not a major factor in determining why the Region did not meet the PSC target for CAIDI.

#### (08) Customer Equipment

There were no outages in the Mohawk Valley Region due to customer equipment in 2018.

#### (09) Lightning

The overall SAIFI for lightning was 0.03 interruptions, which is 40.0% below the previous 5-year average of 0.05 interruptions and 50.0% below the 2017 SAIFI of 0.06 interruptions. The overall CAIDI for lightning was 2.39 hours, which is 16.3% above the previous 5-year average of 1.73 hours and 60.4% above the 2017 CAIDI of 1.26 hours.

Lightning contributed to 1.10% of the total number of customers interrupted (3,573 of 177,829), and 0.70% of the total customer hours interrupted for the Region (8,550 of 406,526). This suggests lightning was not a major factor in determining why the Region did not meet the PSC target for CAIDI.

(10) Unknown

The overall SAIFI for unknown causes was 0.06 interruptions, which is 39.0% below the previous 5-year average of 0.10 interruptions and 49.0% below the 2017 SAIFI of 0.12 interruptions. The overall CAIDI for unknown causes was 2.13 hours, which is 35.6% above the previous 5-year average of 1.57 hours and 48.4% above the 2017 CAIDI of 1.44 hours.

Lightning contributed to 2.70% of the total number of customers interrupted (8,566 of 177,829), and 1.50% of the total customer hours interrupted for the Region (18,255 of 406,526). This suggests unknown causes were not a major factor in determining why the Region did not meet the PSC target for CAIDI.

b. PLANNED PROGRAMS OR PLANNED CORRECTIVE ACTIONS AND PROPOSED IMPROVEMENTS TO THE PERFORMANCE INDICES

The Company is continuing its efforts to improve reliability in the Mohawk Valley. These efforts include transmission and distribution patrols, maintenance programs, line recloser installations, protection coordination studies, lightning protection installations and the tree trimming program. These programs and corrective actions not only will reduce the number of interruptions and/or customers interrupted but also the restoration times.

The Company will continue to stay on schedule for tree trimming and believes that this maintained schedule for tree trimming and miles trimmed will reduce both the incidence and duration of tree-related interruptions.

To help minimize interruptions caused by animal contact, the Company will continue to install animal guards on all new transformer installations and retrofit animal guards on existing transformers in areas plagued with animal-related interruptions in the Mohawk Valley Region.

When opportunities arise, feeder-ties will be constructed to temporarily transfer load onto adjacent feeder and substations. This will improve the reliability for the affected feeders.

An extensive rebuild of the 46kV radial feed to the Old Forge, Eagle Bay, and Raquette Lake stations will start in FY20 and run through FY22. Alternatives for a second source into Raquette Lake are being evaluated in order to loop the 46kV in the area. Non-wires alternatives, such as battery storage and fossil generation, are also being evaluated at this time.

Taken together, the Company believes these preventative actions will help minimize the potential for unplanned interruptions and improve the Capital Region's SAIFI and CAIDI performance.

## H. NORTHEAST REGION

### 1. OPERATING REGIONAL PERFORMANCE

#### a. HISTORIC CAIDI AND SAIFI INDICES

IDS info:

	2018	2017	2016	2015	2014	2013
CAIDI (Target 2.578)	2.42	2.42	2.83	3.00	2.10	2.23
SAIFI (Target 1.372)	1.22	1.36	1.21	1.25	1.36	1.28
SAIDI	2.97	3.30	3.41	3.73	2.85	2.85
Interruptions	2,611	2,284	2,414	2,326	2,296	2,360
Customers Interrupted	275,133	302,792	263,757	269,030	293,464	275,938
Customer-Hours Interrupted	667,045	733,340	745,318	805,885	616,217	616,530
Customers Served	224,817	222,272	218,439	216,005	216,347	216,316
Customers Per Interruption	105.37	132.57	109.26	115.66	127.82	116.92
Availability Index	99.9661	99.9623	99.9612	99.9574	99.9675	99.9675
Interruptions/1000 Customers	11.61	10.28	11.05	10.77	10.61	10.91

#### b. DISCUSSION OF REGIONAL PERFORMANCE

In 2018, the Northeast Region met its CAIDI reliability target and met its SAIFI reliability target as set forth by the New York Public Service Commission (PSC). The final System Average Interruption Frequency Index (SAIFI) result was 1.22 interruptions, 11% below the PSC goal of 1.372 interruptions. As shown in the table above, the Customer Average Interruption Duration index (CAIDI) was 2.42 in 2018, 6% below the PSC's regional target of 2.578 hours.

The 2018 CAIDI result was equal to the 2017 result of 2.42 hours, and 3% below the previous 5-year average of 2.50 hours. The 2018 SAIFI was 10% below the 2017 result of 1.36 interruptions, and 5% below the previous 5-year average of 1.29 interruptions.

In 2018, excluding major storms, the Northeast Region experienced 15 transmission interruptions. These interruptions accounted for 1% of the region's total interruptions (15 of 2,611), 20% of the region's total customers interrupted (CI), (54,258 of 275,133), and 18% (118,676 of 667,045) of the region's total customer-hours interrupted (CHI). Overall, transmission interruptions had a CAIDI of 2.19 hours, and a SAIFI of 0.24 interruptions.



The number of transmission-related interruptions decreased from 24 in 2017 to 15 in 2018 (a decrease of 38%). The number of customers interrupted decreased from 62,202 in 2017, to 54,258 in 2018 (a decrease of 13%), while the customer-hours interrupted decreased from 147,645 in 2017, to 118,676 in 2018 (a decrease of 20%).

In 2018, excluding major storms, the Northeast Region experienced 8 substation interruptions. These interruptions accounted for 0.3% of the region's total interruptions (8 of 2,611), 8% of the region's total customers interrupted, (22,207 of 275,133), and 7% (45,561 of 667,045) of the region's total customer-hours interrupted. Overall, substation interruptions had a CAIDI of 2.05 hours, and a SAIFI of 0.1 interruptions.

The number of substation-related interruptions decreased from 9 to 8 from 2017 to 2018 (a decrease of 11%). The number of customers interrupted increased from 18,026 in 2017, to 22,207 in 2018 (an increase of 23%), while the customer-hours interrupted increased from 23,354 in 2017, to 45,561 in 2018 (an increase of 95%).

In 2018, excluding major storms, the Northeast Region experienced 2,588 distribution interruptions. These interruptions accounted for 99% of the region's total interruptions (2,588 of 2,611), 72% of the region's total customers interrupted, (198,668 of 275,133), and 75% (502,808 of 667,045) of the region's total customer-hours interrupted. Overall, distribution interruptions had a CAIDI of 2.53 hours, and a SAIFI of 0.88 interruptions.

The number of distribution-related interruptions increased from 2,251 to 2,588 from 2017 to 2018 (an increase of 15%). The number of customers interrupted decreased from 222,564 in 2017, to 198,668 in 2018 (a decrease of 11%), while the customer-hours interrupted decreased from 562,340 in 2017, to 502,808 in 2018 (a decrease of 11%).

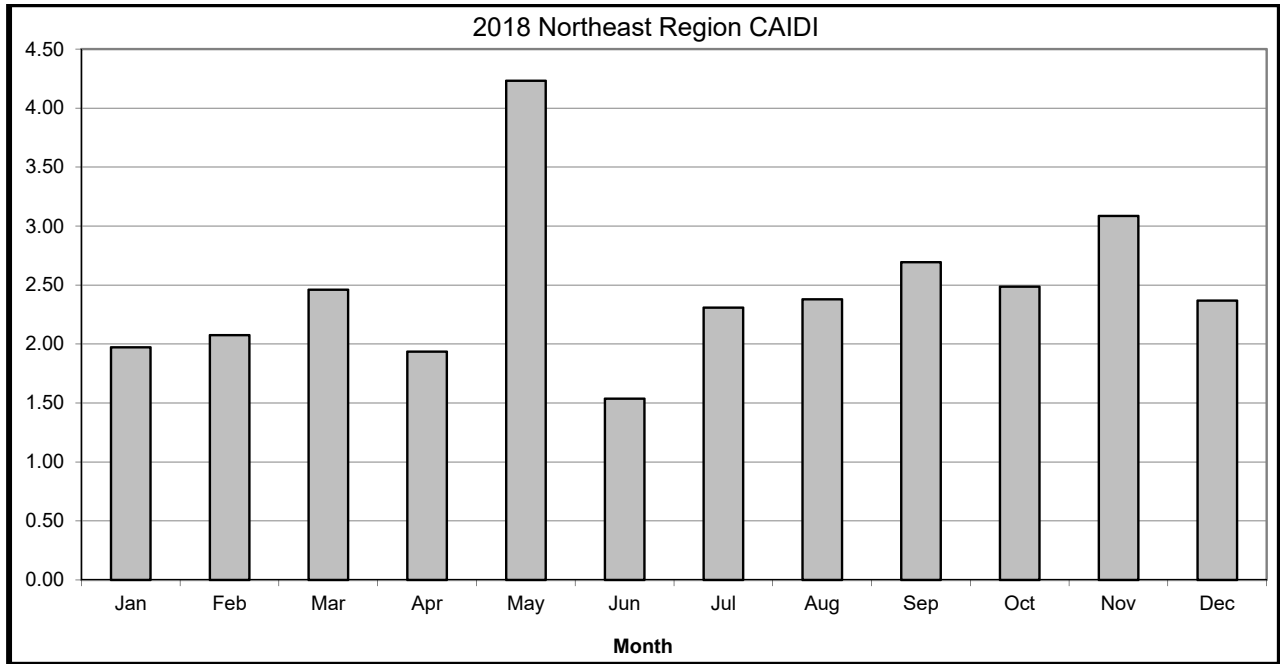
c. MONTHLY CAIDI AND SAIFI GRAPHS

The graphs on the following page show the monthly CAIDI and SAIFI for the Northeast Region for 2018.

The Northeast Region only had three months which exceeded the annual goal of 2.578 for CAIDI; May, September and November. With a peak of 4.23 hours in May it looked as though the Northeast Region CAIDI might exceed the annual CAIDI goal of 2.578 hours at the end of the year should CAIDI not be significantly better for the remainder of the year. However, the Northeast Region experienced a significant turnaround in June, dropping all the way down to a CAIDI of 1.54 hours. The second half of 2018 saw CAIDI stay relatively stable with five of the six months between 2.31 hours and 2.69 hours, with only the month of November going above 3.00 at 3.09 hours. By the end of 2018 the Northeast Region had remained under its goal, with an annual CAIDI of 2.42 hours, or 94% of the goal.

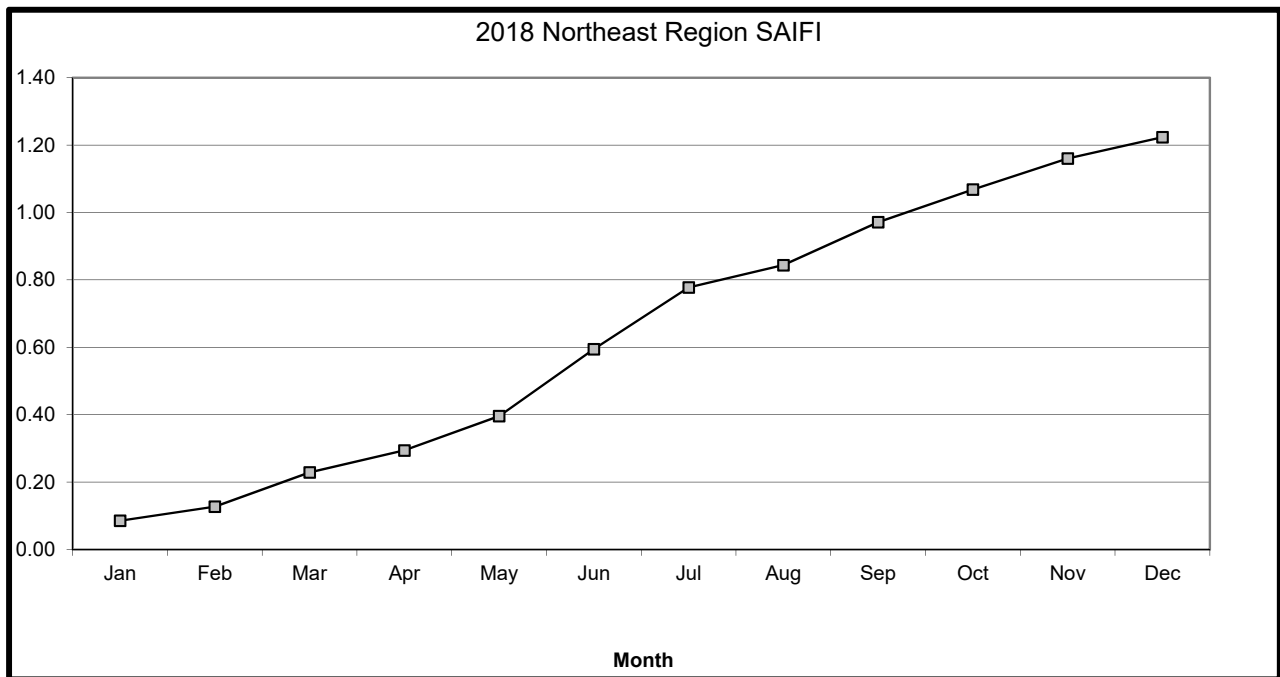
The Northeast Region went into the summer months of 2018 with a SAIFI below target at 0.40 after five months and it looked like staying below the SAIFI goal of 1.372 at the end of the year would be relatively easy. However, similarly to 2017, the months of June and July saw SAIFI in the Northeast Region nearly double to 0.78. August was a good SAIFI month, only rising 0.06, leaving the cumulative SAIFI of Northeast Region at 0.84 at the end of August. Through the fall of 2018, the monthly SAIFI was in the range of 0.10 each month, hitting 0.13 only once during the month of September. By the end of December, SAIFI in the Northeast Region was at 1.22, remaining under the target by 11%.

GRAPH OF MONTHLY CAIDI AND SAIFI FOR THE NORTHEAST REGION



PSC CAIDI Goal:	
Minimum	2.578
2018 Actual	2.42

PSC SAIFI Goal:	
Minimum	1.372
2018 Actual	1.22



d. PSC CAUSE CODES

1) Number of Events by Cause – Historical

IDS info:

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	2,304	1,332	917	0	1,333	564
<b>02</b> Tree Contacts	909	940	984	808	771	840
<b>03</b> Overloads	42	12	12	13	8	29
<b>04</b> Oper. Error	2	10	6	8	13	9
<b>05</b> Equipment	525	407	430	477	453	477
<b>06</b> Accidents	448	362	397	445	416	320
<b>07</b> Prearranged	53	53	38	60	68	107
<b>08</b> Cust. Equip.	0	0	0	0	0	0
<b>09</b> Lightning	37	66	67	98	138	188
<b>10</b> Unknown	595	434	480	417	429	390
<b>Total</b>	<b>4,915</b>	<b>3,616</b>	<b>3,331</b>	<b>2,326</b>	<b>3,629</b>	<b>2,924</b>

2) Customers Interrupted by Cause – Historical

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	225,645	165,837	103,347	0	99,145	69,279
<b>02</b> Tree Contacts	100,589	145,733	122,616	79,096	73,190	91,208
<b>03</b> Overloads	2,494	872	1,007	1,601	103	1,209
<b>04</b> Oper. Error	73	8,343	292	5,067	6,035	1,027
<b>05</b> Equipment	57,743	48,083	48,476	89,490	76,678	55,310
<b>06</b> Accidents	70,225	57,531	53,800	53,734	44,971	42,000
<b>07</b> Prearranged	16,957	7,860	2,422	21,668	6,327	22,473
<b>08</b> Cust. Equip.	0	0	0	0	0	0
<b>09</b> Lightning	877	4,330	10,816	2,626	17,806	20,088
<b>10</b> Unknown	26,175	30,040	24,328	15,748	68,354	42,623
<b>Total</b>	<b>500,778</b>	<b>468,629</b>	<b>367,104</b>	<b>269,030</b>	<b>392,609</b>	<b>345,217</b>

3) Customer-Hours Interrupted by Cause – Historical

Cause Code	2018	2017	2016	2015	2014	2013
01 Major Storms	2,984,805	1,117,998	576,910	0	772,816	334,841
02 Tree Contacts	297,256	390,342	374,189	276,325	229,044	282,025
03 Overloads	8,426	1,811	3,633	1,272	261	2,346
04 Oper. Error	1,382	1,956	741	3,061	2,973	326
05 Equipment	97,352	104,885	135,239	308,977	193,245	131,862
06 Accidents	189,072	133,930	111,538	149,889	82,782	85,975
07 Prearranged	17,969	9,664	2,708	11,227	7,052	11,328
08 Cust. Equip.	0	0	0	0	0	0
09 Lightning	2,877	31,207	73,058	7,712	39,370	42,415
10 Unknown	52,713	59,545	44,213	47,418	61,492	60,254
Total	3,651,851	1,851,338	1,322,228	805,881	1,389,035	951,370

4) Interruptions, Customers Interrupted and Customer-Hours Interrupted – 2018

Cause Code	Interruptions		Customers Interrupted		Customer Hours Interrupted	
	Number	% Total	Number	% Total	Number	% Total
01 Major Storms	2,304	46.9%	225,645	45.1%	2,984,805	81.7%
02 Tree Contacts	909	18.5%	100,589	20.1%	297,256	8.1%
03 Overloads	42	0.9%	2,494	0.5%	8,426	0.2%
04 Oper. Error	2	0.0%	73	0.0%	1,382	0.0%
05 Equipment	525	10.7%	57,743	11.5%	97,352	2.7%
06 Accidents	448	9.1%	70,225	14.0%	189,072	5.2%
07 Prearranged	53	1.1%	16,957	3.4%	17,969	0.5%
08 Cust. Equip.	0	0.0%	0	0.0%	0	0.0%
09 Lightning	37	0.8%	877	0.2%	2,877	0.1%
10 Unknown	595	12.1%	26,175	5.2%	52,713	1.4%
Total	4,915	100.0%	500,778	100.0%	3,651,852	100.0%

e. **INTERRUPTION REVIEW BY PSC CAUSE CODES**

**Cause Code 01 - Major Storms**

In 2018, Major Storms accounted for 47% of interruptions, 45% of customers interrupted, and 82% of Customer-Hours Interrupted.

Interruptions due to Major Storm were up 73% from 2017, and up 178% over the 5 year average. Customers interrupted due to Major Storms were up 36% from 2017, and up 158% over the 5 year average. Customer-Hours interrupted were up 167% from 2017 and up 433% over the 5 year average.

The remaining PSC code descriptions do not include Major Storms in the percentages.

**Cause Code 02 - Tree Contacts**

In 2018, Tree Contacts accounted for 35% of interruptions, 37% of customers interrupted, and 45% of Customer-Hours Interrupted.

Interruptions due to Tree Contacts were down 3% from 2017, and up 5% over the 5 year average. Customers interrupted due to Tree Contacts were down 31% from 2017, and down 2% over the 5 year average. Customer-Hours interrupted were down 24% from 2017 and down 4% over the 5 year average.

Tree Contacts were the largest cause of interruptions in 2018.

**Cause Code 03 - Overloads**

In 2018, Overloads accounted for 2% of interruptions, 1% of customers interrupted, and 1% of Customer-Hours Interrupted.

Interruptions due to Overloads were up 250% from 2017, and up 180% over the 5 year average. Customers interrupted due to Overloads were up 186% from 2017, and up 160% over the 5 year average. Customer-Hours interrupted were up 365% from 2017 and up 352% over the 5 year average.

Overloads were the 6th largest cause of interruptions in 2018.

**Cause Code 04 - Operator Error**

In 2018, Operator Error accounted for 0% of interruptions, 0% of customers interrupted, and 0% of Customer-Hours Interrupted.

Interruptions due to Operator Error were down 80% from 2017, and down 78% over the 5 year average. Customers interrupted due to Operator Error were down 99% from 2017, and down 98% over the 5 year average. Customer-Hours interrupted were down 29% from 2017 and down 24% over the 5 year average.

Operator Error was the 8th largest cause of interruptions in 2018.

### **Cause Code 05 - Equipment Failure**

In 2018, Equipment Failures accounted for 20% of interruptions, 21% of customers interrupted, and 15% of Customer-Hours Interrupted.

Interruptions due to Equipment Failure were up 29% from 2017, and up 17% over the 5-year average. Customers interrupted due to Equipment Failure were up 20% from 2017, and down 9% over the 5-year average. Customer-Hours interrupted were down 7% from 2017 and down 44% over the 5 year average.

Equipment Failures were the 3rd largest cause of interruptions in 2018.

### **Cause Code 06 - Accidents**

In 2018, Accidents accounted for 17% of interruptions, 26% of customers interrupted, and 28% of Customer-Hours Interrupted.

Interruptions due to Accidents were up 24% from 2017, and up 15% over the 5 year average. Customers interrupted due to Accidents were up 22% from 2017, and up 39% over the 5 year average. Customer-Hours interrupted were up 41% from 2017 and up 68% over the 5 year average.

Accidents were the 4th largest cause of interruptions in 2018.

### **Cause Code 07 - Prearranged**

In 2018, Prearranged accounted for 2% of interruptions, 6% of customers interrupted, and 3% of Customer-Hours Interrupted.

Interruptions due to Prearranged were flat at 0% from 2017, and down 18% over the 5 year average. Customers interrupted due to Prearranged were up 116% from 2017, and up 40% over the 5 year average. Customer-Hours interrupted were up 86% from 2017 and up 114% over the 5 year average.

Prearranged was the 5th largest cause of interruptions in 2018.

### **Cause Code 08 - Customer Equipment**

There were no Customer Equipment interruptions in 2018.

### **Cause Code 09 - Lightning**

In 2018, Lightning accounted for 1% of interruptions, 0% of customers interrupted, and 0% of Customer-Hours Interrupted.

Interruptions due to Lightning were down 44% from 2017, and down 67% over the 5 year average. Customers interrupted due to Lightning were down 80% from 2017,

and down 92% over the 5 year average. Customer-Hours interrupted were down 91% from 2017 and down 93% over the 5 year average.

Lightning was the 7th largest cause of interruptions in 2018.

### **Cause Code 10 - Unknown**

In 2018, Unknown causes accounted for 23% of interruptions, 10% of customers interrupted, and 8% of Customer-Hours Interrupted.

Interruptions due to Unknown causes were up 37% from 2017, and up 38% over the 5 year average. Customers interrupted due to Unknown causes were down 13% from 2017, and down 28% over the 5 year average. Customer-Hours interrupted were down 11% from 2017 and down 3% over the 5 year average.

Unknown causes were the 2nd largest cause of interruptions in 2018.



f. **DISCUSSION OF REGIONAL CAPEX PROJECTS WITH 2018/19 SPENDS**

The Company continues to work on capital projects in the Northeast Region to maintain customer satisfaction and future reliability. Engineering works with Operations to address localized concerns raised through PSC complaints and other customer inquiries in the Northeast Region. These solutions were varied and included fusing, adding tree wire, small rebuilds, adding animal guards and tree trimming.

Some of the specific projects that were either constructed in CY2018 or are scheduled to be designed and/or constructed in CY2019 are listed below.

**Construct New Queensbury 29555 Feeder**

A multi-year project to rebuild the Queensbury substation was completed in 2016, which provided a significant amount of additional distribution capacity by replacing the two old 22.4 MVA, 115/13.2 kV transformers with a pair of new 40 MVA, 115/13.2 kV transformers. In order to tap into that additional capacity and help relieve the load on surrounding distribution feeders, two new distribution feeders were also constructed. The first of these feeders the Queensbury 29551 was constructed in 2016 and placed in service in February 2017. The second of these new Queensbury distribution feeders, the 29555, was completed in April of 2018. This project included the reconductoring of Country Club and Quaker Roads with 477 MCM AL conductors up to the first tie point, to increase the capacity of the existing feeders in the area while also constructing new 3Ø on Glenwood Avenue between Quaker Road and Glen Street, which will act as the Queensbury 29555 feeder.

**Port Henry 52 – Moriah Road Rebuild/Conversion**

The Lakeview Avenue tap is the largest single-phase tap on the Port Henry 38852. It is a 4.8 kV, single phase tap which is in excess of 14 miles in length, has 181 customers on it, and over 1.8 MVA of connected load. Less than 1.5 miles from the beginning of this tap, there is a 3,000 foot section of rear lot with limited access, which is heavily treed and crosses a ravine. This project will provide the 180 customers downstream of this rear lot section service from a different direction, thereby isolating them from any problems which may occur in the rear lot. In addition, the load on the 3-phase, 13.2/4.8 kV step down ratio transformer serving this single-phase tap is out of balance due to the load of this tap and is approaching the capacity of the transformer. This project will rebuild and convert Moriah Road to 7.62 kV from the ratio at pole 110 to Henry Allen Road, rebuild and convert Edgemont Rd. from Moriah Road to Fisk Rd., close a distribution gap on Edgemont Rd. east of Lakeview Ave. between poles 10 and 13 and remove rear lot distribution between poles 2 and 5 on Lakeview Ave. and poles 3 & 7 on Harry Allen Rd. Construction was completed on this project in May of 2018.

### **Stoner 52 – Mohawk Drive Conversion to 13.2 kV**

The Montgomery County hamlet of Tribes Hill is served by the Stoner 35852 feeder through a 1,500 kVA, 3Ø, 13.2/4.8 kV ratio transformer. This ratio serves approximately 670 customers who have no alternative means of service. The area has been experiencing voltage problems, and a review of the load on the 1,500 kVA ratio transformer, which is protected by a line recloser on the high side, indicated that the load on the ratio transformer has peaked as high as 143% of nameplate, at nearly 2,200 kVA.

This project will rebuild and convert Mohawk Drive to 13.2 kV from the ratio transformer (approximately 3.5 miles) to 3rd Avenue and will convert all side taps, except for the tap to Shirley Street and Second Avenue, which are both to remain 4.8 kV through 250 kVA single phase ratio transformers. Thereafter, a new 1,500 kVA, 3Ø, 13.2/4.8 kV ratio transformer will be installed on Mohawk Drive near the corner of 3rd Avenue. Construction of this project began in late February 2018 and is expected to be completed in 2019.

### **Bolton 28451/Warrensburg 04251 Feeder Tie**

The Bolton 28451 feeder is repeatedly among the Northeast Region's worst performing feeders (WPF's), being #7 on this year's list after being #19 in 2017. A contributing factor to that reliability problem is the radial 34.5 kV system serving the Bolton substation, as well as the fact that the feeder is very long, heavily wooded, in a storm prone area and has no significant feeder ties. As a result, construction on a feeder tie to the 115/13.2 kV Warrensburg station began in February 2019 and should be completed before summer 2019.

This project will rebuild over 2.5 miles of distribution line on Diamond Point Road, from the existing single-phase 4.8 kV to 3-phase 13.2 kV, to create a 3-phase feeder tie between the Bolton 28451 and the Warrensburg 32151. In addition, loop scheme reclosers will be added to automatically transfer as many as 1,000 of the 2,000 customers on the Bolton 28451 to the Warrensburg 32151, should there be an interruption to the 34.5 kV sub-transmission service into the Bolton substation or the Bolton 28451 station breaker lock-out.

### **Butler 36253 – Install New Breaker in Butler Substation and Build New Feeder**

A project is under construction to add a third distribution breaker in the Butler substation and construct a 3<sup>rd</sup> distribution feeder. The new distribution feeder will proceed from the Butler substation north on U.S. Highway 9 about ¼ mile to Reservoir Road, then utilize the existing 3-phase distribution on Reservoir Road to State Highway 32 where it will turn south on State Highway 32 requiring the reconstruction of about ¾ mile of State Highway 32 to the intersection of State Highway 197 where it will intersect the Butler 36251. This project will transfer 47.2 miles of distribution and about 1,110 customers from the Butler 36251 feeder to the new Butler 36253 feeder while also transferring the 10.1 mile Fortsville Road tap, and the 204 customers it serves from the Wilton 32952 feeder to the Butler 36251. In the process, a new 3-phase recloser will be installed on the Butler 36251 on Fortsville Road which can be used in the future to create a loop scheme between the Butler 36251 and the Wilton 32952. The Butler 36253 feeder is expected to be in service by the summer of 2019.

### **Construct New Sodeman Road Distribution Substation**

A multi-year project to construct a new substation in the Town of Milton in Saratoga County west of the City of Saratoga Springs began in late 2018. This substation will have a 25 MVA, 115/13.2 kV transformer with four new distribution feeders. Construction of the substation is expected to be complete by the middle of 2019; however, initially very little load will be connected to the substation.

Construction of the distribution to be attached to the Sodeman Road substation has begun with the distribution work closest to the substation from which all four distribution feeders will build. The first of these feeders, the Sodeman Road 130151, is scheduled to begin construction of its first phase in FY2020 and will proceed west on State Highway 29 from the substation to Rock City Falls to allow retirement of the Rock City Falls substation. Ultimately, the Sodeman Road 130151 will continue west to create a feeder tie with the Vail Mills 39252. The Sodeman Road 130152 is scheduled to be built in late FY2020 or early FY2021 depending upon the receipt of the necessary easements and will be constructed north on Sodeman Road to Middle Grove Road to serve a significant portion of the existing Brook Road 36955 feeder. The Sodeman Road 130153 and 130154 feeders will begin construction in FY2020 and FY2021 respectively. It is expected that all phases of the Sodeman Road distribution construction will be completed in FY2022 or FY2023.

### **Construct New Maple Avenue Distribution Substation**

A multi-year project to construct a new substation in the Town of Perth in Fulton County north of the City of Amsterdam began in early 2019. This substation will have a 25 MVA, 115/13.2 kV transformer with four new distribution feeders. Construction of the substation is expected to be complete by the end of 2019.

Construction of the distribution to be attached to the Maple Avenue substation will likely begin in the Summer of 2019 with construction of the distribution duct bank from the substation to the intersection of State Highway 30 and Maple Avenue about ½ mile south of the substation. The overhead distribution construction will begin in late 2019 or early 2020 by constructing double circuit distribution on Maple Avenue from State Highway 30 to Midline Road and extend two overhead distribution feeders south along State Highway 30 to Golf Course Road. It is expected that all phases of the Maple Avenue distribution construction will be completed in FY2022 or FY2023 after which time the Market Hill substation will be retired.

Northeast Region Capital Projects in Excess of \$1M Completed in 2018:

<b>Region</b>	<b>Project Name</b>	<b>Project Type</b>	<b>Fin Sys Proj No.</b>	<b>Finish Date</b>	<b>Total Spend</b>
Northeast	Queensbury Station Getaways and Distribution	D Line	CD00895	4/12/2018	\$7,188,066
Northeast	Ticonderoga Sub. – Install Capacitor Bank & Replace OCB's	T-Sub	C060254	12/20/2018	\$3,838,987

g. DISCUSSION OF REGIONAL PERFORMANCE OF LVAC NETWORK DISTRIBUTION SYSTEM(S)

**Glens Falls LVAC Network**

The Glens Falls Secondary Network serves the area of Glen Street between Mohican and Glen Streets. This network is supplied by 4 – 4.160 KV feeders from the Glens Falls and Henry Street Substations. This system serves approximately 290 customer accounts and experienced an estimated / simulated peak load of approximately 2.48 MVA in 2018.

The table below lists each distribution circuit serving the Glens Falls Secondary Network with the number of events that caused an operation of the Substation Breaker.

<b>Substation</b>	<b>Feeder</b>	<b># Breaker Operations from Faults / Failures</b>
Glens Falls	7505	0
Glens Falls	7507	1
Henry Street	31638	0
Henry Street	31639	0

As shown above the Glens Falls Secondary Network experienced 1 unplanned distribution circuit outage in 2018.

Major equipment replacements in 2018 consisted of 1 transformer and 1 network protector. Annual maintenance consisted of manhole and vault inspections, network protector and transformer inspections, and network protector operation checks.

## 2. OPERATING CIRCUIT LISTS

This section includes the following three tables and worst performing feeder analysis for the Northeast Region.

- a. Worst Performing Circuit List
- b. Worst Performing Circuits with 3 Year History for CAIDI & SAIFI Indices
- c. Worst Performing Circuits by # of Momentary Interruptions

a. NATIONAL GRID WORST PERFORMING CIRCUIT LIST

NORTHEAST REGION

FEEDER #	A CUST. SERVED	B TOTAL INTER.	C # CUST. INTER.	D CUST. HRS. INTER.	C/A SAIFI	D/A SAIDI	D/C CAIDI	NUMBER OF MOMENTARIES
HAGUE ROAD 41853	2,205	37	13,330	36,208	6.05	16.42	2.72	4
FORT GAGE 31954	1,902	45	8,391	17,482	4.41	9.19	2.08	2
PORT HENRY 38551	1,741	28	7,172	21,109	4.12	12.12	2.94	8
VAIL MILLS 39253	3,091	61	8,262	27,516	2.67	8.90	3.33	0
BURGOYNE 33751	1,813	52	6,397	13,418	3.53	7.40	2.10	5
GILMANTOWN 15451	2,042	32	6,172	19,328	3.02	9.47	3.13	5
BOLTON 28451	2,034	37	5,499	17,729	2.70	8.72	3.22	1
HAGUE ROAD 41852	1,724	25	6,029	16,211	3.50	9.40	2.69	3
WILTON 32952	1,575	23	7,654	12,674	4.86	8.05	1.66	1
OTTEN 41213	542	21	3,089	10,397	5.70	19.18	3.37	5
MIDDLEBURG 39051	1,251	44	3,941	8,114	3.15	6.49	2.06	3
PORT HENRY 38552	1,642	17	6,356	17,578	3.87	10.71	2.77	6
E J WEST 03851	1,469	34	3,105	11,263	2.11	7.67	3.63	1
WILTON 32951	1,538	23	7,167	8,697	4.66	5.65	1.21	3
BURGOYNE 33752	2,091	33	5,669	10,393	2.71	4.97	1.83	1
CROWN POINT 24951	1,094	22	2,567	10,469	2.35	9.57	4.08	5
SCHOHARIE 23452	1,626	29	2,787	13,734	1.71	8.45	4.93	3
EAST SPRINGFIELD 47751	996	22	3,425	6,095	3.44	6.12	1.78	2
BUTLER 36251	2,926	35	6,427	11,133	2.20	3.80	1.73	2
DELANSON 26951	2,007	38	4,166	8,762	2.08	4.37	2.10	3

Regional Goals:  
CAIDI Min. 2.578  
SAIFI Min. 1.372



b. NATIONAL GRID WORST PERFORMING CIRCUITS WITH 3 YEAR HISTORY FOR CAIDI AND SAIFI INDICES

NORTHEAST REGION

FEEDER #	2018 CAIDI	2017 CAIDI	2016 CAIDI	2015 CAIDI	2018 SAIFI	2017 SAIFI	2016 SAIFI	2015 SAIFI
HAGUE ROAD 41853	2.72	2.74	3.49	3.48	6.05	4.78	3.08	1.80
FORT GAGE 31954	2.08	1.73	3.81	2.48	4.41	3.70	3.92	2.31
PORT HENRY 38551	2.94	2.73	2.38	2.84	4.12	4.18	1.14	3.45
VAIL MILLS 39253	3.33	0.98	5.54	3.59	2.67	2.16	0.74	0.40
BURGOYNE 33751	2.10	3.01	2.43	2.42	3.53	2.73	1.50	2.66
GILMANTOWN 15451	3.13	3.51	4.60	4.25	3.02	0.35	6.95	8.44
BOLTON 28451	3.22	1.88	2.73	2.07	2.70	2.75	2.20	2.79
HAGUE ROAD 41852	2.69	3.79	1.94	3.81	3.50	2.39	0.41	1.71
WILTON 32952	1.66	3.35	2.19	4.50	4.86	2.80	3.33	2.18
OTTEN 41213	3.37	3.62	2.73	7.69	5.70	2.55	2.04	1.46
MIDDLEBURG 39051	2.06	3.21	2.99	3.57	3.15	1.40	0.91	1.41
PORT HENRY 38552	2.77	2.89	1.33	2.54	3.87	3.15	0.67	2.16
E J WEST 03851	3.63	4.09	3.15	2.52	2.11	2.67	1.26	1.16
WILTON 32951	1.21	2.12	2.50	4.02	4.66	0.09	2.74	3.44
BURGOYNE 33752	1.83	3.74	3.66	1.12	2.71	1.53	1.38	2.46
CROWN POINT 24951	4.08	3.26	3.34	3.47	2.35	2.87	0.55	2.08
SCHOHARIE 23452	4.93	4.67	3.37	2.71	1.71	1.17	0.38	1.91
EAST SPRINGFIELD 47751	1.78	2.49	5.42	4.34	3.44	4.06	0.36	0.44
BUTLER 36251	1.73	1.11	1.71	3.52	2.20	1.24	0.93	1.01
DELANSON 26951	2.10	2.32	2.35	3.02	2.08	1.25	0.73	0.77

Regional Goals:  
CAIDI Min. 2.578  
SAIFI Min. 1.372

c. NATIONAL GRID WORST PERFORMING CIRCUITS BY # OF MOMENTARY INTERRUPTIONS

NORTHEAST REGION

Feeders			Customer Momentaries				Ranks		
Volts (kV)	Station Name	Ckt/F No.	Substation	Transmission	Distribution	Total	Within Region	Within System	Reliability Ranking
No circuits experienced 10 or more momentary interruptions in 2018.									

d. WORST PERFORMING CIRCUIT ANALYSIS

For 2018, the Company is reporting on the 20 Worst Performing Feeders in the Northeast Region. This year, the Northeast Region's list of Worst Performing Feeders consists of nineteen 13.2 kV feeders and one 4.8 kV feeder.

For the Northeast Region, the PSC minimum CAIDI is 2.578 hours and the PSC minimum SAIFI is 1.372 interruptions.

## 1. HAGUE ROAD 41853 – 13.2 kV

Profile: 2,205 Customers, 75.2 Circuit Miles

Indices: CAIDI = 2.72, SAIFI = 6.05

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	19	51.35%	1,806	13.55%	7,320	20.22%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	4	10.81%	1,269	9.52%	2,543	7.02%
6	ACCIDENTS	10	27.03%	7,944	59.59%	23,936	66.11%
7	PREARRANGED	1	2.70%	2,213	16.60%	1,844	5.09%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	3	8.11%	98	0.74%	565	1.56%
Totals		37	100.00%	13,330	100.00%	36,208	100.00%

### Problem Analysis:

- There were 37 interruptions on the Hague Road 41853 in 2018.
- There were 3 transmission interruptions.
- The three transmission interruptions on the Hague Road 41853 in 2018 were the result of Osprey activity on the Ticonderoga-Whitehall #3, 115 kV transmission line. These three events combined, interrupted 6,626 customers (50%) and accounted for 18,383 customer hours of interruption (51%).
  - The first event occurred on May 26th when part of an Osprey nest fell causing an interruption on the Ticonderoga-Whitehall #3, 115 kV transmission line for 7 hours and 23 minutes while the problem was located and repaired.
  - The second Osprey event occurred on June 13th and was momentary in nature, but for the transmission system to cycle through the necessary operations to be assured that the fault was gone, 8 minutes past before service was restored to the Hague Road station.
- The third Osprey related event was a planned interruption on June 14th to remove an inactive Osprey nest at structure 320 which was completed in 50 minutes.
- There were no substation interruptions.
- The remaining 34 events occurred at the distribution level.
- The distribution circuit breaker for the Hague Road 41853 experienced 4 momentary operations in 2018.
- The 34 interruptions on the Hague Road 41853 in 2018 attributed to the distribution system, interrupted 6,704 customers (50%) and accounted for 17,825 customer-hours interrupted (49%), for a distribution SAIFI of 3.04 and CAIDI of 2.66.
- The distribution circuit breaker for the Hague Road 41853 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 17% of the total amount of

customers interrupted (2,233 out of 13,330) and 8% of the total amount of the customer-hours interrupted (2,828 out of 36,208).

- This blackout, which occurred on July 30, 2018, was the result of a customer cutting a tree (PSC cause code 06: non-company activities) which fell on the 3-phase main-line near the substation locking out the station breaker. Fortunately, the tree was removed and service restored in 1 hour 16 minutes.
- The largest accident related interruption on the Hague Road 41853 in 2018 which occurred on the distribution feeder was the result of a motor vehicle accident. This accident broke pole 153 on State Highway 9N and locked out a line recloser interrupting 1,270 customers (10%) and accounting for 4,487 customer-hours interrupted (12%).
- These two large distribution interruptions listed above when combined with the three Osprey related interruptions on the 115 kV transmission system accounted for only 14% of the 37 total interruptions experienced on the Hague Road 41853 in 2018, but they affected 10,129 customers (76%) and accounted for 25,699 customer-hours interrupted (71%).
- Trees were the leading cause of interruptions on the Hague Road 41853 in 2018, accounting for 33% of the interruptions, however, no single tree related interruption impacted more than 337 customers (3%) or accounted for more than 2,828 customer-hours of interruption (8%).
- Of the 37 interruptions on this circuit, 17 affected 10 customers or less, with 3 being single customer outages.

**Actions Taken:**

- There are five 3-phase reclosers and one single-phase recloser on the Hague Road 41853. Three 3-phase reclosers were installed in the early to mid-1990's (one of which was replaced in 2007), and all were brought up to current National Grid standards in 2010. The remaining two 3-phase reclosers were installed in 2014 during a storm hardening project on Baldwin Road, while the single-phase recloser was installed in 2008.
- A Minor Storm Hardening project was completed in 2014, at a cost of \$959,928, to rebuild and convert about 7,000 feet of Baldwin Road to 13.2 kV and install a new line recloser to protect the tap.
  - A small capital improvement project to convert Lord Howe Street to 7.62 kV was completed in 2018 at a cost of \$48,087.
  - A small fusing project to better fuse the Black Point Road tap was completed in 2018 at a cost of \$29,318.
- A maintenance foot patrol of the Hague Road 41853 was completed in 2018 and all level 1 maintenance has been completed.
- Tree trimming and a hazard tree review, which removed 456 hazard trees and another 290 Ash trees infested with the Emerald Ash Borer, was completed on the Hague Road 41853 in FY2019.
- A maintenance foot patrol of the Ticonderoga-Whitehall #3, 115 kV transmission line was completed in 2015, and all identified maintenance has been completed.
- A maintenance foot patrol of the Ticonderoga-Republic #2, 115 kV transmission line was completed in 2018 and no level 1 or 2 maintenance items were identified.
- Integrated Vegetation Management was completed on the Ticonderoga-Whitehall #3; 115 kV transmission line in FY2018.

**Action Plan:**

- Complete all identified level 2 and 3 maintenance on the Hague Road 41853.
- Generators will be installed to serve the customers on the Hague Road 41853 in the spring of 2019 to allow for critical repairs to be made to the Ticonderoga-Republic #2 and Ticonderoga-Whitehall #3, 115 kV transmission lines as well as the relocation of multiple Osprey nests.
- A small capital improvement project is budgeted for FY2020 to reconfigure the tap on Silver Bay Road to reduce exposure for customers in Silver Bay to tree related interruptions.
- A capital improvement project to replace the submarine cable which traverses Lake George at Friends Point is budgeted for FY2021.
- A capital improvement project to rebuild and convert the east side of Lake George from 4.8 kV to 13.2 kV to create a feeder tie to the Hague Road 41852 is budgeted for FY2021.
- A capital improvement project to rebuild and convert Alexandria Avenue and a portion of the former Village of Ticonderoga from 4.8 kV to 13.2 kV is budgeted for FY2024.
- Complete all identified level 3 maintenance on the Ticonderoga-Republic #2, 115 kV transmission line.
- Integrated Vegetation Management is scheduled on the Ticonderoga-Republic #2; 115 kV transmission line in FY2020.

## 2. FORT GAGE 31954 – 13.2 kV

*Profile: 1,902 Customers, 47.1 Circuit Miles*  
*Indices: CAIDI = 2.08, SAIFI = 4.41*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	18	40.00%	5,940	70.79%	14,304	81.83%
3	OVERLOADS	3	6.67%	34	0.41%	83	0.47%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	7	15.56%	169	2.01%	460	2.63%
6	ACCIDENTS	7	15.56%	1,920	22.88%	2,237	12.80%
7	PREARRANGED	2	4.44%	277	3.30%	181	1.04%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	8	17.78%	51	0.61%	215	1.23%
Totals		45	100.00%	8,391	100.00%	17,482	100.00%

### **Problem Analysis:**

- There were 45 interruptions on the Fort Gage 31954 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - The substation interruption was the result of animal contact inside the Fort Gage substation which interrupted 1,880 customers (22%) and accounted for 2,162 customer-hours of interruption (12%).
- The remaining 44 events occurred at the distribution level.
- The distribution circuit breaker for the Fort Gage 31954 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the Fort Gage 31954 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the number one cause of interruptions on the Fort Gage 31954 in 2018 accounting for 18 of the 45 interruptions (40%). Three tree-related events resulted in the lock-out of the 3-phase line recloser closest to the Fort Gage substation, R88896, on pole 42 State Highway 9L, impacting over 1,650 customers each time. Combined, these three recloser lock-outs interrupted a total of 4,960 customers (59%) and accounted for 10,500 customer-hours of interruption (60%).
  - The first of these events occurred on June 27, 2018 when a tree fell across all 3 phases on State Highway 9L between poles 52 and 53, interrupting 1,652 customers (20%) for only 16 minutes accounting for 413 customer-hours of interruption (2%).
  - The second event occurred on July 22, 2018 when a tree fell across all 3 phases on State Highway 9L near pole 63 interrupting 1,656 customers (20%) for over 2½ hours accounting for 4,195 customer-hours interrupted (24%).

- The third event occurred on October 21, 2018 when a tree fell across all three phases near pole 91 on State Highway 9L affecting 1,652 customers (20%) and accounting for 5,892 customer-hours interrupted (34%).
- The four interruptions listed above which locked out either the station breaker or a line recloser, when combined, accounted for only 9% of the interruptions experienced by the Fort Gage 31954 in 2018, but they affected 6,840 customers (82%) and accounted for 12,662 customer-hours interrupted (72%).
- Twenty-four of the 45 interruptions (53%) experienced on the Fort Gage 31954 in 2018 affected ten customers or less and eleven of those affected only a single customer.

**Actions Taken:**

- There are five 3-phase reclosers and two single-phase reclosers on the Fort Gage 31954. One of the 3-phase reclosers was originally installed in the mid 1990's but its controller has recently been upgraded. Three other 3-phase reclosers and one of the single-phase reclosers were installed between 2006 and 2009. The fifth 3-phase recloser was relocated in early 2013 to better split the zones of protection on the feeder. The second single phase recloser was replaced by a TripSaver, cut-out mounted single phase recloser in early 2019.
- An extensive review of the Fort Gage 31954 was performed in 2018, including detailed patrols of large sections of the feeder to identify and address tree and equipment issues on the feeder, installation of recording meters at various points on the feeder to evaluate transients on the feeder and other measures to improve reliability on the feeder.
- Tree trimming and a hazard tree review, which removed 61 hazard trees and another 5 Ash trees infested with the Emerald Ash Borer, was completed on the Fort Gage 31954 in FY2017.
- A distribution automation project was completed in 2014 on the Fort Gage-Queensbury #2, Warrensburg-Fort Gage #8, and Warrensburg-Queensbury #9, 34.5 kV sub-transmission lines to automatically sectionalize the 34.5 kV system to isolate faults while maintaining service to as many of the substations served from this system as possible.
- Animal guards were installed in the Fort Gage substation in 2015.
- Distribution line sensors were installed at the Fort Gage substation in 2018 to provide remotely accessible feeder load data.
- A maintenance foot patrol was completed on the Fort Gage 31954 in 2015 and all identified maintenance has been completed.
- A maintenance foot patrol of the Fort Gage-Queensbury #2, 34.5 kV sub-transmission line was completed in 2016 and all level 1 and 2 maintenance has been completed.
- A maintenance foot patrol of the Warrensburg-Fort Gage #8, 34.5 kV sub-transmission line was completed in 2017 and all level 1 and 2 maintenance has been completed.
- Integrated Vegetation Management was completed on the Fort Gage-Queensbury #2, Warrensburg-Fort Gage #8, and the Warrensburg-Queensbury #9, 34.5 kV sub-transmission lines in FY2019.



**Action Plan:**

- A maintenance foot patrol of the Fort Gage 31954 is scheduled for 2020.
- An ERR will be performed on the Fort Gage 31954 in 2019.
- An animal fence will be installed around the energized equipment within the Fort Gage substation in 2019.
- A capital improvement project is budgeted for FY2021 to rebuild State Route 9L from pole 215 to pole 265 to allow the conversion to 13.2 kV and the creation of a feeder tie with the Cedar 45351, which could potentially be automated with loop scheme reclosers.
- Complete all identified level 3 maintenance on the Warrensburg-Fort Gage #8, 34.5 kV sub-transmission line.
- Complete all identified level 3 maintenance on the Fort Gage-Queensbury #2; 34.5 kV sub-transmission line.

### 3. PORT HENRY 38551 – 13.2 kV

Profile: 1,741 Customers, 98.1 Circuit Miles  
 Indices: CAIDI = 2.94, SAIFI = 4.12

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	11	39.29%	1,855	25.86%	6,254	29.63%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	10.71%	75	1.05%	184	0.87%
6	ACCIDENTS	6	21.43%	3,463	48.29%	12,995	61.56%
7	PREARRANGED	1	3.57%	1,720	23.98%	1,433	6.79%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	3.57%	2	0.03%	8	0.04%
10	UNKNOWN	6	21.43%	57	0.79%	235	1.11%
Totals		28	100.00%	7,172	100.00%	21,109	100.00%

**Problem Analysis:**

- There were 28 interruptions on the Port Henry 38551 in 2018.
- There were 3 transmission interruptions.
- The three transmission interruptions on the Port Henry 38551 in 2018 were the result of Osprey activity on the Ticonderoga-Whitehall #3, 115 kV transmission line. These three events combined, interrupted 5,154 customers (72%) and accounted for 14,318 customer hours of interruption (68%).
  - The first event occurred on May 26th when part of an Osprey nest fell causing an interruption on the Ticonderoga-Whitehall #3, 115 kV transmission line for 7 hours and 23 minutes while the problem was located and repaired.
  - The second Osprey event occurred on June 13th and was momentary in nature, but for the transmission system to cycle through the necessary operations to be assured that the fault was gone, 8 minutes past before service was restored to the Port Henry station.
  - The third Osprey related event was a planned interruption on June 14th to remove an inactive Osprey nest at structure 320 which was completed in 50 minutes.
- There were no substation interruptions.
- The remaining 25 events occurred at the distribution level.
- The distribution circuit breaker for the Port Henry 38551 experienced 8 momentary operations in 2018.
- The 25 interruptions on the Port Henry 38551 in 2018 attributed to the distribution system, interrupted 2,018 customers (28%) and accounted for 6,791 customer-hours interrupted (32%), for a distribution SAIFI of 1.16 and CAIDI of 3.37.

- The distribution circuit breaker for the Port Henry 38551 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 88% of the total customers interrupted due to events on the distribution feeder (1,776 out of 2,018) and 82% of the total amount of the customer-hours interrupted (5,590 out of 6,791).
  - This lockout occurred on September 3, 2018 when a tree fell less than one mile from the substation.
  - No other interruption on the Port Henry 38551 distribution feeder impacted more than 69 customers or accounted for more than 273 customer-hours of interruption.
- This distribution feeder lockout when combined with the three Osprey related interruptions on the 115 kV transmission system accounted for only 14% of the 28 total interruptions experienced on the Port Henry 38551 in 2018, but they affected 6,930 customers (97%) and accounted for 19,908 customer-hours interrupted (94%).
- Seventeen of the 28 interruptions (61%) experienced on the Port Henry 38551 in 2018 affected ten or fewer customers, and three of those affected only one customer.

**Actions Taken:**

- There are four 3-phase reclosers and one single-phase recloser on the Port Henry 38551. Two of the 3-phase reclosers were installed in 2006, the third 3-phase recloser and the single-phase recloser were installed in 2012 as part of the Westport conversion project. The fourth 3-phase recloser was installed in 2018 due to a recloser failure and as part of the Wadham's Hydro recloser upgrade project.
- Three TripSaver, cut-out mounted single phase reclosers were installed on the Port Henry 38551 in early 2019.
- A major project was completed on the Port Henry 38551 in 2012 to rebuild the 3-phase backbone within the Town of Westport, to allow the conversion from 4.8 kV to 13.2 kV, and to provide better voltage performance and fuse coordination throughout the feeder, at a total cost in excess of \$1,600,000.
- A capital improvement project was completed in 2014, at a cost of approximately \$239,000, to construct new 3-phase distribution along State Highway 9N between poles 148 and 158, to allow the retirement of approximately 2,000 feet of rear lot distribution.
- A capital improvement project was completed in 2017, at a cost of about \$356,250, to construct new 3-phase distribution along State Highway 9N between poles 195 and 205 and single phase along Napper Road, to allow the retirement of approximately 1,956 feet of 3-phase rear lot distribution and another 1,473 feet of rear lot single phase distribution.
- A maintenance foot patrol was performed on the Port Henry 38551 in 2017 and all identified level 1 and 2 maintenance has been completed.
- Tree trimming and a hazard tree review, which removed 732 hazard trees and another 191 Ash trees infested with the Emerald Ash Borer, was completed on the Port Henry 38551 in FY2018.
- A maintenance foot patrol of the Ticonderoga-Whitehall #3, 115 kV transmission line was completed in 2015 and all identified maintenance has been completed.
- A maintenance foot patrol of the Ticonderoga-Republic #2, 115 kV transmission line was completed in 2018 and no level 1 or 2 maintenance items were identified.
- Integrated Vegetation Management was completed on the Ticonderoga-Whitehall #3; 115 kV transmission line in FY2018.

**Action Plan:**

- Complete all identified level 3 maintenance on the Port Henry 38551.
- Generators will be installed to serve the customers on the Port Henry 38551 in the spring of 2019 to allow for critical repairs to be made to the Ticonderoga-Republic #2 and Ticonderoga-Whitehall #3, 115 kV transmission lines as well as the relocation of multiple Osprey nests.
- A capital improvement project is scheduled for FY2020 to construct approximately 2,500 feet of new single phase 4.8 kV distribution along State Highway 9N, near the intersection of Sam Spear Road, to allow the retirement of a similar amount of rear lot distribution.
- A capital improvement project is under construction and will be completed by the summer of 2019 to replace all three 3-phase line reclosers between the Port Henry substation and the River Rat Hydroelectric plant in Wadhams, to better protect the distribution system from faults at the hydroelectric facility and protect against islanding. A new PCC recloser will also be installed at the River Rat Hydroelectric facility.
- A capital improvement project to rebuild and convert the Hamlet of Port Henry from 4.8 kV to 13.2 kV is budgeted for FY2022.
- A capital improvement project to rebuild and convert Broad Street in Port Henry from 4.8 kV to 13.2 kV to create a 13.2 kV feeder tie with the Port Henry 38552 feeder is budgeted for FY2023.
- Complete all identified level 3 maintenance on the Ticonderoga-Republic #2; 115 kV transmission line.
- Integrated Vegetation Management is scheduled on the Ticonderoga-Republic #2; 115 kV transmission line in FY2020.

#### 4. VAIL MILLS 39253 – 13.2 kV

Profile: 3,091 Customers, 82.1 Circuit Miles  
 Indices: CAIDI = 3.33, SAIFI = 2.67

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	20	32.79%	3,492	42.27%	13,523	49.15%
3	OVERLOADS	3	4.92%	349	4.22%	631	2.29%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	12	19.67%	1,582	19.15%	6,025	21.90%
6	ACCIDENTS	12	19.67%	2,061	24.95%	4,905	17.83%
7	PREARRANGED	1	1.64%	28	0.34%	35	0.13%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	1.64%	318	3.85%	1,367	4.97%
10	UNKNOWN	12	19.67%	432	5.23%	1,029	3.74%
Totals		61	100.00%	8,262	100.00%	27,516	100.00%

**Problem Analysis:**

- There were 61 interruptions on the Vail Mills 39253 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 61 events occurred at the distribution level.
- The distribution circuit breaker for the Vail Mills 39253 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the Vail Mills 39253 experienced 0 sustained operations (lockouts) in 2018.
- There were two interruptions on the Vail Mills 39253 that involved 3-phase mainline but were not associated with the circuit breaker. The isolating devices were all pole-top reclosers. These interruptions accounted for 44% of the total amount of customers interrupted (3,676 of 8,262) and 24% of the total amount of the customer-hours interrupted (6,716 of 27,516).
  - The first interruption occurred on November 1, 2018 as a result of a motor vehicle accident at pole 129 County Highway 110. The recloser at pole 4 County Highway 110 locked open as a result. This interruption accounted for 22% of the total amount of customers interrupted (1,851 of 8,262) and 16% of the total amount of the customer-hours interrupted (4,359 of 27,516).
  - The second interruption occurred on December 31, 2018 as a result of trees falling across primary wire at pole 159 County Highway 110. The recloser at pole 4 County Highway 110 locked open as a result. This interruption accounted for 22% of the total amount of customers interrupted (1,825 of 8,262) and 9% of the total amount of the customer-hours interrupted (2,357 of 27,516)

- Trees were the leading cause of interruptions on the Vail Mills 39253 in 2018, accounting for 33% of total interruptions (20 of 61). Equipment Failures were the 2nd leading cause of interruptions, accounting for 20% of total interruptions (12 of 61). Accidents were the 3rd leading cause of interruptions, accounting for 20% of total interruptions (12 of 61).
- Trees were the leading cause of customers interrupted (CI) on the Vail Mills 39253 in 2018, accounting for 42% of total customers interrupted (3,492 of 8,262). Accidents were the 2nd leading cause of customers interrupted, accounting for 25% of total customers interrupted (2,061 of 8,262). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 19% of total customers interrupted (1,582 of 8,262).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Vail Mills 39253 in 2018, accounting for 49% of total customer-hours interrupted (13,523 of 27,516). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 22% of total customer-hours interrupted (6,025 of 27,516). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 18% of total customer-hours interrupted (4,905 of 27,516).
- Of the 61 interruptions on this circuit, 27 affected 10 customers or less, with 10 being single customer outages.

**Actions Taken:**

- There are five 3-phase reclosers on the Vail Mills 39253, including one Loop Scheme Recloser tied to the Mayfield 35651 feeder. These reclosers have proven to be beneficial to the reliability of the feeder since two of the mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These reclosers have minimized the customer interruptions and customer-hour interruptions over the past year for the Vail Mills 39253.
- A maintenance foot patrol of the Vail Mills 39253 was completed in 2017 and all identified level 1 and level 2 maintenance have been completed.
- Tree trimming of the Vail Mills 39253 feeder was completed in FY2014.

**Action Plan:**

- An Engineering Reliability Review (ERR) on the Vail Mills 39253 is scheduled for FY2020.
- Complete all identified level 3 maintenance on the Vail Mills 39253 feeder.
- In 2019 one of the radial 3-phase reclosers on the Vail Mills 39253 will be replaced with a loop scheme sectionalizing recloser and a loop scheme tie recloser will be installed between the Vail Mills 39253 and the Northville 33252 to automatically transfer about 790 customers from the Vail Mills 39253 to the Northville 33252 should either of two upstream 3-phase reclosers or the station breaker lock out.
- Tree trimming for the Vail Mills 39253 is scheduled for completion in FY2020.

## 5. BURGOYNE 33751 – 13.2 kV

Profile: 1,813 Customers, 139.4 Circuit Miles  
 Indices: CAIDI = 2.10, SAIFI = 3.53

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	16	30.77%	2,288	35.77%	3,717	27.70%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	16	30.77%	1,719	26.87%	1,647	12.28%
6	ACCIDENTS	9	17.31%	1,672	26.14%	6,636	49.45%
7	PREARRANGED	4	7.69%	450	7.03%	457	3.41%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	7	13.46%	268	4.19%	961	7.16%
Totals		52	100.00%	6,397	100.00%	13,418	100.00%

### Problem Analysis:

- There were 52 interruptions on the Burgoyne 33751 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - The substation interruption was the result of animal contact inside the Burgoyne substation which interrupted 1,586 customers (25%) and accounted for 6,344 customer-hours of interruption (47%).
- The remaining 51 events occurred at the distribution level.
- The distribution circuit breaker for the Burgoyne 33751 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Burgoyne 33751 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 29% of the total amount of customers interrupted (1,845 out of 6,397) and 11% of the total amount of the customer-hours interrupted (1,476 out of 13,418).
  - This lockout occurred on September 14, 2018 when a tree came down and broke pole 52 ½ on Lower Maple Street. Fortunately, the customers on the feeder were able to be switched to adjacent feeders within 48 minutes restoring service while the pole was replaced.
- Trees were tied with Equipment for the leading cause of interruptions on the Burgoyne 33751 in 2018, accounting for 31% of total interruptions (16 of 52). Other than the tree event which locked out the station breaker listed above, no other tree event affected more than 60 customers (1%) or accounted for more than 452 customer-hours of interruption (3%).

- The largest interruption due to an Equipment Failure on the Burgoyne 33751 in 2018 occurred on June 28, 2018 when a cross arm broke on Yole Dr. affecting 1,649 customers (26%) and accounting for 1,408 customer-hours of interruption (10%).
- The substation interruption when combined with the distribution feeder lockout and the broken crossarm accounted for only 6% of the 52 total interruptions experienced on the Burgoyne 33751 in 2018, but they affected 5,080 customers (79%) and accounted for 9,228 customer-hours interrupted (69%).
- Twenty-eight of the 52 interruptions (54%) experienced on the Burgoyne 33751 in 2018 affected 10 or fewer customers, and eleven of those affected only one customer.

**Actions Taken:**

- There are two 3-phase reclosers on the Burgoyne 33751, both of which were installed in 1997, but one of which was replaced in 2018.
- The 115/13.2 kV Burgoyne substation transformer which was beginning to accumulate damaging gases was replaced in 2017 at a cost in excess of \$1.7M.
- A project was completed in 2015 to replace an overloaded single-phase ratio transformer on West Road at a cost of about \$33,000.
- A project was completed in 2015 to replace a failed 3-phase bank of voltage regulators on State Highway 197 at a cost of about \$61,000.
- A project was completed in 2018 at a cost of \$163,954 to construct 4.8 kV distribution on County Highway 46 and North Ridge Road near West Road to allow removal of heavily treed, inaccessible, rear lot 4.8 kV distribution.
- A project was completed in 2018 at a cost of \$70,216 to construct about 2,600 feet of new 7.62 kV distribution on County Highway 41 east of Hartman Road to allow removal of about 4,910 feet of heavily treed, inaccessible, rear lot 7.62 kV distribution.
- A project was completed in 2018 at a cost of \$45,923 to close a 625 foot single-phase distribution gap on West Valley Road to allow the 9 mile long West Road single-phase tap to be split into 2 smaller single-phase taps and to reduce the load on the overloaded 7.62/4.8 kV ratio transformer serving the West Road tap.
- A maintenance foot patrol was completed on the Burgoyne 33751 in 2016 and all level 1 and 2 maintenance has been completed.
- Tree trimming and a hazard tree review, which removed 187 hazard trees and another 64 Ash trees infested with the Emerald Ash Borer, was completed on the Burgoyne 33751 was completed in FY2019.

**Action Plan:**

- Complete all identified level 3 maintenance on the Burgoyne 33751.
- An animal fence will be installed around the energized equipment within the Burgoyne substation in 2019.
- A project is currently under construction to rebuild 7,400 feet of State Highway 197 between poles 100 and 137 as necessary to convert to 13.2 kV and create a feeder tie with the Butler 36253 which could be automated with loop scheme reclosers.
- Three TripSaver, cut-out mounted single phase reclosers are scheduled to be installed on the Burgoyne 33751 in 2019.
- A new 3-phase, G&W line recloser is scheduled to be installed on Brennan Road in 2019.
- A project is scheduled for FY2020 to construct 1,400 feet of single-phase distribution on Safford Road to allow the transfer of 1.7 miles of single-phase distribution with 64 customers from the Burgoyne 33751 to the Burgoyne 33752 feeder, to address the overloaded Coach Road ratio transformer.



- A project is currently in Design for FY2020 construction to construct about 1,400 feet of new single phase, 4.8 kV distribution on Lick Springs Road near State Hwy. 40 to allow the removal of a similar amount of rear lot distribution.
- A small capital improvement project is scheduled for FY2021 to extend 3-phase on State Highway 40 approximately three sections beyond McEachron Hill Road to allow the balance of State Highway 40 and McEachron Hill Road to be served from separate 7.62/4.8 kV ratio transformers.
- A capital improvement project is scheduled for FY2020 to rebuild approximately 1 mile of Durkeetown Road between State Highway 197 and County Highway 46 to 3-phase, 13.2 kV to provide better balance on the entire feeder and better voltage downstream of Durkeetown Road.

## 6. GILMANTOWN 15451 – 13.2 kV

*Profile:* 2,042 Customers, 78.8 Circuit Miles  
*Indices:* CAIDI = 3.13, SAIFI = 3.02

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	20	62.50%	3,677	59.58%	15,227	78.79%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	2	6.25%	50	0.81%	354	1.83%
6	ACCIDENTS	2	6.25%	380	6.16%	1,550	8.02%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	8	25.00%	2,065	33.46%	2,197	11.37%
Totals		32	100.00%	6,172	100.00%	19,328	100.00%

### Problem Analysis:

- There were 32 interruptions on the Gilmantown 15451 in 2018.
- There was 1 transmission interruption.
  - This interruption occurred on October 12, 2018 due to an unknown cause. The Northville-Wells #1 line was patrolled and now cause was found. This interruption accounted for 33% of the total amount of customers interrupted (2,050 of 6,172) and 11% of the total amount of the customer-hours interrupted (2,118 of 19,328).
- There were no substation interruptions.
- The remaining 31 events occurred at the distribution level.
- The distribution circuit breaker for the Gilmantown 15451 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Gilmantown 15451 experienced 0 sustained operations (lockouts) in 2018.
- There were three interruptions on the Gilmantown 15451 that involved 3-phase mainline but were not associated with the circuit breaker. The isolating devices were all pole-top reclosers. These interruptions accounted for 49% of the total amount of customers interrupted (3,018 of 6,172) and 65% of the total amount of the customer-hours interrupted (12,509 of 19,328).
  - The first interruption occurred on October 18, 2018 as a result of trees falling across primary wire. The recloser at pole 256 County Highway 8 locked open as a result. This interruption accounted for 6% of the total amount of customers interrupted (361 of 6,172) and 12% of the total amount of the customer-hours interrupted (2,268 of 19,328).

- The second interruption occurred on December 3, 2018 as a result of trees falling across primary wire. The recloser at pole 120 State Highway 8 locked open as a result. This interruption accounted for 17% of the total amount of customers interrupted (1,037 of 6,172) and 9% of the total amount of the customer-hours interrupted (1,694 of 19,328).
- The third interruption occurred on December 18, 2018 as a result of trees falling across primary wire. The recloser at pole 147 County Highway 11 locked open. Crews isolated the outage, recovering 94% of the customers before repairing the infrastructure. This interruption accounted for 26% of the total amount of customers interrupted (1,620 of 6,172) and 44% of the total amount of the customer-hours interrupted (8,547 of 19,328).
- Trees were the leading cause of interruptions on the Gilmantown 15451 in 2018, accounting for 63% of total interruptions (20 of 32). Unknown were the 2nd leading cause of interruptions, accounting for 25% of total interruptions (8 of 32). Equipment Failures were the 3rd leading cause of interruptions, accounting for 6% of total interruptions (2 of 32).
- Trees were the leading cause of customers interrupted (CI) on the Gilmantown 15451 in 2018, accounting for 60% of total customers interrupted (3,677 of 6,172). Unknown were the 2nd leading cause of customers interrupted, accounting for 33% of total customers interrupted (2,065 of 6,172). Accidents were the 3rd leading cause of customers interrupted, accounting for 6% of total customers interrupted (380 of 6,172).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Gilmantown 15451 in 2018, accounting for 79% of total customer-hours interrupted (15,227 of 19,328). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 11% of total customer-hours interrupted (2,197 of 19,328). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (1,550 of 19,328).
- Of the 32 interruptions on this circuit, 17 affected 10 customers or less, with 8 being single customer outages.

**Actions Taken:**

- Following a detailed investigation into the cause of the multiple outages on the 23 kV sub-transmission lines that feed Gilmantown, Wells, and Charley Lake Substations, a large capital improvement project was completed in October 2015 to replace 198 of the horizontal post insulators on 66 light angle structures on the Northville-Wells #1 and the Wells-Gilmantown #2, 23 kV sub-transmission lines.
- There are seven 3-phase reclosers on the Gilmantown 15451. The reclosers have proven to be beneficial to the reliability of the feeder as three of the 3-phase mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These recloser have minimized customers interrupted and customer hours interrupted over the past year for the Gilmantown Road 15451.
- A 23 kV sectionalizer was placed in service on the Wells-Gilmantown #2, 23kV sub-transmission line just outside of the Wells Substation.
- The existing Cooper Type VWE 3-phase recloser on pole 147 County Highway 11 was replaced with a radial G&W recloser with integrated potential transformers and Schweitzer control. This will allow for remote control of the recloser and remote access to recloser data.

- The existing Cooper Type VWE 3-phase recloser on pole 204 State Route 8 was replaced with a radial G&W recloser with integrated potential transformers and Schweitzer control. This will allow for remote control of the recloser and remote access to recloser data.
- Tree trimming, and a hazard tree review were completed on the Gilmantown 15451 in FY2015.
- A maintenance foot patrol (I&M inspection) was performed on the Gilmantown 15451 in 2018.

**Action Plan:**

- A project to continue replacing all 1995 era Lapp insulators on the Northville-Wells #1 and the Wells-Gilmantown #2, 23kV transmission lines is scheduled to begin in 2019. These insulators have been substantially cracking in the first skirt from the steel connection, ultimately leading to its failure. Approximately 436 Lapp insulators on 146 structures have been identified.
- A project is in place to replace the high side fuse at the Gilmantown Station with a recloser with both distribution overcurrent protection and the transmission ground fault overvoltage protection (3V0) capabilities.
- A project is in place to install Tripsavers in six locations across the Gilmantown 15451 where the ability to reclose due to temporary faults has been found necessary, but the need for a recloser is not warranted.
- The Northville-Mayfield #8, 69kV transmission line is inspected aurally once a year to look for mid-cycle danger trees.
- Complete all identified level 3 maintenance on the Gilmantown 15451 feeder by April 2021.
- Monitor results of vegetation work from FY2016 on the Gilmantown 15451 in 2019.

## 7. BOLTON 28451 – 13.2 kV

Profile: 2,034 Customers, 58.9 Circuit Miles  
 Indices: CAIDI = 3.22, SAIFI = 2.70

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	19	51.35%	4,732	86.05%	16,480	92.96%
3	OVERLOADS	1	2.70%	4	0.07%	34	0.19%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	16.22%	363	6.60%	365	2.06%
6	ACCIDENTS	4	10.81%	192	3.49%	406	2.29%
7	PREARRANGED	1	2.70%	20	0.36%	36	0.20%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	6	16.22%	188	3.42%	408	2.30%
Totals		37	100.00%	5,499	100.00%	17,729	100.00%

### Problem Analysis:

- There were 37 interruptions on the Bolton 28451 in 2018.
- There was 1 transmission interruption.
  - The transmission interruption impacting the Bolton 28451 in 2018 occurred on October 12, 2018 when a tree fell at structure 710 on the Warrensburg-Fort Gage #8, 34.5 kV sub-transmission line. This event interrupted 2,104 customers (38%) and accounted for 5,646 customer hours of interruption (32%).
- There were no substation interruptions.
- The remaining 36 events occurred at the distribution level.
- The distribution circuit breaker for the Bolton 28451 experienced 1 momentary operation in 2018.
- The 36 interruptions on the Bolton 28451 in 2018 attributed to the distribution system, interrupted 3,395 customers (62%) and accounted for 12,084 customer-hours interrupted (68%), for a distribution SAIFI of 1.67 and CAIDI of 3.56.
- The distribution circuit breaker for the Bolton 28451 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 39% of the total amount of customers interrupted (2,124 out of 5,499) and 45% of the total amount of the customer-hours interrupted (7,977 out of 17,729).
  - This lockout occurred on July 25, 2018 when a tree fell between poles 297 and 298 on State Highway 9N. Customers were returned to service incrementally as repairs were made with outage durations ranging between 38 minutes and 5 hours.
- This distribution feeder lockout when combined with the tree event on the Warrensburg-Fort Gage #8, 34.5 kV sub-transmission line accounted for only 5% of the 37 total interruptions experienced on the Bolton 28451 in 2018, but they affected 4,228 customers (77%) and accounted for 13,623 customer-hours interrupted (77%).

- While trees were the largest cause of interruptions, customers interrupted, and customer-hours of interruption on the Bolton 28451 in 2018, the largest tree related interruption other than the two previously mentioned events which impacted the sub-transmission system and caused the station breaker to lock out, affected only 173 customers (3%) and accounted for only 297 customer-hours of interruption (2%).
- Twenty-four of the 37 interruptions (65%) experienced on the Bolton 28451 in 2018 affected ten or fewer customers, and six of those affected only one customer.

**Actions Taken:**

- There is one 3-phase recloser, three single-phase reclosers and two TripSaver, cut-out mounted single phase reclosers on the Bolton 28451. The 3-phase recloser was originally installed in 2000, but the recloser controller was replaced in 2008. Two of the single phase reclosers were installed in 2000 and the third was installed in 2011. Both TripSaver, cut-out mounted single phase reclosers were installed in 2015.
- The Bolton 28451 was reconfigured in late 2016, transferring the 7.25 miles of distribution and 159 customers on Stone Schoolhouse and Flat Rock Roads from the Bolton 28451 to the Birch Avenue 32252.
- A voltage study was performed on the Bolton 28451 in 2013. Voltage regulators and capacitors were added to the feeder, and the feeder was better balanced to improve the voltage performance.
- A capital project to construct a single phase feeder tie between the Bolton 28451 and Bolton 28452 by converting Potter Hill Road to 13.2 kV was completed in 2015 at a cost of \$256,244.
- A distribution automation project was placed in service in 2014 on the Fort Gage-Queensbury #2, Warrensburg-Fort Gage #8, and Warrensburg-Queensbury #9, 34.5 kV sub-transmission lines to automatically sectionalize the 34.5 kV system to isolate faults while maintaining service to as many of the substations served from this system as possible, including the Bolton substation which is served from a tap off the Warrensburg-Fort Gage #8 line.
- Tree trimming and a hazard tree review, which removed 418 danger trees and 51 trees infested with the Emerald Ash Borer, was completed on the Bolton 28451 in FY18.
- A maintenance foot patrol of the Bolton 28451 was completed in 2016 and all level 1 and 2 maintenance has been completed.
- A maintenance foot patrol of the Fort Gage-Queensbury #2, 34.5 kV sub-transmission line was completed in 2016 and all level 1 and 2 maintenance has been completed.
- A maintenance foot patrol of the Warrensburg-Fort Gage #8, 34.5 kV sub-transmission line was completed in 2017 and all level 1 and 2 maintenance has been completed.
- Integrated Vegetation Management was completed on the Fort Gage-Queensbury #2, Warrensburg-Fort Gage #8, and the Warrensburg-Queensbury #9, 34.5 kV sub-transmission lines in FY2019.

**Action Plan:**

- Complete all identified level 3 maintenance on the Bolton 28451.
- A project began construction in February 2019 to construct a 13.2 kV, 3-phase feeder tie between the Bolton 28451 and the Warrensburg 32151 on Diamond Point – Bakers Road which will eventually be automated by the use of loop scheme reclosers.
- The Bolton 28451 will be reconfigured in the spring of 2019 to transfer about 165 customers and 3.18 MVA of connected load from the Bolton 28451 to the Birch Avenue 32252 to reduce the load on the Bolton substation.

- A project is budgeted for FY21 to rebuild Trout Lake Road from U.S. Highway 9 to Coolidge Hill Road to 3-phase and convert to 13.2 kV, which will create a 3-phase feeder tie between the Bolton 28451 and Bolton 28452 feeders and transfer approximately 16 miles of distribution and 440 customers from the Bolton 28451 feeder to the much smaller Bolton 28452 feeder.
- Complete all identified level 3 maintenance on the Warrensburg-Fort Gage #8, 34.5 kV sub-transmission line.
- Complete all identified level 3 maintenance on the Fort Gage-Queensbury #2, 34.5 kV sub-transmission line.

## 8. HAGUE ROAD 41852 – 13.2 kV

Profile: 1,724 Customers, 81.9 Circuit Miles  
 Indices: CAIDI = 2.69, SAIFI = 3.50

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	10	40.00%	262	4.35%	1,146	7.07%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	24.00%	612	10.15%	713	4.40%
6	ACCIDENTS	2	8.00%	3,414	56.63%	12,831	79.15%
7	PREARRANGED	3	12.00%	1,720	28.53%	1,449	8.94%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	4.00%	7	0.12%	23	0.14%
10	UNKNOWN	3	12.00%	14	0.23%	49	0.30%
Totals		25	100.00%	6,029	100.00%	16,211	100.00%

### Problem Analysis:

- There were 25 interruptions on the Hague Road 41852 in 2018.
- There were 3 transmission interruptions.
- The three transmission interruptions on the Hague Road 41852 in 2018 were the result of Osprey activity on the Ticonderoga-Whitehall #3, 115 kV transmission line. These three events combined, interrupted 5,121 customers (85%) and accounted for 14,253 customer hours of interruption (88%).
  - The first event occurred on May 26th when part of an Osprey nest fell causing an interruption on the Ticonderoga-Whitehall #3, 115 kV transmission line for 7 hours and 23 minutes while the problem was located and repaired.
  - The second Osprey event occurred on June 13th and was momentary in nature, but for the transmission system to cycle through the necessary operations to be assured that the fault was gone, 8 minutes past before service was restored to the Hague Road station.
  - The third Osprey related event was a planned interruption on June 14th to remove an inactive Osprey nest at structure 320 which was completed in 50 minutes.
- There were no substation interruptions.
- The remaining 22 events occurred at the distribution level.
- The distribution circuit breaker for the Hague Road 41852 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Hague Road 41852 experienced 0 sustained operations (lockouts) in 2018.
- The 22 interruptions on the Hague Road 41852 in 2018 attributed to the distribution system, interrupted 908 customers (15%) and accounted for 1,958 customer-hours interrupted (12%), for a distribution SAIFI of 0.53 and CAIDI of 2.16.



- The largest interruption on the Hague Road 41852 distribution feeder occurred on May 10, 2018 when a device failed causing the 3-phase line recloser on pole 1, Burgoyne Road to lockout interrupting 583 customers (10%) and accounted for 544 customer-hours of interruption (3%).
- This distribution interruption when combined with the three Osprey related interruptions on the 115 kV transmission system accounted for only 16% of the 25 total interruptions experienced on the Hague Road 41852 in 2018, but they affected 5,704 customers (95%) and accounted for 14,797 customer-hours interrupted (91%).
- Fourteen of the 25 interruptions (56%) experienced on the Hague Road 41852 in 2018 affected ten or fewer customers, and three of those affected only one customer.

**Actions Taken:**

- There are three 3-phase reclosers on the Hague Road 41852. One of the 3-phase reclosers was installed in 1996 while the remaining two were installed in 2015 and 2016.
- A maintenance foot patrol was performed on the Hague Road 41852 in 2017 and all identified level 1 and 2 maintenance has been completed.
- Tree trimming and a hazard tree review, which removed 193 hazard trees and another 159 Ash trees infested with the Emerald Ash Borer, was completed on the Hague Road 41852 in FY2019.
- A maintenance foot patrol of the Ticonderoga-Whitehall #3, 115 kV transmission line was completed in 2015 and all identified maintenance has been completed.
- A maintenance foot patrol of the Ticonderoga-Republic #2, 115 kV transmission line was completed in 2018 and no level 1 or 2 maintenance items were identified.
- Integrated Vegetation Management was completed on the Ticonderoga-Whitehall #3, 115 kV transmission line in FY2018.

**Action Plan:**

- Complete all identified level 3 maintenance on the Hague Road 41852.
- Generators will be installed to serve the customers on the Hague Road 41852 in the spring of 2019 to allow for critical repairs to be made to the Ticonderoga-Republic #2 and Ticonderoga-Whitehall #3, 115 kV transmission lines as well as the relocation of multiple Osprey nests.
- A capital improvement project to replace the submarine cable which traverses Lake George at Friends Point is budgeted for FY2021.
- A capital improvement project to rebuild and convert the east side of Lake George from 4.8 kV to 13.2 kV to create a feeder tie to the Hague Road 41853 is budgeted for FY2021.
- Complete all identified level 3 maintenance on the Ticonderoga-Republic #2, 115 kV transmission line.
- Integrated Vegetation Management is scheduled on the Ticonderoga-Republic #2, 115 kV transmission line in FY2020.

## 9. WILTON 32952 - 13.2 kV

Profile: 1,575 Customers, 66.7 Circuit Miles  
 Indices: CAIDI = 1.66, SAIFI = 4.86

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	8	34.78%	1,312	17.14%	5,796	45.73%
3	OVERLOADS	1	4.35%	2	0.03%	6	0.05%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	7	30.43%	6,272	81.94%	6,600	52.08%
6	ACCIDENTS	2	8.70%	43	0.56%	148	1.17%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	5	21.74%	25	0.33%	124	0.98%
Totals		23	100.00%	7,654	100.00%	12,674	100.00%

### Problem Analysis:

- There were 23 interruptions on the Wilton 32952 in 2018.
- There were 3 transmission interruptions.
  - The three transmission interruptions on the Wilton 32952 in 2018 were all the result of insulator failures. The first occurred on January 1st, the second on February 12th and the third on July 16th. Several insulators on this line are known to be structurally deficient and are planned for replacement as part of an insulator replacement program scheduled for construction in FY2021. These three transmission related interruptions, combined, accounted for only 13% of the interruptions on the Wilton 32952 in 2018, but they accounted for 61% of the customers interrupted (4,682 of 7,654) and 38% of the customer-hours of interruption (4,771 of 12,674).
- There were no substation interruptions.
- The remaining 20 events occurred at the distribution level.
- The distribution circuit breaker for the Wilton 32952 experienced 1 momentary operation in 2018.
- The 20 interruptions on the Wilton 32952 in 2018 attributed to the distribution system interrupted 2,972 customers (39%) and accounted for 7,903 customer-hours interrupted (62%), for a distribution SAIFI of 1.89 and CAIDI of 2.66.
- The distribution circuit breaker for the Wilton 32952 experienced 1 sustained operation (lockout) in 2018. This lockout occurred on June 30, 2018 when a transformer failed causing the Wilton R520 station breaker to lock out. This lockout accounted for 21% of the total customers interrupted (1,582 of 7,654), and 14% of the total customer-hours interrupted (1,768 of 12,674).

- This distribution feeder lockout when combined with the three interruptions on the 34.5 kV sub-transmission system accounted for only 17% of the 23 total interruptions experienced on the Wilton 32952 in 2018, but they affected 6,264 customers (82%) and accounted for 6,539 customer-hours interrupted (52%).
- Trees were the leading cause of interruptions on the Wilton 32952 in 2018, accounting for 35% of the interruptions, 17% of the customers interrupted and 46% of the customer-hours interruption. The largest of these tree related interruptions, in terms of customers interrupted, occurred on March 8, 2018 when a tree limb fell across the phases, blowing a set of fuses at pole 12 on Ganesvoort Road impacting 347 customers (5%) and accounting for 719 customer-hours of interruption (6%).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Wilton 32952 in 2018. Of the seven Equipment Failure related interruptions, four are attributed to the distribution system while the remaining three transmission related interruptions are listed above. The largest distribution interruption was the station breaker lock out listed above. These four major interruptions, when combined, impacted 6,264 customers (82%) accounting for 6,539 customer-hours of interruption (52%).
- Thirteen of the 23 interruptions (57%) experienced on the Wilton 32952 in 2018 affected 14 or fewer customers, and five of those affected only one or two customers.

**Actions Taken:**

- There are two 3-phase reclosers and one TripSaver, cut-out mounted single phase recloser on the Wilton 32952. The 3-phase reclosers were installed in 2007 and both had setting changes in 2014 to better coordinate with the new station breakers installed at that time. The cut-out mounted recloser was installed in 2017, requiring another setting change to the 3-phase recloser upstream.
- A project was completed in 2012 at a cost of \$22,368 to address an overloaded single-phase ratio transformer on U.S. Highway 9 by installing a second single phase ratio transformer on Washburn Road and reconfiguring the feeder to split the load between the two ratio transformers.
- A capital project was completed on the Wilton 32952 in 2013 at a cost of \$917,484 to rebuild approximately 7,600 feet of U.S. Highway 9 to 3-phase, 13.2 kV and another 5,200 feet to single phase, 7.62 kV to address major voltage issues along U.S. Highway 9, as the load in that area continued to grow beyond the capabilities of the distribution system.
- The 10/12.5 MVA, 34.5/13.2 kV substation transformer in the Wilton substation failed in early 2015 and was replaced with a new 12/16/20 MVA, 34.5/13.2 kV substation transformer. In addition, a 34.5 kV line recloser was installed on the source side of the new station transformer to replace the fuses which were used to protect the old transformer. The new substation transformer and recloser were placed in service in December of 2015.
- A maintenance foot patrol was completed on the Wilton 32952 in 2017 and all level 1 and 2 maintenance has been completed.
- Tree trimming and a hazard tree review which removed 137 danger trees was completed on the Wilton 32952 in FY2016.

**Action Plan:**

- Complete all identified level 3 maintenance on the Wilton 32952.
- Tree trimming and a hazard tree review are scheduled for the Wilton 32952 in FY2022.
- A capital improvement project is under construction and scheduled for completion in the spring of 2019 to construct a new feeder out of the Butler substation which will allow the 10.1 mile Fortsville Road tap, and the 204 customers it serves, to be transferred from the Wilton 32952 feeder to the Butler 36251.
- EMS is scheduled to be installed in the Wilton substation in FY2020.
- A capital improvement project is budgeted for FY2022 to rebuild approximately 1.7 miles of State Highway 32 to relieve a soon-to-be overloaded single phase ratio transformer and create a feeder tie to the Wilton 32951 at the far east end of both feeders.
- A capital improvement project is planned for construction in FY2021 to replace vintage vertical post insulators on four 34.5kV sub-transmission circuits, including the Spier-Brook Road #3, 34.5 kV sub-transmission line.
- A capital improvement project is planned for FY2021 to install an automation scheme on the sub-transmission lines that serve Wilton. This scheme will enable automatic fault detection, sectionalizing and restoration of the Wilton substation following interruptions on the sub-transmission lines.

## 10. OTTEN 41213 – 4.8 kV

Profile: 542 Customers, 36.5 Circuit Miles  
 Indices: CAIDI = 3.37, SAIFI = 5.70

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	10	47.62%	599	19.39%	3,214	30.92%
3	OVERLOADS	1	4.76%	301	9.74%	1,969	18.94%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	14.29%	178	5.76%	221	2.12%
6	ACCIDENTS	4	19.05%	1,429	46.26%	4,402	42.34%
7	PREARRANGED	1	4.76%	551	17.84%	459	4.42%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	2	9.52%	31	1.00%	132	1.27%
Totals		21	100.00%	3,089	100.00%	10,397	100.00%

### Problem Analysis:

- There were 21 interruptions on the Otten 41213 in 2018.
- There were 3 transmission interruptions.
- The three transmission interruptions on the Otten 41213 in 2018 were the result of Osprey activity on the Ticonderoga-Whitehall #3, 115 kV transmission line. These three events combined, interrupted 1,823 customers (59%) and accounted for 4,781 customer hours of interruption (46%).
  - The first event occurred on May 26th when part of an Osprey nest fell causing an interruption on the Ticonderoga-Whitehall #3, 115 kV transmission line for 7 hours and 23 minutes while the problem was located and repaired.
  - The second Osprey event occurred on June 13th and was momentary in nature, but for the transmission system to cycle through the necessary operations to be assured that the fault was gone, 8 minutes past before service was restored to the Otten station.
  - The third Osprey related event was a planned interruption on June 14th to remove an inactive Osprey nest at structure 320 which was completed in 50 minutes.
- There were no substation interruptions.
- The remaining 18 events occurred at the distribution level.
- The distribution circuit breaker for the Otten 41213 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Otten 41213 experienced 0 sustained operations (lockouts) in 2018.
- The 18 interruptions on the Otten 41213 in 2018 attributed to the distribution system, interrupted 1,266 customers (41%) and accounted for 5,616 customer-hours interrupted (54%), for a distribution SAIFI of 2.34 and CAIDI of 4.44.

- The largest interruption on the Otten 41213 distribution feeder occurred during Memorial Day weekend when two sections of the feeder were tied together causing an overload which blew line fuses interrupting 301 customers (10%) and accounted for 1,969 customer-hours of interruption (19%).
- Trees were the number one cause of interruptions on the Otten 41213 in 2018, accounting for 10 of the 21 interruptions (48%).
  - The largest tree related interruption on the Otten 41213 distribution feeder in 2018 in term of customers interrupted occurred on January 24, 2018 when a tree fell on the primary on North Road blowing the fuses on State Highway 22 interrupting 168 customers (5%) and accounting for 283 customer-hours of interruption (3%).
  - The largest tree related interruption on the Otten 41213 distribution feeder in 2018 in term of customer-hours of interruption occurred on July 26, 2018 when a tree fell in the rear lot off Huletts Back Road blowing a set of fuses interrupting 150 customers (5%) and accounting for 700 customer-hours of interruption (7%).
- Eight of the 21 interruptions (38%) experienced on the Otten 41213 in 2018 affected ten or fewer customers, and one of those affected a single customer.

**Actions Taken:**

- A maintenance foot patrol of the Otten 41213 was performed in 2018 and all identified level 1 maintenance has been completed.
- Tree trimming and a hazard tree review, which removed 647 hazard trees and another 140 Ash trees infested with the Emerald Ash Borer, was completed on the Otten 41213 was completed in FY2018.
- A project was completed on the Otten 41213 in October of 2011 to construct distribution on Cat Den Road to allow the removal of the old cross lot feed at a cost of \$215,000.
- A project was completed on the Otten 41213 in July of 2013 to rebuild the distribution on Ottenburgh Road to allow the removal of the old cross lot feed at a cost of \$84,360.
- A maintenance foot patrol of the Ticonderoga-Whitehall #3, 115 kV transmission line was completed in 2015 and all identified maintenance has been completed.
- A maintenance foot patrol of the Ticonderoga-Republic #2, 115 kV transmission line was completed in 2018 and no level 1 or 2 maintenance items were identified.
- Integrated Vegetation Management was completed on the Ticonderoga-Whitehall #3, 115 kV transmission line in FY2018.

**Action Plan:**

- Complete all identified level 2 and 3 maintenance on the Otten 41213.
- Generators will be installed to serve the customers on the Otten 41213 in the spring of 2019 to allow for critical repairs to be made to the Ticonderoga-Republic #2 and Ticonderoga-Whitehall #3, 115 kV transmission lines as well as the relocation of multiple Osprey nests.
- A capital improvement project to rebuild the distribution along Crusher Hill Road to relocate it from the rear lot to adjacent to the road is budgeted for FY2020.
- Complete all identified level 3 maintenance on the Ticonderoga-Republic #2, 115 kV transmission line.
- Integrated Vegetation Management is scheduled on the Ticonderoga-Republic #2, 115 kV transmission line in FY2020.

## 11. MIDDLEBURG 39051 – 13.2 kV

Profile: 1,251 Customers, 110.5 Circuit Miles  
 Indices: CAIDI = 2.06, SAIFI = 3.15

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	17	38.64%	1,576	39.99%	3,631	44.75%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	4	9.09%	1,108	28.11%	658	8.11%
6	ACCIDENTS	7	15.91%	1,115	28.29%	3,464	42.70%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	3	6.82%	20	0.51%	51	0.63%
10	UNKNOWN	13	29.55%	122	3.10%	309	3.81%
Totals		44	100.00%	3,941	100.00%	8,114	100.00%

### Problem Analysis:

- There were 44 interruptions on the Middleburg 39051 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 44 events occurred at the distribution level.
- The distribution circuit breaker for the Middleburg 39051 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Middleburg 39051 experienced 0 sustained operations (lockouts) in 2018.
- There were five interruptions on the Gilmantown 15451 that involved 3-phase mainline but were not associated with the circuit breaker. The isolating devices were all pole-top reclosers. These interruptions accounted for 49% of the total amount of customers interrupted (3,018 of 6,172) and 65% of the total amount of the customer-hours interrupted (12,509 of 19,328).
  - The first interruption occurred on January 5, 2018 as a result of a motor vehicle accident at pole 210-1 State Route 30. The recloser at pole 154 State Route 30 locked open as a result. This interruption accounted for 8% of the total amount of customers interrupted (310 of 3,941) and 8% of the total amount of the customer-hours interrupted (615 of 8,114).
  - The second interruption occurred on March 12, 2018 as a result of a motor vehicle accident at pole 222 State Route 30. The recloser at pole 12 VFW Lane locked open as a result. This interruption accounted for 20% of the total amount of customers interrupted (789 of 3,941) and 34% of the total amount of the customer-hours interrupted (2,796 of 8,114).

- The third interruption occurred on August 17, 2018 as a result of trees falling and taking down primary near pole 19 Mullberry Lane. The recloser at pole 12 VFW Lane locked open as a result. This interruption accounted for 20% of the total amount of customers interrupted (794 of 3,941) and 18% of the total amount of the customer-hours interrupted (1,469 of 8,114).
- The fourth interruption occurred on September 10, 2018 as a result of device failure. A recloser at pole 12 VFW Lane failed. Crews used the bypass switch on the recloser and began repairs. This interruption accounted for 20% of the total amount of customers interrupted (796 of 3,941) and 6% of the total amount of the customer-hours interrupted (504 of 8,114).
- The fifth interruption occurred on September 26, 2018 as a result of trees falling and taking down primary between poles 40 and 41 on Mill Valley Road. The single phase hydraulic recloser at P ½ State Route 30 locked open as a result. This interruption accounted for 2% of the total amount of customers interrupted (75 of 3,941) and 2% of the total amount of the customer-hours interrupted (128 of 8,114).
- Trees were the leading cause of interruptions on the Middleburg 39051 in 2018, accounting for 39% of total interruptions (17 of 44). Unknown were the 2nd leading cause of interruptions, accounting for 30% of total interruptions (13 of 44). Accidents were the 3rd leading cause of interruptions, accounting for 16% of total interruptions (7 of 44).
- Trees were the leading cause of customers interrupted (CI) on the Middleburg 39051 in 2018, accounting for 40% of total customers interrupted (1,576 of 3,941). Accidents were the 2nd leading cause of customers interrupted, accounting for 28% of total customers interrupted (1,115 of 3,941). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 28% of total customers interrupted (1,108 of 3,941).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Middleburg 39051 in 2018, accounting for 45% of total customer-hours interrupted (3,631 of 8,114). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 43% of total customer-hours interrupted (3,464 of 8,114). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (658 of 8,114).
- Of the 44 interruptions on this circuit, 24 affected 10 customers or less, with 7 being single customer outages.

**Actions Taken:**

- There are three 3-phase electronic reclosers, and two 1-phase hydraulic reclosers on the Middleburg 39051. The reclosers have proven to be beneficial to the reliability of the feeder as four of the 3-phase mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These recloser have minimized customers interrupted and customer hours interrupted over the past year for the Middleburg 39051.
- A project was completed to construct about 860 feet of new 1/0 AL, 7.62kV, single phase distribution on Bear Ladder Rd between poles 37 and 37h. This would make the existing tap across the Schoharie Creek a contingency instead of a primary tap, reducing the outage time for any future faults.
- A maintenance foot patrol was completed on the Middleburgh 39051 in 2015 and all identified maintenance work has been completed.
- Tree trimming of the Middleburg 39051 feeder was completed in FY2014.



**Action Plan:**

- A project to build approximately 5,400 feet of new 3 phase distribution and rebuild approximately 5,000 ft of existing distribution to 13.2kV construction in order to relieve an overloaded ratio on Mill Lane and eliminate a river crossing is currently scheduled for construction in FY 21.
- Monitor results of vegetation work from FY2014 on the Middleburg 39051 in 2019.

## 12. PORT HENRY 38552 – 13.2 kV

Profile: 1,642 Customers, 71.4 Circuit Miles  
 Indices: CAIDI = 2.77, SAIFI = 3.87

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	41.18%	194	3.05%	234	1.33%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	17.65%	1,273	20.03%	2,608	14.83%
6	ACCIDENTS	3	17.65%	3,843	60.46%	13,322	75.79%
7	PREARRANGED	1	5.88%	176	2.77%	50	0.28%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	5.88%	1	0.02%	5	0.03%
10	UNKNOWN	2	11.76%	869	13.67%	1,360	7.74%
Totals		17	100.00%	6,356	100.00%	17,578	100.00%

### Problem Analysis:

- There were 17 interruptions on the Port Henry 38552 in 2018.
- There were 2 transmission interruptions.
- The two transmission interruptions on the Port Henry 38552 in 2018 were the result of Osprey activity on the Ticonderoga-Whitehall #3, 115 kV transmission line. These two events combined, interrupted 3,269 customers (51%) and accounted for 12,442 customer hours of interruption (71%).
  - The first event occurred on May 26th when part of an Osprey nest fell causing an interruption on the Ticonderoga-Whitehall #3, 115 kV transmission line for 7 hours and 23 minutes while the problem was located and repaired.
  - The second Osprey event occurred on June 13th and was momentary in nature, but for the transmission system to cycle through the necessary operations to be assured that the fault was gone, 8 minutes past before service was restored to the Port Henry station.
- There were no substation interruptions.
- The remaining 15 events occurred at the distribution level.
- The distribution circuit breaker for the Port Henry 38552 experienced 6 momentary operations in 2018.
- The 15 interruptions on the Port Henry 38552 in 2018 attributed to the distribution system, interrupted 3,087 customers (49%) and accounted for 5,137 customer-hours interrupted (29%), for a distribution SAIFI of 1.88 and CAIDI of 1.66.
- The distribution circuit breaker for the Port Henry 38552 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 34% of the total customers interrupted due to events on the distribution feeder (1,055 out of 3,087) and 49% of the total amount of the customer-hours interrupted (2,532 out of 5,137).

- This lockout occurred on November 2, 2018 when a tree fell in the distribution right-of-way less than 1,000 feet from the substation.
- The largest distribution related interruption on the Port Henry 38552 distribution feeder that didn't impact the entire feeder occurred on October 27, 2018 when a motor vehicle accident broke pole 63 on Plank Road locking out the 3-phase line recloser on pole 53 impacting 574 customers (9%) and accounting for 880 customer-hours of interruption (5%).
- These two large distribution feeder interruptions when combined with the two Osprey related interruptions on the 115 kV transmission system accounted for only 24% of the 17 total interruptions experienced on the Port Henry 38552 in 2018, but they affected 4,898 customers (77%) and accounted for 15,854 customer-hours interrupted (90%).
- Seven of the 17 interruptions (41%) experienced on the Port Henry 38552 in 2018 affected ten or fewer customers, and four of those affected only one customer.

**Actions Taken:**

- There are four 3-phase reclosers and one single-phase recloser on the Port Henry 38552. All four 3-phase reclosers were installed in 2007 while the single-phase recloser was installed in 2006.
- A capital improvement project was completed in 2018 at a cost of \$621,556 to rebuild and convert Moriah and Edgemont Roads from 4.8 kV to 7.62 kV.
- A 3-phase tap into a former stone quarry off Switchback Road was removed in 2018 at a cost of \$12,554.
- A maintenance foot patrol was performed on the Port Henry 38552 in 2016 and all identified level 1 and 2 maintenance has been completed.
- Tree trimming and a hazard tree review, which removed 705 hazard trees and another 272 Ash trees infested with the Emerald Ash Borer, was completed on the Port Henry 38552 in FY2018.
- A maintenance foot patrol of the Ticonderoga-Whitehall #3, 115 kV transmission line was completed in 2015 and all identified maintenance has been completed.
- A maintenance foot patrol of the Ticonderoga-Republic #2, 115 kV transmission line was completed in 2018 and no level 1 or 2 maintenance items were identified.
- Integrated Vegetation Management was completed on the Ticonderoga-Whitehall #3, 115 kV transmission line in FY2018.

**Action Plan:**

- Complete all identified level 3 maintenance on the Port Henry 38552.
- Generators will be installed to serve the customers on the Port Henry 38552 in the spring of 2019 to allow for critical repairs to be made to the Ticonderoga-Republic #2 and Ticonderoga-Whitehall #3, 115 kV transmission lines as well as the relocation of multiple Osprey nests.
- A capital improvement project is budgeted for FY2020 to rebuild and convert Dalton Hill Road from 4.8 kV to 7.62 kV to allow better coordination between protective devices.
- Three TripSaver, cut-out mounted single phase reclosers are scheduled to be installed on the Port Henry 38552 in 2019.
- Complete all identified level 3 maintenance on the Ticonderoga-Republic #2, 115 kV transmission line.
- Integrated Vegetation Management is scheduled on the Ticonderoga-Republic #2, 115 kV transmission line in FY2020.

### 13. E J WEST 03851 – 13.2 kV

Profile: 1,469 Customers, 76.7 Circuit Miles  
 Indices: CAIDI = 3.63, SAIFI = 2.11

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	21	61.76%	2,751	88.60%	10,015	88.92%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	8.82%	28	0.90%	165	1.46%
6	ACCIDENTS	3	8.82%	259	8.34%	848	7.53%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	2.94%	2	0.06%	3	0.03%
10	UNKNOWN	6	17.65%	65	2.09%	232	2.06%
Totals		34	100.00%	3,105	100.00%	11,263	100.00%

**Problem Analysis:**

- There were 34 interruptions on the EJ West 03851 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 34 events occurred at the distribution level.
- The distribution circuit breaker for the EJ West 03851 experienced 1 momentary operation in 2018.
- The distribution circuit breaker for the EJ West 03851 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 48% of the total amount of customers interrupted (1,485 out of 3,105) and 58% of the total amount of the customer-hours interrupted (6,527 out of 11,263).
  - This lockout occurred on October 07, 2018 when a tree fell on Stewart Bridge Road. This event should have locked out a distribution line recloser which would have limited the event to affecting only 250 people and accounting for 1,567 customer-hours of interruption, but a recloser programming error caused the recloser to ignore the event and remain closed. The error was quickly identified and corrected.
- Trees were the leading cause of interruptions on the EJ West 03851 in 2018, accounting for 21 of the 34 interruptions (62%). In addition to the event above which locked out the station breaker, one tree related event caused a three-phase line recloser to lock-out. This event occurred on January 9, 2018 when a tree fell on the primary at pole 56 ½ North Shore Road during a snow storm locking out recloser R5945 on pole 20 North Shore Road, interrupting 685 customers (22%) and accounting for 2,348 customer-hours of interruption (21%).

- One of the 3 accident related interruptions on the EJ West 03851 in 2018 occurred when a motor vehicle struck and broke pole 136 on North Shore Road interrupting 209 customers (7%) and accounting for 706 customer-hours of interruption (6%). Fortunately, the pole broke in such a way that the loop scheme between the EJ West 03851 and the Northville 33252 was able to operate minimizing the number of customers affected and using available switches, all but 46 of the 209 customers affected were able to be restored within 1 hour and 36 minutes.
- The three interruptions listed above accounted for only 9% of the 34 interruptions on the EJ West 03851 in 2018 but they interrupted 2,379 customers (77%) and accounted for 9,581 customer-hours of interruption (85%).
- Sixteen of the 34 interruptions (47%) experienced on the EJ West 03851 in 2018 affected ten or fewer customers, and seven of those affected only one customer.

**Actions Taken:**

- A multi-year project to rebuild and convert the EJ West 03851, 3-phase mainline, to 13.2 kV and to create a 3-phase distribution tie with the Northville 33252 was completed in 2014 at a total cost of over \$2.4M. These projects allowed the creation of a loop scheme between the EJ West 03851 and the Northville 33252 to automatically transfer 742 customers from the EJ West 03851 to the Northville 33252 should the station breaker lock-out or the 115 kV transmission system experience an interruption.
- A load transfer scheme was constructed in 2013 between the EJ West 03851 and the Scofield Road 45053 to automatically transfer 330 customers from the EJ West 03851 to the Scofield Road 45053 should the station breaker lock out or the 115 kV system transmission system experience an interruption.
- There are five 3-phase reclosers and six single-phase reclosers on the EJ West 03851. Two of the 3-phase reclosers are sectionalizing reclosers and two others are open tie reclosers for the automated ties to Northville 33252 and the Scofield Road 45053. The fifth 3-phase recloser is a radial recloser. The six single phase reclosers were placed into service while the feeder was being rebuilt and converted to 13.2 kV.
- A single-phase feeder tie was constructed in 2014 to the Scofield Road 45053 on South Shore Road at the Hadley/Day town line at a cost of about \$128,000.
- Two of the single-phase reclosers were replaced with TripSaver, cut-out mounted single phase reclosers in 2017.
- A maintenance foot patrol of the EJ West 03851 was completed in 2018 and all level 1 and 2 maintenance has been completed.
- Tree trimming and a hazard tree review, which removed 413 hazard trees and another 12 Ash trees infested with the Emerald Ash Borer, was completed on the EJ West 03851 was completed in FY2017.

**Action Plan:**

- Complete all identified level 3 maintenance on the EJ West 03851.

## 14. WILTON 32951 – 13.2 kV

Profile: 1,538 Customers, 67.9 Circuit Miles  
 Indices: CAIDI = 1.21, SAIFI = 4.66

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	4	17.39%	100	1.40%	101	1.16%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	8	34.78%	6,873	95.90%	8,189	94.16%
6	ACCIDENTS	5	21.74%	147	2.05%	298	3.43%
7	PREARRANGED	1	4.35%	7	0.10%	9	0.10%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	5	21.74%	40	0.56%	99	1.14%
Totals		23	100.00%	7,167	100.00%	8,697	100.00%

### Problem Analysis:

- There were 23 interruptions on the Wilton 32951 in 2018.
- There were 3 transmission interruptions.
  - The three transmission interruptions on the Wilton 32951 in 2018 were all the result of insulator failures on the Spier-Brook Road #3, 34.5 kV sub-transmission line. The first occurred on January 1st, the second on February 12th and the third on July 16th. Several insulators on this line are known to be structurally deficient and are planned for replacement as part of an insulator replacement program scheduled for construction in FY2021. The three transmission related interruptions, combined, accounted for only 13% of the interruptions on the Wilton 32951 in 2018, but they accounted for 64% of the customers interrupted (4,610 of 7,167) and 54% of the customer-hours of interruption (4,714 of 8,697).
- There were no substation interruptions.
- The remaining 20 events occurred at the distribution level.
- The distribution circuit breaker for the Wilton 32951 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Wilton 32951 experienced 0 sustained operations (lockouts) in 2018.
- The 20 interruptions on the Wilton 32951 in 2018 attributed to the distribution system interrupted 2,557 customers (35%) and accounted for 3,983 customer-hours interrupted (46%), for a distribution SAIFI of 1.66 and CAIDI of 1.56.
- Equipment Failures were the leading cause of interruptions on the Wilton 32951 in 2018, accounting for 35% of total interruptions (8 of 23), 96% of total customers interrupted (6,873 of 7,167) and 94% of total customer-hours interrupted (8,189 of 8,697). Of the eight

Equipment Failure related interruptions, five are attributed to the distribution system while the remaining three transmission related interruptions are listed above.

- The largest distribution interruption, by customer hours of interruption, occurred on April 30, 2018 when a fire at P20 on Duncan Road due to a down tree on the primary caused recloser R88029 on pole 1 Duncan Road to lock out, impacting 739 customers (10%) and accounting for 2,139 customer-hours of interruption (25%).
- The second largest distribution interruption, by customer hours of interruption, occurred on July 17, 2018 when a neutral conductor at pole 32 on Ballard Road was struck by lightning and fell across Interstate I-87 which impacted 1,403 customers (20%) and accounting for 997 customer-hours of interruption (11%).
- These two large distribution feeder interruptions when combined with the three interruptions on the 34.5 kV sub-transmission system accounted for only 22% of the 23 total interruptions experienced on the Wilton 32951 in 2018, but they affected 6,752 customers (94%) and accounted for 7,850 customer-hours interrupted (90%).
- Ten of the 23 interruptions (43%) experienced on the Wilton 32951 in 2018 affected eleven or fewer customers, and four of those affected only one customer.

**Actions Taken:**

- There is one 3-phase recloser and two single-phase reclosers on the Wilton 32951. The 3-phase recloser was installed in 2008 within a major project to extend 3-phase on Stone Bridge Road. The two single-phase reclosers were installed in 2005.
- Switching was performed on the Wilton 32951 in 2013 to transfer about 2 miles of single-phase, 4.8 kV distribution serving 26 customers from the Wilton 32951 to the Weibel Avenue 41556 to improve voltage performance.
- Switching was performed on the Wilton 32951 in 2015 to transfer about 6.8 miles of single phase, 4.8 kV distribution serving 66 customers from the Schuylerville 03912 to the Wilton 32951 to improve voltage performance.
- The 10/12.5 MVA, 34.5/13.2 kV substation transformer in the Wilton substation failed in early 2015 and was replaced with a new 12/16/20 MVA, 34.5/13.2 kV substation transformer. In addition, a 34.5 kV line recloser was installed on the source side of the new station transformer to replace the fuses which were used to protect the old transformer. The new substation transformer and recloser were placed in service in December of 2015.
- A maintenance foot patrol was performed on the Wilton 32951 in 2015 and all identified maintenance has been completed.
- Tree trimming and a hazard tree review, which removed 81 hazard trees and another 29 Ash trees infested with the Emerald Ash Borer, was completed on the Wilton 32951 was completed in FY2017.

**Action Plan:**

- A maintenance foot patrol of the Wilton 32951 is scheduled for 2020.
- Tree trimming and a hazard tree review are scheduled to be performed on the Wilton 32951 in FY2022.
- EMS is scheduled to be installed in the Wilton substation in 2019.
- A capital improvement project is budgeted for FY2022 to rebuild approximately 1.7 miles of the Wilton 32952 on State Highway 32 to relieve a soon-to-be overloaded single phase ratio transformer and create a feeder tie to the Wilton 32951 at the far east end of both feeders.

- A capital improvement project is planned for construction in FY2021 to replace vintage vertical post insulators on four 34.5kV sub-transmission circuits, including the Spier-Brook Road #3, 34.5 kV sub-transmission line.
- A capital improvement project is planned for FY2021 to install an automation scheme on the sub-transmission lines that serve Wilton. This scheme will enable automatic fault detection, sectionalizing and restoration of the Wilton substation following interruptions on the sub-transmission lines.



## 15. BURGOYNE 33752 – 13.2 kV

Profile: 2,091 Customers, 116.7 Circuit Miles  
 Indices: CAIDI = 1.83, SAIFI = 2.71

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	21.21%	2,279	40.20%	2,174	20.92%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	8	24.24%	21	0.37%	78	0.75%
6	ACCIDENTS	8	24.24%	3,122	55.07%	7,755	74.62%
7	PREARRANGED	1	3.03%	19	0.34%	19	0.18%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	9	27.27%	228	4.02%	367	3.53%
Totals		33	100.00%	5,669	100.00%	10,393	100.00%

### Problem Analysis:

- There were 33 interruptions on the Burgoyne 33752 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - The substation interruption was the result of animal contact inside the Burgoyne substation which interrupted 2,119 customers (37%) and accounted for 5,933 customer-hours of interruption (57%).
- The remaining 32 events occurred at the distribution level.
- The distribution circuit breaker for the Burgoyne 33752 experienced 1 momentary operation in 2018.
- The distribution circuit breaker for the Burgoyne 33751 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 37% of the total amount of customers interrupted (2,071 out of 5,669) and 16% of the total amount of the customer-hours interrupted (1,657 out of 10,393).
  - This lockout occurred on September 14, 2018 when a tree came down and broke pole 52½ on Lower Maple Street. Fortunately, the customers on the feeder were able to be switched to adjacent feeders within 48 minutes restoring service while the pole was replaced.
- Accidents were the leading cause of customers interrupted (CI) and customer-hours interrupted (CHI) on the Burgoyne 33752 in 2018. The largest accident related outage on the Burgoyne 33752 in 2018 besides the aforementioned animal outage within the substation was a motor vehicle accident on State Highway 196 which broke a pole. Restoration was performed in steps with 81% of the 961 customers affected restored in 1½ hours, while 4 customers were out for over 9½ hours while the pole was being replaced. In total this event interrupted 961 customers (17%) and accounted for 1,744 customer-hours of interruption.

- The substation interruption when combined with the distribution feeder lockout and the motor vehicle accident accounted for only 9% of the 33 total interruptions experienced on the Burgoyne 33752 in 2018, but they affected 5,151 customers (91%) and accounted for 9,334 customer-hours interrupted (90%).
- Unknowns were the leading cause of interruptions on the Burgoyne 33752 in 2018 but no outage of unknow cause affected more than 121 customers (2%) or accounted for more than 145 customer-hours of interruption (1%).
- Nineteen of the 33 interruptions (58%) experienced on the Burgoyne 33752 in 2018 affected 10 or fewer customers, and ten of those affected only one customer.

**Actions Taken:**

- There are two 3-phase reclosers on the Burgoyne 33752. One was installed new in 2017 and the second was installed in 2018 to replace a recloser originally installed in 1996.
- Four TripSaver, cut-out mounted single phase reclosers were installed on the Burgoyne 33752 in 2018.
- A maintenance foot patrol was completed on the Burgoyne 33752 in 2016 and all level 1 and 2 maintenance has been completed.
- A project was completed in 2018 at a cost of \$111,153 which rebuilt and converted about ½ mile of single phase distribution on the Burgoyne 33752 allowing 44 customers and 275 kVA of connected load to be transferred from the Burgoyne 33752 to the Burgoyne 33754 to reduce the load on the overloaded Bly Avenue ratio transformer.
- Tree trimming and a hazard tree review were completed on the Burgoyne 33752 in FY2015.
- A failed voltage regulator on pole 259 on State Highway 196 was replaced in early 2015.

**Action Plan:**

- Complete all identified level 3 maintenance on the Burgoyne 33752.
- An animal fence will be installed around the energized equipment within the Burgoyne substation in 2019.
- Two new 3-phase line reclosers will be installed on State Highway 40 on either side of the intersection with State Highway 196 in 2019.
- A project is scheduled for 2019 to add or replace fuses at 15 locations on the County Highway 30 single phase tap to provide better fault isolation, reliability and coordination.
- A small project is scheduled for 2019 to construct about 582 feet of new single phase distribution on Gilchrist Hill Road to allow the removal of about 992 feet of rear lot distribution constructed in 1947.
- A small project will be scheduled for construction as soon as the necessary easements can be obtained to construct about 674 feet of new single phase distribution on Lundy Road to allow the removal of about 1,222 feet of rear lot distribution.
- Tree trimming and a hazard tree review of the Burgoyne 33752 is scheduled for FY2021.

## 16. CROWN POINT 24951 – 13.2 kV

Profile: 1,094 Customers, 72.7 Circuit Miles  
 Indices: CAIDI = 4.08, SAIFI = 2.35

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	12	54.55%	268	10.44%	1,335	12.75%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	13.64%	17	0.66%	70	0.67%
6	ACCIDENTS	2	9.09%	1,166	45.42%	8,078	77.16%
7	PREARRANGED	1	4.55%	1,093	42.58%	911	8.70%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	18.18%	23	0.90%	76	0.73%
Totals		22	100.00%	2,567	100.00%	10,469	100.00%

### **Problem Analysis:**

- There were 22 interruptions on the Crown Point 24951 in 2018.
- There were 2 transmission interruptions.
- The two transmission interruptions on the Crown Point 24951 were the result of Osprey activity on the Ticonderoga-Whitehall #3, 115 kV transmission line. These two events combined, interrupted 2,184 customers (85%) and accounted for 8,966 customer hours of interruption (86%).
  - The first event occurred on May 26th when part of an Osprey nest fell causing an interruption on the Ticonderoga-Whitehall #3, 115 kV transmission line for 7 hours and 23 minutes while the problem was located and repaired.
  - The second Osprey related event was a planned interruption on June 14th to remove an inactive Osprey nest at structure 320 which was completed in 50 minutes.
- There were no substation interruptions.
- The remaining 20 events occurred at the distribution level.
- The distribution circuit breaker for the Crown Point 24951 experienced 5 momentary operations in 2018.
- The distribution circuit breaker for the Crown Point 24951 experienced 0 sustained operations (lockouts) in 2018.
- The 20 interruptions on the Crown Point 24951 in 2018 attributed to the distribution system, interrupted only 383 customers (15%) and accounted for 1,503 customer-hours interrupted (14%), for a distribution SAIFI of 0.35 and CAIDI of 3.93.

- The largest distribution related interruption on the Crown Point 24951 distribution feeder occurred on June 28, 2018 when a tree fell on Goodrich Road locking out the single phase recloser on pole 1 on Lake Road impacting 168 customers (7%) and accounting for 734 customer-hours of interruption (7%).
- This distribution interruption when combined with the two Osprey related interruptions on the 115 kV transmission system accounted for only 14% of the 22 total interruptions experienced on the Crown Point 24951 in 2018, but they affected 2,352 customers (92%) and accounted for 9,700 customer-hours interrupted (93%).
- Fifteen of the 22 interruptions (68%) experienced on the Crown Point 24951 in 2018 affected ten or fewer customers, and seven of those affected only one customer.

**Actions Taken:**

- There are three 3-phase reclosers and one single-phase recloser on the Crown Point 24951. The single-phase recloser and one of the 3-phase reclosers were installed in 2007. The second 3-phase recloser was installed in 2008 and paired with the third 3-phase recloser, which is an open-tie recloser, installed in 2009 to create a loop scheme with the Hague Road 41851, which automatically restores service to 81 of the 1,040 customers on the Crown Point 24951 (7.8%) in the event of a transmission or substation outage.
- A maintenance foot patrol was performed on the Crown Point 24951 in 2015 and all maintenance has been completed.
- Tree trimming and a hazard tree review which removed 370 danger trees was completed on the Crown Point 24951 in FY2015.
- A capital project was completed on the Crown Point 24951 in 2013 at a cost of \$21,410 to extend 3-phase about 1,600 feet on Creek Road to White Church Road.
- A capital project was completed on the Crown Point 24951 in 2015 at a cost of \$265,230 to construct about 3,300 feet of single-phase distribution along White Church Road to replace an equivalent amount of heavily treed cross-lot distribution.
- A second capital project was completed on the Crown Point 24951 in 2015 at a cost of \$75,761 to construct about 1,600 feet of single-phase distribution along Breed Hill Road to replace about 1,900 feet of heavily treed cross-lot distribution.
- A small project was completed in 2017 to replace the overloaded 100 kVA, 7.62/4.8 kV single-phase ratio transformer on Sugar Hill Road with a 167 kV transformer protected by a TripSaver, cutout mounted recloser.
- A project was completed in 2018 at a cost of \$129,426 to address the overloaded 250 kVA ratio transformer on Lake Road by converting about 2,700 feet of Lake Road to 7.62 kV and installing a 333 kV, 7.62/4.8 kV ratio transformer.
- Distribution line sensors were installed at the Crown Point substation in 2017 to provide remotely accessible feeder load data.
- A maintenance foot patrol of the Ticonderoga-Whitehall #3, 115 kV transmission line was completed in 2015 and all identified maintenance has been completed.
- A maintenance foot patrol of the Ticonderoga-Republic #2, 115 kV transmission line was completed in 2018 and no level 1 or 2 maintenance items were identified.
- Integrated Vegetation Management was completed on the Ticonderoga-Whitehall #3, 115 kV transmission line in FY2018.

**Action Plan:**

- Generators will be installed to serve the customers on the Crown Point 24951 in the spring of 2019 to allow for critical repairs to be made to the Ticonderoga-Republic #2 and Ticonderoga-Whitehall #3, 115 kV transmission lines as well as the relocation of multiple Osprey nests.
- A capital project is scheduled to FY2020 to convert about 2,500 feet of Creek Road and Pearl Street from 4.8 kV to 13.2 kV, moving one 3-phase recloser and installing a second 3-phase recloser.
- A small project is scheduled for FY2020 to install additional fuses and fault indicators on Breed Hill Road to better isolate faults in order to reduce outage times.
- A capital improvement project is scheduled for FY2020 to construct about 1,500 feet of single-phase distribution along Creek Road to replace an equivalent amount of heavily treed cross-lot distribution serving Creek Road from Breed Hill Road.
- A capital improvement project to rebuild and convert the balance of the 3-phase distribution on Creek Road from 4.8 kV to 13.2 kV is budgeted for FY2023.
- A capital improvement project to rebuild and convert Pearl Street from 4.8 kV to 13.2 kV is budgeted for FY2023.
- A capital improvement project to rebuild and convert the balance of the 3-phase distribution on State Highway 9N from 4.8 kV to 13.2 kV is budgeted for FY2024.
- Complete all identified level 3 maintenance on the Ticonderoga-Republic #2, 115 kV transmission line.
- Integrated Vegetation Management is scheduled on the Ticonderoga-Republic #2, 115 kV transmission line in FY2020.

## 17. SCHOHARIE 23452 – 13.2 kV

*Profile: 1,626 Customers, 129.7 Circuit Miles*  
*Indices: CAIDI = 4.93, SAIFI = 1.71*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	8	27.59%	1,590	57.05%	10,641	77.48%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	9	31.03%	52	1.87%	180	1.31%
6	ACCIDENTS	2	6.90%	46	1.65%	35	0.25%
7	PREARRANGED	1	3.45%	4	0.14%	10	0.07%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	2	6.90%	2	0.07%	10	0.07%
10	UNKNOWN	7	24.14%	1,093	39.22%	2,858	20.81%
Totals		29	100.00%	2,787	100.00%	13,734	100.00%

### **Problem Analysis:**

- There were 29 interruptions on the Schoharie 23452 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 29 events occurred at the distribution level.
- The distribution circuit breaker for the Schoharie 23452 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Schoharie 23452 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Schoharie 23452 in 2018, accounting for 31% of total interruptions (9 of 29). Trees were the 2nd leading cause of interruptions, accounting for 28% of total interruptions (8 of 29). Unknown were the 3rd leading cause of interruptions, accounting for 24% of total interruptions (7 of 29).
- There were two interruptions on the Schoharie 23452 that involved 3-phase mainline but were not associated with the circuit breaker. The isolating devices were all pole-top reclosers. These interruptions accounted for 69% of the total amount of customers interrupted (1,935 of 2,787) and 72% of the total amount of the customer-hours interrupted (9,946 of 13,734).
  - The first interruption occurred on March 17, 2018 due to an unknown cause. The recloser at pole 16 State Route 433 locked open. Crews surveyed the line and did not find a cause. The recloser was closed back into service without any further interruption. This interruption accounted for 35% of the total amount of customers interrupted (968 of 2,787) and 19% of the total amount of the customer-hours interrupted (2,581 of 13,734).

- The second interruption occurred on March 18, 2018 as a result of a tree falling and taking primary down at pole 62-1 State Route 443. The recloser at pole 16 State Route 443 locked open as a result. This interruption accounted for 35% of the total amount of customers interrupted (967 of 2,787) and 54% of the total amount of the customer-hours interrupted (7,365 of 13,734).
- Trees were the leading cause of customers interrupted (CI) on the Schoharie 23452 in 2018, accounting for 57% of total customers interrupted (1,590 of 2,787). Unknown were the 2nd leading cause of customers interrupted, accounting for 39% of total customers interrupted (1,093 of 2,787). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 2% of total customers interrupted (52 of 2,787).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Schoharie 23452 in 2018, accounting for 77% of total customer-hours interrupted (10,641 of 13,734). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 21% of total customer-hours interrupted (2,858 of 13,734). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (180 of 13,734).
- Of the 29 interruptions on this circuit, 19 affected 10 customers or less, with 12 being single customer outages.

**Actions Taken:**

- There are three 3-phase electronic reclosers on the Schoharie 23452. The reclosers have proven to be beneficial to the reliability of the feeder as two of the 3-phase mainline interruptions were isolated by a recloser instead of affecting the entire feeder. These recloser have minimized customers interrupted and customer hours interrupted over the past year for the Schoharie 23452.
- A maintenance foot patrol was performed on the Schoharie 23452 in 2018.
- A capital project was completed in 2018 to install fault indicators on State Route 443 at various distribution road crossing locations. The fault indicators will allow the crews to identify the location of the outage faster in rear lot locations.
- Tree trimming and a hazard tree review, which removed 707 hazard trees and another 97 Ash trees infested with the Emerald Ash Borer, was completed on the Schoharie 23452 was completed in FY2017.

**Action Plan:**

- A project to construct approximately 5,400 feet of new three-phase mainline along Cook Road and State Route 443, to allow for the removal of an equivalent amount of heavily treed rear-lot three-phase mainline, is scheduled for FY2020.
- Complete all identified level 3 maintenance on the Schoharie 23452 feeder by September 2021.
- Monitor results of vegetation work from FY2017 on the Schoharie 23452 in 2019.

## 18. EAST SPRINGFIELD 47751 – 13.2 kV

Profile: 996 Customers, 93.7 Circuit Miles  
 Indices: CAIDI = 1.78, SAIFI = 3.44

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	8	36.36%	2,084	60.85%	4,987	81.81%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	22.73%	1,000	29.20%	515	8.45%
6	ACCIDENTS	4	18.18%	125	3.65%	518	8.49%
7	PREARRANGED	1	4.55%	208	6.07%	35	0.57%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	18.18%	8	0.23%	41	0.67%
Totals		22	100.00%	3,425	100.00%	6,095	100.00%

### Problem Analysis:

- There were 22 interruptions on the East Springfield 47751 in 2018.
- There was 1 transmission interruption.
  - This interruption occurred on January 22, 2018 due to downed wire on the Inghams-Richfield Springs transmission line. This interruption accounted for 29% of the total customers interrupted (979 of 3,425), and 7% of the total customer-hours interrupted (408 of 6,095).
- There were no substation interruptions.
- The remaining 21 events occurred at the distribution level.
- The distribution circuit breaker for the East Springfield 47751 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the East Springfield 47751 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 29% of the total amount of customers interrupted (987 out of 3,425) and 46% of the total amount of the customer-hours interrupted (2,834 out of 5,687).
  - This lockout occurred on April 16, 2018, coded as a cause of tree fell (PSC cause code 02). A tree fell on primary at pole 98 County Route 54, resulting in the R510 station breaker locking out. This lockout accounted for 28% of the total customers interrupted (950 of 3,425), and 29% of the total customer-hours interrupted (1,669 of 6,095).
- There was one significant interruption on the East Springfield 47751 that involved three-phase mainline. It occurred on September 21, 2018 due to a tree falling. Trees took down two sections of C phase primary by pole 86 County Highway 54. Crews were able to isolate the outage and re-



energize customers. This interruption accounted for 29% of the total customers interrupted (987 of 3,425), and 46% of the total customer-hours interrupted (2,834 of 6,095).

- Trees were the leading cause of interruptions on the East Springfield 47751 in 2018, accounting for 36% of total interruptions (8 of 22). Equipment Failures were the 2nd leading cause of interruptions, accounting for 23% of total interruptions (5 of 22). Accidents were the 3rd leading cause of interruptions, accounting for 18% of total interruptions (4 of 22).
- Trees were the leading cause of customers interrupted (CI) on the East Springfield 47751 in 2018, accounting for 61% of total customers interrupted (2,084 of 3,425). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 29% of total customers interrupted (1,000 of 3,425). Prearranged were the 3rd leading cause of customers interrupted, accounting for 6% of total customers interrupted (208 of 3,425).
- Trees were the leading cause of customer-hours interrupted (CHI) on the East Springfield 47751 in 2018, accounting for 82% of total customer-hours interrupted (4,987 of 6,095). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (518 of 6,095). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (515 of 6,095).
- Of the 22 interruptions on this circuit, 13 affected 10 customers or less, with 5 being single customer outages.

**Actions Taken:**

- There are three 3-phase line reclosers on the East Springfield 47751. Two installed in 2005 and the third upgraded in 2013.
- Tree trimming of the East Springfield 47751 feeder was completed in FY2017.
- An I&M foot patrol of the East Springfield 47751 was completed in 2015 and all identified maintenance was completed.
- Tree trimming and a hazard tree review, which removed 184 hazard trees and another 21 Ash trees infested with the Emerald Ash Borer, was completed on the East Springfield 47751 was completed in FY2017.

**Action Plan:**

- Complete an Engineering Reliability Report on the East Springfield 47751 in 2019.
- Monitor results of vegetation work from FY2017 on the East Springfield 47751 in 2019.

## 19. BUTLER 36251 – 13.2 kV

*Profile: 2,926 Customers, 97.9 Circuit Miles*  
*Indices: CAIDI = 1.73, SAIFI = 2.20*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	15	42.86%	6,064	94.35%	10,081	90.55%
3	OVERLOADS	3	8.57%	54	0.84%	83	0.75%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	14.29%	28	0.44%	130	1.17%
6	ACCIDENTS	3	8.57%	91	1.42%	490	4.40%
7	PREARRANGED	3	8.57%	62	0.96%	37	0.34%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	6	17.14%	128	1.99%	311	2.79%
Totals		35	100.00%	6,427	100.00%	11,133	100.00%

### **Problem Analysis:**

- There were 35 interruptions on the Butler 36251 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 35 events occurred at the distribution level.
- The distribution circuit breaker for the Butler 36251 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the Butler 36251 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 46% of the total amount of customers interrupted (2,927 out of 6,427) and 36% of the total amount of the customer-hours interrupted (4,049 out of 11,133).
  - This lockout occurred on March 08, 2018 when a tree fell near pole 27 on State Highway 197 interrupting all 2,927 customers on the feeder for 1 hour and 23 minutes.
- Trees were the leading cause of interruptions, customers interrupted (CI), and customer-hours interrupted (CHI) on the Butler 36251 in 2018, accounting for 43% of the 35 interruptions. In addition to the tree related event which locked out the station breaker listed above, three tree-related events caused interruptions at a three-phase line recloser either via lock-out or manual operation, accounting for a total of 2,462 customers interrupted (38%) and 4,276 customer-hours of interruption (38%).
  - The first of these events occurred on March 8, 2018 when a tree limb fell on the primary near the intersection of Mountain and Spier Falls Roads locking out recloser R88567 on pole 3 Spier Falls Road, interrupting 722 customers (11%) and accounting for 1,143 customer-hours of interruption (10%).

- The second event occurred on October 11, 2018 when a tree took the primary down at pole 50 on State Highway 197. This event did not cause a recloser to lock-out, however, recloser R88481 on pole 57 State Highway 197 was opened manually to isolate the problem so repairs could be made. This event affected 871 customers (14%) and accounted for 290 customer-hours interrupted (3%).
- The third event occurred on December 22, 2018 when a tree fell on State Highway 197 locking out recloser R88481 on pole 57 State Highway 197, interrupting 870 customers (14%) and accounting for 2,842 customer-hours interrupted (26%).
- The three tree related events on the Butler 36251 which impacted 3-phase line reclosers when combined with the tree event which locked out the station breaker accounted for only 11% of the 35 total interruptions experienced on the Butler 36251 in 2018, but they affected 5,389 customers (84%) and accounted for 8,325 customer-hours interrupted (75%).
- Thirteen of the 35 interruptions (37%) experienced on the Butler 36251 in 2018 affected 10 or fewer customers, and five of those affected only one customer.

**Actions Taken:**

- There are two 3-phase reclosers and one TripSaver, cut-out mounted single phase recloser on the Butler 36251. One 3-phase recloser was installed in 2006 while the other was installed in 2007. The TripSaver, cut-out mounted single phase recloser was installed in 2017.
- A maintenance foot patrol was completed on the Butler 36251 in 2016 and all identified maintenance has been completed.
- A project was completed in 2016 at a cost of \$65,265 which rebuilt and converted about ½ mile of 3-phase distribution on Mountain Road to 13.2 kV and installed a new, larger ratio transformer to reduce the load on the Mountain Road ratio transformer which was estimated to be loaded to 147% of nameplate.
- A project was completed in 2016 at a cost of \$241,478 to replace the failing underground cable on Oak View Drive.
- Tree trimming and a hazard tree review were completed on the Butler 36251 in FY2016.

**Action Plan:**

- A capital improvement project is under construction and scheduled for completion in the spring of 2019 to construct a new feeder out of the Butler substation which will transfer 47.2 miles of distribution and about 1,110 customers from the Butler 36251 feeder to the new Butler 36253 feeder while also transferring the 10.1 mile Fortsville Road tap, and the 204 customers it serves from the Wilton 32952 feeder to the Butler 36251. In the process, one of the 3-phase reclosers and the TripSaver, cut-out mounted single phase recloser on the Butler 36251 will be transferred to the Butler 36253 and a new 3-phase recloser will be installed on the Butler 36251 on Fortsville Road.
- One TripSaver, cut-out mounted single phase recloser is scheduled to be installed on the Butler 36251 in 2019.
- Tree trimming and a hazard tree review of the Butler 36251 is scheduled for FY2021.

## 20. DELANSON 26951 – 13.2 kV

*Profile: 2,007 Customers, 123.4 Circuit Miles*  
*Indices: CAIDI = 2.10, SAIFI = 2.08*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	8	21.05%	1,312	31.49%	3,164	36.11%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	9	23.68%	185	4.44%	1,637	18.68%
6	ACCIDENTS	3	7.89%	11	0.26%	39	0.45%
7	PREARRANGED	1	2.63%	2,132	51.18%	2,487	28.39%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	6	15.79%	260	6.24%	780	8.90%
10	UNKNOWN	11	28.95%	266	6.39%	655	7.47%
Totals		38	100.00%	4,166	100.00%	8,762	100.00%

### **Problem Analysis:**

- There were 38 interruptions on the Delanson 26951 in 2018.
- There were no transmission interruptions.
- There was 1 substation interruption.
  - This Substation interruption occurred on April 14, 2018, coded as a cause of maintenance (PSC cause code 07). This lockout accounted for 51% of the total customers interrupted (2,132 of 4,166), and 28% of the total customer-hours interrupted (2,487 of 8,762). This interruption was a company scheduled outage to work on the leads to the 69kV switches at the Delanson Substation.
- The remaining 37 events occurred at the distribution level.
- The distribution circuit breaker for the Delanson 26951 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Delanson 26951 experienced 0 sustained operations (lockouts) in 2018.
- There was one interruption on the Delanson 26951 that involved 3-phase mainline but was not associated with the circuit breaker. The isolating device was a pole-top recloser. This interruption accounted for 23% of the total amount of customers interrupted (957 of 4,166) and 28% of the total amount of the customer-hours interrupted (2,472 of 8,762).
- Unknown were the leading cause of interruptions on the Delanson 26951 in 2018, accounting for 29% of total interruptions (11 of 38). Equipment Failures were the 2nd leading cause of interruptions, accounting for 24% of total interruptions (9 of 38). Trees were the 3rd leading cause of interruptions, accounting for 21% of total interruptions (8 of 38).

- Prearranged were the leading cause of customers interrupted (CI) on the Delanson 26951 in 2018, accounting for 51% of total customers interrupted (2,132 of 4,166). Trees were the 2nd leading cause of customers interrupted, accounting for 31% of total customers interrupted (1,312 of 4,166). Unknown were the 3rd leading cause of customers interrupted, accounting for 6% of total customers interrupted (266 of 4,166).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Delanson 26951 in 2018, accounting for 36% of total customer-hours interrupted (3,164 of 8,762). Prearranged were the 2nd leading cause of customer-hours interrupted, accounting for 28% of total customer-hours interrupted (2,487 of 8,762). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 19% of total customer-hours interrupted (1,637 of 8,762).
- Of the 38 interruptions on this circuit, 16 affected 10 customers or less, with 8 being single customer outages.

**Actions Taken:**

- There are six 3-phase electronic reclosers, one point of common coupling recloser at a distributed generation site, and one 1-phase hydraulic recloser on the Delanson 26951. The reclosers have proven to be beneficial to the reliability of the feeder as the one main 3-phase mainline interruption was isolated by the recloser instead of affecting the entire feeder.
- Tree trimming of the Delanson 26951 feeder was completed in FY2015.
- A maintenance foot patrol of the Delanson 26951 was completed in 2016 and all level 1 and 2 maintenance was completed.

**Action Plan:**

- Complete all identified level 3 maintenance on the Delanson 26951 feeder by May 2019. Monitor results of vegetation work from FY2015 on the Delanson 26951 in 2019

3. ACTION PLAN SUMMARIES

a. SUMMARY OF ACTION PLANS FOR 2018 WORST PERFORMING CIRCUITS

Station	Feeder	Year	Action Plan	Est. Completion Date	Approx. Cost	Comments
Hague Road	41853	2018	Complete level 2 maintenance.	Nov-19		
Hague Road	41853	2018	Complete level 3 maintenance.	Nov-21		
Hague Road	41853	2018	Install generators to perform critical 115 kV maintenance & Osprey nest relocation.	May-19		
Hague Road	41853	2018	Silver Bay Road Reconfiguration.	Jul-19	\$51.9k	WR #26464462
Hague Road	41853	2018	Replace Lake George submarine cable.	Apr-21	\$2.6M	Project C050522. In Design.
Hague Road	41853	2018	Construct feeder tie to Hague Road 52.	Apr-21	\$1.6M	Project C050717.
Hague Road	41853	2018	Rebuild & convert Alexandria Avenue.	Apr-24	\$500k	Project C081836.
Hague Road	41853	2018	Ticonderoga-Republic #2 level 3 maintenance.	May-21		
Hague Road	41853	2018	Ticonderoga-Republic #2 IVM.	Apr-20		
Fort Gage	31954	2018	Maintenance foot patrol.	Dec-20		
Fort Gage	31954	2018	Complete ERR.	Apr-20		
Fort Gage	31954	2018	Substation animal fence.	Jul-19		
Fort Gage	31954	2018	Rebuild State Highway 9L.	Apr-21	\$997	Project C050680. Design complete.
Fort Gage	31954	2018	Warrensburg-Fort Gage #8 level 3 maintenance.	Apr-20		
Fort Gage	31954	2018	Fort Gage-Queensbury #2 level 3 maintenance.	Mar-19		
Port Henry	38551	2018	Complete level 3 maintenance.	Sep-20		
Port Henry	38551	2018	Install generators to perform critical 115 kV maintenance & Osprey nest relocation.	May-19		
Port Henry	38551	2018	Rebuild State Highway 9N at Sam Spear Road.	Apr-20	\$237.7	WR #24805909. Awaiting construction.
Port Henry	38551	2018	Install/replace reclosers for River Rat Hydro.	Dec-19	\$220k	Project C080097.
Port Henry	38551	2018	Rebuild and convert Hamlet of Port Henry.	Apr-22	\$760k	Project C081529.
Port Henry	38551	2018	Rebuild and convert Broad Street.	Apr-23	\$750k	Project C081530.
Port Henry	38551	2018	Ticonderoga-Republic #2 level 3 maintenance.	May-21		
Port Henry	38551	2018	Ticonderoga-Republic #2 IVM.	Apr-20		
Vail Mills	39253	2018	Perform ERR.	Apr-20		
Vail Mills	39253	2018	Complete level 3 maintenance.	Oct-20		
Vail Mills	39253	2018	Construct loop scheme with Northville 33252.	Jul-19	\$120k	WR #'s 27963185 & 28010877.
Vail Mills	39253	2018	Tree trimming and hazard tree review.	Apr-20		
Burgoyne	33751	2018	Complete level 3 maintenance.	Sep-19		
Burgoyne	33751	2018	Substation animal fence.	Dec-19		
Burgoyne	33751	2018	Construct feeder tie with Butler 36253.	Jul-19	\$215k	Project C080260. Under construction.
Burgoyne	33751	2018	Install TripSaver cut-out mounted reclosers.	Jul-19	\$15k	WR #'s 26908909, 26908615 & 26547010.
Burgoyne	33751	2018	Install Brennan Road 3Ø recloser.	Sep-19	\$71k	WR #26907954. Awaiting construction.
Burgoyne	33751	2018	Coach Road ratio relief.	Apr-19	\$91k	WR #23603487. In ROW.
Burgoyne	33751	2018	Lick Springs Road rebuild.	Apr-20	\$75k	WR #26387081. In design.
Burgoyne	33751	2018	State Highway 40 3Ø line extension.	Apr-19	\$96k	WR #18071911. Awaiting construction.
Burgoyne	33751	2018	Durkeetown Road rebuild.	Apr-20	\$356k	Project CD00222. In ROW.
Gilmantown Road	15451	2018	Replace Lapp Insulators on Northville-Wells #1 and Wells-Gilmantown #2, 23 kV sub-transmission lines.	Dec-19	\$1.3M	Project C075062.
Gilmantown Road	15451	2018	Gilmantown Station High Side Recloser.	Dec-19	\$100K	Project C078254.
Gilmantown Road	15451	2018	Install Tripsavers on various locations across the feeder.	Dec-19		WR#s 27816078, 27818612, 27819165, 227819561, and 27970608

Station	Feeder	Year	Action Plan	Est. Completion Date	Approx. Cost	Comments
Gilmantown Road	15451	2018	Northville-Mayfield #8 helicopter patrol.	Dec-19		
Gilmantown Road	15451	2018	Complete level 3 maintenance.	Apr-21		
Gilmantown Road	15451	2018	Monitor results of vegetation work from FY16.	Dec-19		
Bolton	28451	2017	Complete level 3 maintenance.	Jul-19		
Bolton	28451	2017	Construct 3Ø feeder tie to Warrensburg 32151.	Sep-19	\$1.2M	Project CD00606. Under construction.
Bolton	28451	2017	Transfer load to Birch Avenue 32252.	Jul-19	\$16k	WR #27889825, Awaiting construction.
Bolton	28451	2017	Rebuild Trout Lake Road to transfer load to Bolton 28452.	Apr-21	\$574k	Project C049560. Awaiting construction.
Bolton	28451	2017	Warrensburg-Fort Gage #8 level 3 maintenance.	Apr-20		
Bolton	28451	2017	Fort Gage-Queensbury #2 level 3 maintenance.	Mar-19		
Hague Road	41852	2018	Complete level 3 maintenance.	Sep-20		
Hague Road	41852	2018	Install generators to perform critical 115 kV maintenance & Osprey nest relocation.	May-19		
Hague Road	41852	2018	Replace Lake George submarine cable.	Apr-21	\$2.6M	Project C050522. In Design.
Hague Road	41852	2018	Construct feeder tie to Hague Road 52.	Apr-21	\$1.6M	Project C050717.
Hague Road	41852	2018	Ticonderoga-Republic #2 level 3 maintenance.	May-21		
Hague Road	41852	2018	Ticonderoga-Republic #2 IVM.	Apr-20		
Wilton	32952	2018	Complete level 3 maintenance.	Jun-20		
Wilton	32952	2018	Tree trimming and hazard tree review.	Apr-22		
Wilton	32952	2018	Construct Butler 36253 & transfer Fortsville Rd.	Dec-18	\$840k	Projects C028878 & C047455. Under construction.
Wilton	32952	2018	Add EMS to Wilton substation.	Apr-20		
Wilton	32952	2018	Rebuild and convert State Hwy. 32 to 3Ø.	Apr-22	\$680k	Project C019570. In Design.
Wilton	32952	2018	Replace insulators on Spier-Brook Rd #3.	Apr-21		
Wilton	32952	2018	Install 34.5 kV DA reclosers.	Apr-21		
Otten	41213	2018	Complete level 2 maintenance.	Jul-19		
Otten	41213	2018	Complete level 3 maintenance.	Jul-21		
Otten	41213	2018	Install generators to perform critical 115 kV maintenance & Osprey nest relocation.	May-19		
Otten	41213	2018	Rebuild distribution on Crusher Hill Road.	Apr-20	\$91k	Project C053692. Awaiting construction.
Otten	41213	2018	Ticonderoga-Republic #2 level 3 maintenance.	May-21		
Otten	41213	2018	Ticonderoga-Republic #2 IVM.	Apr-20		
Middleburg	39051	2018	Middleburgh 51 - Route 145 Extend/Conversion.	Apr-21	\$850K	Project CD01010.
Middleburg	39051	2018	Monitor results of vegetation work from FY14.	Dec-19		
Port Henry	38552	2018	Complete level 3 maintenance.	Nov-19		
Port Henry	38552	2018	Install generators to perform critical 115 kV maintenance & Osprey nest relocation.	May-19		
Port Henry	38552	2018	Rebuild & convert Dalton Hill Road.	Apr-20	\$183k	Project C054285. Awaiting construction.
Port Henry	38552	2018	Install TripSaver cut-out mounted reclosers.	Dec-19	\$15k	WR #'s 27988054, 27988871 & 26548436.
Port Henry	38552	2018	Ticonderoga-Republic #2 level 3 maintenance.	May-21		
Port Henry	38552	2018	Ticonderoga-Republic #2 IVM.	Apr-20		
EJ West	03851	2018	Complete level 3 maintenance.	Aug-21		
Wilton	32951	2018	Maintenance foot patrol.	Dec-20		
Wilton	32951	2018	Tree trimming and hazard tree review.	Apr-22		
Wilton	32951	2018	Add EMS to Wilton substation.	Apr-20		



Station	Feeder	Year	Action Plan	Est. Completion Date	Approx. Cost	Comments
Wilton	32951	2018	Rebuild and convert State Hwy. 32 to 3Ø.	Apr-22	\$680k	Project C019570. In Design.
Wilton	32951	2018	Replace insulators on Spier-Brook Rd #3.	Apr-21		
Wilton	32951	2018	Install 34.5 kV DA reclosers.	Apr-21		
Burgoyne	33752	2018	Complete level 3 maintenance.	Jul-19		
Burgoyne	33752	2018	Substation animal fence.	Dec-19		
Burgoyne	33752	2018	Install 2 3Ø reclosers on State Highway 40.	Dec-19	\$138k	WR #'s 26990391 & 26990366.
Burgoyne	33752	2018	County Highway 30 fusing.	Dec-19	\$22k	WR # 27006043. Awaiting construction.
Burgoyne	33752	2018	Gilchrist Hill Road distribution relocation.	Dec-19	\$35k	WR #23852774. Awaiting construction.
Burgoyne	33752	2018	Lundy Road distribution relocation.	Dec-20	\$78k	WR #19486880. In ROW.
Burgoyne	33752	2018	Tree trimming and hazard tree review.	Apr-21		
Crown Point	24951	2018	Install generators to perform critical 115 kV maintenance & Osprey nest relocation.	May-19		
Crown Point	24951	2018	Convert Creek Road to Pearl Street	Apr-19	\$228k	Project C078667. Awaiting construction.
Crown Point	24951	2018	Breed Hill Road fusing.	Apr-19	\$34k	WR #24400433. Awaiting construction.
Crown Point	24951	2018	Creek Road rear lot relocation.	Apr-20	\$95k	Project C048906. In ROW.
Crown Point	24951	2018	Complete Creek Road 3Ø rebuild/conversion.	Apr-23	\$250k	Project C081827.
Crown Point	24951	2018	Pearl Street 3Ø conversion.	Apr-23	\$250k	Project C081829.
Crown Point	24951	2018	State Highway 9N 3Ø rebuild/conversion.	Apr-24	\$500k	Project C081834.
Crown Point	24951	2018	Ticonderoga-Republic #2 level 3 maintenance.	May-21		
Crown Point	24951	2018	Ticonderoga-Republic #2 IVM.	Apr-20		
Schoharie	23452	2018	Schoharie 52 - State Route 443 Rebuild.	Mar-20	\$485K	Project CD00424.
Schoharie	23452	2018	Complete level 3 maintenance.	May-19		
Schoharie	23452	2018	Monitor results of vegetation work from FY17.	Dec-19		
East Springfield	44751	2018	Complete ERR.	Apr-20		
East Springfield	44751	2018	Monitor results of vegetation work from FY17.	Dec-19		
Butler	36251	2018	Construct Butler 36253 & transfer Fortsville Rd.	Dec-18	\$840k	Projects C028878 & C047455. Under construction.
Butler	36251	2018	Install TripSaver cut-out mounted reclosers.	Dec-19	\$5k	WR #26913649. Awaiting construction.
Butler	36251	2018	Tree trimming and hazard tree review.	Apr-21		
Delanson	26951	2018	Complete level 3 maintenance.	May-19		
Delanson	26951	2018	Monitor results of vegetation work from FY15.	Dec-19		

b. STATUS OF ACTION PLANS FOR 2017 WORST PERFORMING CIRCUITS

Station	Feeder	Year	Action Plan	Actual Completion Date	Actual Approx. Cost	Comments
Hague Road	41853	2017	Maintenance foot patrol.	Dec-18		Completed 11/6/2018.
Hague Road	41853	2017	Tree trimming and hazard tree review.	Apr-19		Complete.
Hague Road	41853	2017	Perform ERR.	Apr-19		Cancelled.
Hague Road	41853	2017	Convert Lord Howe St. to 7.62 kV.	Apr-19	\$48k	Completed 7/17/2018.
Hague Road	41853	2017	Black Point Road fusing.	Apr-19	\$29k	Completed 8/30/2018.
Hague Road	41853	2017	Replace Lake George submarine cable.	Apr-21	\$2.6M	In Design.
Hague Road	41853	2017	Construct feeder tie to Hague Road 52.	Apr-21	\$1.6M	Preliminary design complete, awaiting scheduling.
Hague Road	41853	2017	Ticonderoga-Republic #2 maintenance foot patrol.	Dec-18		Completed 5/15/2018.
Hague Road	41853	2017	Ticonderoga-Republic #2 IVM.	Apr-20		Bid out - on schedule
Port Henry	38551	2017	Complete level 2 maintenance.	Sep-18		Completed 5/29/2018.
Port Henry	38551	2017	Complete level 3 maintenance.	Sep-20		On schedule.
Port Henry	38551	2017	Rebuild State Highway 9N at Sam Spear Road.	Apr-19	\$237.7	APA permit received. Awaiting construction.
Port Henry	38551	2017	Install/replace reclosers for River Rat Hydro..	Apr-19	\$220k	Under construction.
Port Henry	38551	2017	Ticonderoga-Republic #2 maintenance foot patrol.	Dec-18		Completed 5/15/2018.
Port Henry	38551	2017	Ticonderoga-Republic #2 IVM.	Apr-20		Bid out - on schedule
Brook Road	36955	2017	Complete level 2 maintenance.	Jun-18		Completed 10/20/2017.
Brook Road	36955	2017	Complete level 3 maintenance.	Jun-20		On schedule.
Brook Road	36955	2017	Rebuild and convert Coy Road to 7.62 kV.	Apr-19	\$173k	Design complete. In ROW.
Brook Road	36955	2017	Alpine Meadows Road gap closing.	Apr-19	\$51k	Completed 10/25/2018.
Brook Road	36955	2017	Rebuild and convert Barney Road to 7.62 kV.	Apr-20	\$331k	Design complete. In ROW.
Brook Road	36955	2017	Automate feeder tie with Corinth 28851 on Route 9N.	Apr-19	\$85k	Delayed to FY20.
Brook Road	36955	2017	Rebuild and convert Lake Desolation Road to 13.2 kV.	Apr-21	\$311	Design complete. In ROW.
Brook Road	36955	2017	Construct Sodeman Road 130152 feeder.	Apr-20	\$725	In Design.
North Creek	12251	2017	Replace recloser R89479 on County Hwy. 77.	Jul-18	\$78k	Completed 8/9/2018.
North Creek	12251	2017	Perform ERR.	Apr-19		Cancelled.
North Creek	12251	2017	Chestertown-North Creek #2 level 3 maintenance.	Feb-19		4 poles remaining.
Cedar	45351	2017	Maintenance foot patrol.	Dec-18		Completed 11/28/2018.
Cedar	45351	2017	Perform ERR.	Apr-19		Cancelled.
Cedar	45351	2017	Rebuild Buttermilk Falls Road.	Apr-20	\$357k	Design complete. Awaiting construction.
Cedar	45351	2017	Rebuild intersection of Dean & Bardin Roads.	Apr-19	\$45k	WR Cancelled in error. Needs redesign.
EJ West	03851	2017	Maintenance foot patrol.	Dec-18		Completed 7/31/2018.
Indian Lake	31075	2017	Complete level 3 maintenance.	Nov-18		On schedule.
Indian Lake	31075	2017	Tree trimming and hazard tree review.	Apr-19		Complete.
Indian Lake	31075	2017	Perform ERR.	Apr-19		Cancelled.
Indian Lake	31075	2017	Indian Lake-North Creek #1 maintenance foot patrol.	Dec-18		Completed 5/31/2018.
Indian Lake	31075	2017	Indian Lake-North Creek #1 IVM.	Apr-19		Complete.
Burgoyne	33751	2017	Tree trimming and hazard tree review.	Apr-19		Complete.
Burgoyne	33751	2017	Complete level 3 maintenance.	Sep-19		On schedule.
Burgoyne	33751	2017	Perform ERR.	Apr-19		Cancelled.
Burgoyne	33751	2017	Replace recloser R7003 on State Highway 197.	Jun-18	\$63k	Completed 9/7/2018.
Burgoyne	33751	2017	Close distribution gap on West Valley Road.	Jun-18	\$45k	Completed 3/30/2018.

Station	Feeder	Year	Action Plan	Actual Completion Date	Actual Approx. Cost	Comments
Burgoyne	33751	2017	Construct distribution along County Highway 46.	Dec-18	\$164k	Completed 9/19/2018.
Burgoyne	33751	2017	Coach Road ratio relief.	Apr-19	\$91k	Design complete. In ROW.
Burgoyne	33751	2017	State Highway 40 3Ø line extension.	Apr-19	\$96k	WR Cancelled in error. Needs redesign.
Burgoyne	33751	2017	Durkeetown Road rebuild.	Apr-20	\$356k	Design complete. In ROW.
Burgoyne	33751	2017	County Highway 41 rebuild.	Apr-20	\$70k	Completed 9/5/2018.
Burgoyne	33751	2017	Construct feeder tie to Butler 36253.	Apr-20	\$300k	Under construction.
Union Street	37652	2017	Construct distribution on Content Farm and Wallace Rds.	Apr-20	\$125k	In Design.
Union Street	37652	2017	Rebuild Center Cambridge & Brownell Roads.	Apr-21	\$104k	Design complete. In ROW.
Union Street	37652	2017	Cement Mtn.-Cambridge #2 level 3 maintenance.	Sep-19		On schedule.
Union Street	37652	2017	Cement Mtn.-Cambridge #2 IVM.	Apr-20		Bid out - on schedule
Union Street	37652	2017	Cambridge-Hoosick #3 IVM.	Apr-20		Bid out - on schedule
Indian Lake	31076	2017	Complete level 3 maintenance.	Nov-18		On schedule.
Indian Lake	31076	2017	Tree trimming and hazard tree review.	Apr-19		Complete.
Indian Lake	31076	2017	Install reclosers on Indian Lake 30176.	Apr-19		Design complete. Awaiting installation.
Indian Lake	31076	2017	Indian Lake-North Creek #1 maintenance foot patrol.	Dec-18		Completed 5/31/2018.
Indian Lake	31076	2017	Indian Lake-North Creek #1 IVM.	Apr-19		Complete.
Fort Gage	31954	2017	Complete level 3 maintenance.	Nov-18		On schedule.
Fort Gage	31954	2017	Rebuild State Highway 9L.	Apr-19	\$997	Design complete, Delayed to FY21.
Fort Gage	31954	2017	Warrensburg-Fort Gage #8 level 2 maintenance.	Apr-18		Complete.
Fort Gage	31954	2017	Warrensburg-Fort Gage #8 level 3 maintenance.	Apr-20		On schedule.
Fort Gage	31954	2017	Fort Gage-Queensbury #2 level 3 maintenance.	Mar-19		Re-inspected 2018.
Fort Gage	31954	2017	Fort Gage-Queensbury #2 IVM.	Apr-19		Complete.
Fort Gage	31954	2017	Warrensburg-Fort Gage #8 IVM.	Apr-19		Complete.
Fort Gage	31954	2017	Warrensburg-Queensbury #9 IVM.	Apr-19		Complete.
Schroon Lake	42951	2017	Minor Storm Hardening on Hoffman Road.	Apr-18	\$356k	Under construction.
Schroon Lake	42951	2017	Minor Storm Hardening on Blue Ridge Road.	Apr-19	\$447k	Awaiting APA permit.
Schroon Lake	42951	2017	State Highway 74 cut-out mounted reclosers.	Dec-18	\$40k	Completed 9/14/2018.
Schroon Lake	42951	2017	Warrensburg-Chestertown #6 level 3 maintenance.	Feb-19		15 poles remaining.
Schroon Lake	42951	2017	Chestertown-Schroon #3 level 3 maintenance.	Nov-18		Complete, except replacement of pole 102
Schroon Lake	42951	2017	Chestertown-Schroon #3 IVM.	Apr-19		Complete.
Vail Mills	39252	2017	Upgrade recloser R5237 on pole 5 State Highway 29.	Apr-19	\$60k	Completed 2/20/2018.
Vail Mills	39252	2017	Complete level 2 maintenance.	Aug-18		Completed 6/16/2018.
Vail Mills	39252	2017	Complete level 3 maintenance.	Aug-20		On schedule.
Crown Point	24951	2017	Complete level 3 maintenance.	Jul-18		On schedule.
Crown Point	24951	2017	Convert Creek Road to Pearl Street	Apr-19	\$228k	Awaiting construction.
Crown Point	24951	2017	Breed Hill Road fusing.	Apr-19	\$34k	Awaiting construction.
Crown Point	24951	2017	Lake Road ratio relief.	Apr-19	\$129k	Completed 9/14/2018.
Crown Point	24951	2017	Creek Road rear lot relocation.	Apr-20	\$95k	Design complete. In ROW.
Crown Point	24951	2017	Ticonderoga-Republic #2 maintenance foot patrol.	Dec-18		Completed 5/15/2018.
Crown Point	24951	2017	Ticonderoga-Republic #2 IVM.	Apr-20		Bid out - on schedule
East Springfield	47751	2017	Complete level 3 maintenance.	Jul-18		Completed 5/23/2018.
Chestertown	04251	2017	Complete level 3 maintenance.	Jul-19		On schedule.
Chestertown	04251	2017	Investigate feeder tie to Warrensburg 32152.	Dec-18		Complete.

Station	Feeder	Year	Action Plan	Actual Completion Date	Actual Approx. Cost	Comments
Chestertown	04251	2017	Minor Storm Hardening on White Schoolhouse Road..	Sep-18	\$336k	Completed 8/31/2018.
Chestertown	04251	2017	Warrensburg-Chestertown #6 level 3 maintenance.	Feb-19		15 poles remaining.
Chestertown	04252	2017	Complete level 2 maintenance.	Sep-18		Completed 3/21/2018.
Chestertown	04252	2017	Complete level 3 maintenance.	Sep-20		On schedule.
Chestertown	04252	2017	Warrensburg-Chestertown #6 level 3 maintenance.	Feb-19		15 poles remaining.
Wilton	32952	2017	Complete level 2 maintenance.	Jun-18		Completed 6/20/2018.
Wilton	32952	2017	Complete level 3 maintenance.	Jun-20		On schedule.
Wilton	32952	2017	Construct Butler 36253 & transfer Fortsville Rd.	Dec-18	\$840k	Under construction.
Wilton	32952	2017	Rebuild and convert State Hwy. 32 to 3Ø.	Apr-22	\$680k	In Design.
Bolton	28451	2017	Complete level 3 maintenance.	Jul-19		On schedule.
Bolton	28451	2017	Rebuild Trout Lake Road to transfer load to Bolton 28452.	Apr-19	\$574k	Delayed to FY21 due to OPEX challenge. Awaiting scheduling
Bolton	28451	2017	Construct 3Ø feeder tie to Warrensburg 32151.	Apr-19	\$1,068	Under construction.

## I. NORTHERN REGION

### 1. OPERATING REGIONAL PERFORMANCE

#### a. HISTORIC CAIDI AND SAIFI INDICES

IDS Info:

	2018	2017	2016	2015	2014	2013
CAIDI (Target 2.111)	1.84	2.34	1.87	1.51	2.13	1.78
SAIFI (Target 1.412)	1.34	1.48	1.35	1.50	1.06	1.47
SAIDI	2.47	3.45	2.52	2.27	2.25	2.61
Interruptions	1,683	1,831	1,654	1,507	1,590	1,753
Customers Interrupted	182,717	201,008	182,146	201,982	141,476	197,152
Customers Hours Interrupted	336,850	469,371	340,842	305,632	301,519	350,148
Customers Served	136,426	135,968	135,005	134,501	134,091	133,987
Customers Per Interruption	108.57	109.78	110.12	134.03	88.98	112.47
Availability Index	99.9718	99.9606	99.9713	99.9741	99.9743	99.9702
Interruptions/1000 Customers	12.34	13.47	12.25	11.20	11.86	13.08

#### b. DISCUSSION OF REGIONAL PERFORMANCE

In 2018, the Northern Region met its CAIDI reliability target and met its SAIFI reliability target as set forth by the New York Public Service Commission (PSC). The final System Average Interruption Frequency Index (SAIFI) result was 1.34 interruptions, 5% below the PSC goal of 1.412 interruptions. As shown in the table above, the Customer Average Interruption Duration index (CAIDI) was 1.84 in 2018, 13% below the PSC's regional target of 2.111 hours.

The 2018 CAIDI result was 21% below the 2017 result of 2.34 hours, and 4% below the previous 5-year average of 1.92 hours. The 2018 SAIFI was 9% below the 2017 result of 1.48 interruptions, and 2% below the previous 5-year average of 1.37 interruptions.

In 2018, excluding major storms, the Northern Region experienced 25 transmission interruptions. These interruptions accounted for 1% of the region's total interruptions (25 of 1,683), 26% of the region's total customers interrupted (CI), (48,053 of 182,717), and 22% (75,679 of 336,848) of the region's total customer-hours interrupted (CHI). Overall, transmission interruptions had a CAIDI of 1.57 hours, and a SAIFI of 0.35 interruptions.

The number of transmission-related interruptions increased from 24 in 2017 to 25 in 2018 (an increase of 4%). The number of customers interrupted increased from 29,412 in 2017, to 48,053 in 2018 (an increase of 63%), while the customer-hours interrupted increased from 55,307 in 2017, to 75,679 in 2018 (an increase of 37%).

In 2018, excluding major storms, the Northern Region experienced 12 substation interruptions. These interruptions accounted for 1% of the region's total interruptions (12 of 1,683), 10% of the region's total customers interrupted, (17,852 of 182,717), and 8% (25,875 of 336,848) of the region's total customer-hours interrupted. Overall, substation interruptions had a CAIDI of 1.45 hours, and a SAIFI of 0.13 interruptions.

The number of substation-related interruptions increased from 7 to 12 from 2017 to 2018 (an increase of 71%). The number of customers interrupted decreased from 25,260 in 2017, to 17,852 in 2018 (a decrease of 29%), while the customer-hours interrupted decreased from 31,933 in 2017, to 25,875 in 2018 (a decrease of 19%).

In 2018, excluding major storms, the Northern Region experienced 1,646 distribution interruptions. These interruptions accounted for 98% of the region's total interruptions (1,646 of 1,683), 64% of the region's total customers interrupted, (116,812 of 182,717), and 70% (235,294 of 336,848) of the region's total customer-hours interrupted. Overall, distribution interruptions had a CAIDI of 2.01 hours, and a SAIFI of 0.86 interruptions.

The number of distribution-related interruptions decreased from 1,800 to 1,646 from 2017 to 2018 (a decrease of 9%). The number of customers interrupted decreased from 146,336 in 2017, to 116,812 in 2018 (a decrease of 20%), while the customer-hours interrupted decreased from 382,131 in 2017, to 235,294 in 2018 (a decrease of 38%).

### c. MONTHLY CAIDI AND SAIFI GRAPHS

The graphs on the following page show the monthly CAIDI and Year-to-Date SAIFI for the Northern Region for 2018.

The CAIDI graph shows the individual CAIDI by month. The Northern Region was below the PSC minimum CAIDI of 2.2111 hours for 10 of the 12 months in 2018, with April and October being the two months above target.

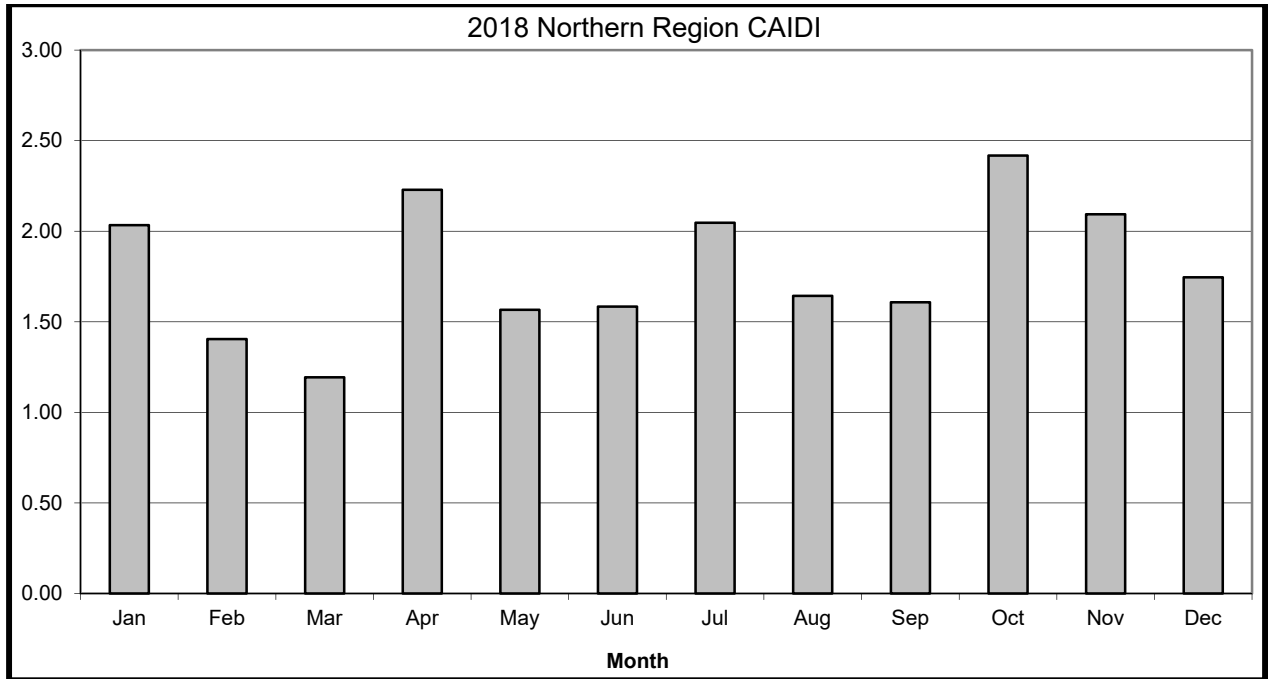
- Excluding Major Storms, there were 2.23 hours of CAIDI for April, which was mainly due to device failures and tree related outages. There were 59 interruptions due to equipment failures during April. Equipment failures accounted for 7% (13,275 of 182,717) customers interrupted and 10% (33,886 of 336,850) customer-hours interrupted. In total there were 15% (26,729 of 182,717) customers interrupted and 18% (59,648 of 336,850) customer-hours interrupted during April.
- Excluding Major Storms, there were 2.42 hours of CAIDI for October, which was mainly due to tree related outages. There were 43 interruptions due to trees during October. Tree related interruptions accounted for 1% (2,260 of 182,717) of the customers interrupted and 2% (6,508 of 336,850) customer-hours interrupted. In total there were 4% (7,305 of 182,717) customers interrupted and 5% (17,667 of 336,850) customer-hours interrupted during October.

The SAIFI graph shows the cumulative SAIFI by month. The Northern Region ended the year at 1.34 interruptions, below the minimum SAIFI target of 1.412 interruptions.

- Excluding Major Storms, there were 26,729 customers interrupted from April to May. Between April through May SAIFI increased by 0.2. This is mainly due to the 13,275 customer interruptions caused by equipment failures.

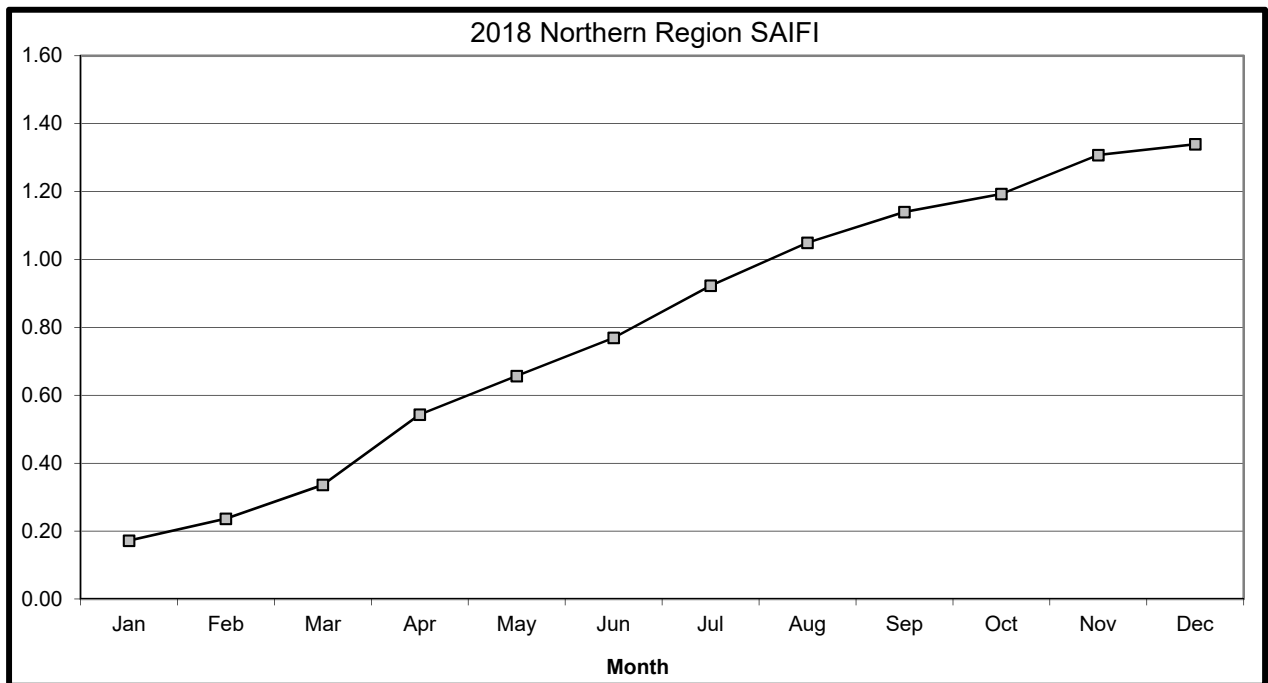


GRAPH OF MONTHLY CAIDI AND SAIFI FOR THE NORTHERN REGION



PSC CAIDI Goal:	
Minimum	2.2111
2018 Actual	1.84

PSC SAIFI Goal:	
Minimum	1.412
2018 Actual	1.34



d. PSC CAUSE CODES

1) Number of Events by Cause – Historical

IDS Info:

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	1,144	180	109	0	271	1,680
<b>02</b> Tree Contacts	504	651	550	535	423	648
<b>03</b> Overloads	5	7	8	4	5	4
<b>04</b> Oper. Error	6	2	4	6	5	7
<b>05</b> Equipment	408	454	385	363	437	440
<b>06</b> Accidents	262	250	245	221	223	203
<b>07</b> Prearranged	35	23	36	24	27	44
<b>08</b> Cust. Equip.	0	0	0	1	0	0
<b>09</b> Lightning	63	118	61	62	104	113
<b>10</b> Unknown	400	326	365	291	366	294
<b>Total</b>	<b>2,827</b>	<b>2,011</b>	<b>1,763</b>	<b>1,507</b>	<b>1,861</b>	<b>3,433</b>

2) Customers Interrupted by Cause – Historical

IDS Info:

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	84,763	24,128	7,270	0	25,497	179,934
<b>02</b> Tree Contacts	37,260	63,157	44,582	42,152	25,046	50,843
<b>03</b> Overloads	18	4,534	49	22	23	11
<b>04</b> Oper. Error	199	1,227	3,063	6,958	1,363	23,751
<b>05</b> Equipment	75,891	57,339	65,689	61,693	58,753	54,385
<b>06</b> Accidents	21,395	21,261	29,019	30,478	18,953	36,868
<b>07</b> Prearranged	11,819	18,165	5,229	21,675	4,413	10,398
<b>08</b> Cust. Equip.	0	0	0	158	0	0
<b>09</b> Lightning	3,710	5,987	4,255	6,491	6,159	3,933
<b>10</b> Unknown	32,425	29,338	30,260	32,355	26,766	16,963
<b>Total</b>	<b>267,480</b>	<b>225,136</b>	<b>189,416</b>	<b>201,982</b>	<b>166,973</b>	<b>377,086</b>

### 3) Customer-Hours Interrupted by Cause – Historical

IDS Info:

Cause Code	2018	2017	2016	2015	2014	2013
01 Major Storms	694,029	108,835	51,793	0	191,989	1,869,757
02 Tree Contacts	94,622	158,959	126,982	86,194	58,157	116,268
03 Overloads	79	24,363	86	45	63	33
04 Oper. Error	331	616	1,719	6,249	6,396	23,989
05 Equipment	134,501	168,457	115,525	99,439	143,469	101,453
06 Accidents	38,125	33,613	38,178	39,607	30,680	49,951
07 Prearranged	19,859	12,312	4,545	12,702	6,222	16,334
08 Cust. Equip.	0	0	0	137	0	0
09 Lightning	5,054	10,919	7,665	11,100	18,996	10,494
10 Unknown	44,277	60,133	46,143	50,157	37,535	31,625
Total	1,030,877	578,206	392,635	305,361	493,506	2,219,905

### 4) Interruptions, Customers Interrupted and Customer-Hours Interrupted – 2018

Cause Code	Interruptions		Customers Interrupted		Customer-hours Interrupted	
	Number	% Total	Number	% Total	Number	% Total
01 Major Storms	1,144	40.5%	84,763	31.7%	694,029	67.3%
02 Tree Contacts	504	17.8%	37,260	13.9%	94,622	9.2%
03 Overloads	5	0.2%	18	0.0%	79	0.0%
04 Oper. Error	6	0.2%	199	0.1%	331	0.0%
05 Equipment	408	14.4%	75,891	28.4%	134,501	13.0%
06 Accidents	262	9.3%	21,395	8.0%	38,125	3.7%
07 Prearranged	35	1.2%	11,819	4.4%	19,859	1.9%
08 Cust. Equip.	0	0.0%	0	0.0%	0	0.0%
09 Lightning	63	2.2%	3,710	1.4%	5,054	0.5%
10 Unknown	400	14.1%	32,425	12.1%	44,277	4.3%
Total	2,827	100.0%	267,480	100.0%	1,030,877	100.0%

e. **INTERRUPTION REVIEW BY PSC CAUSE CODES**

**Cause Code 01 - Major Storms**

In 2018, Major Storms accounted for 40% of interruptions, 32% of customers interrupted, and 67% of Customer-Hours Interrupted.

Interruptions due to Major Storm were up 536% from 2017, and up 155% over the 5 year average. Customers interrupted due to Major Storms were up 251% from 2017, and up 79% over the 5 year average. Customer-Hours interrupted were up 538% from 2017 and up 56% over the 5 year average.

The remaining PSC code descriptions do not include Major Storms in the percentages.

**Cause Code 02 - Tree Contacts**

In 2018, Tree Contacts accounted for 30% of interruptions, 20% of customers interrupted, and 28% of Customer-Hours Interrupted.

Interruptions due to Tree Contacts were down 23% from 2017, and down 10% over the 5 year average. Customers interrupted due to Tree Contacts were down 41% from 2017, and down 17% over the 5 year average. Customer-Hours interrupted were down 40% from 2017 and down 13% over the 5 year average.

Tree Contacts were the largest cause of interruptions in 2018.

**Cause Code 03 - Overloads**

In 2018, Overloads accounted for 0% of interruptions, 0% of customers interrupted, and 0% of Customer-Hours Interrupted.

Interruptions due to Overloads were down 29% from 2017, and down 17% over the 5 year average. Customers interrupted due to Overloads were down 100% from 2017, and down 98% over the 5 year average. Customer-Hours interrupted were down 100% from 2017 and down 98% over the 5 year average.

Overloads were the 8th largest cause of interruptions in 2018.

**Cause Code 04 - Operator Error**

In 2018, Operator Errors accounted for 0% of interruptions, 0% of customers interrupted, and 0% of Customer-Hours Interrupted.

Interruptions due to Operator Error were up 200% from 2017, and up 20% over the 5 year average. Customers interrupted due to Operator Error were down 84% from 2017, and down 97% over the 5 year average. Customer-Hours interrupted were down 46% from 2017 and down 96% over the 5 year average.

Operator Error was the 7th largest cause of interruptions in 2018.

### **Cause Code 05 - Equipment Failure**

In 2018, Equipment Failure accounted for 24% of interruptions, 42% of customers interrupted, and 40% of Customer-Hours Interrupted.

Interruptions due to Equipment Failure were down 10% from 2017, and down 2% over the 5 year average. Customers interrupted due to Equipment Failure were up 32% from 2017, and up 27% over the 5 year average. Customer-Hours interrupted were down 20% from 2017 and up 7% over the 5 year average.

Equipment Failures were the 2nd largest cause of interruptions in 2018.

### **Cause Code 06 - Accidents**

In 2018, Accidents accounted for 16% of interruptions, 12% of customers interrupted, and 11% of Customer-Hours Interrupted.

Interruptions due to Accidents were up 5% from 2017, and up 15% over the 5 year average. Customers interrupted due to Accidents were up 1% from 2017, and down 22% over the 5 year average. Customer-Hours interrupted were up 13% from 2017 and down 1% over the 5 year average.

Accidents were the 4th largest cause of interruptions in 2018.

### **Cause Code 07 - Prearranged**

In 2018, Prearranged accounted for 2% of interruptions, 6% of customers interrupted, and 6% of Customer-Hours Interrupted.

Interruptions due to Prearranged were up 52% from 2017, and up 13% over the 5 year average. Customers interrupted due to Prearranged were down 35% from 2017, and down 1% over the 5 year average. Customer-Hours interrupted were up 61% from 2017 and up 91% over the 5 year average.

Prearranged was the 6th largest cause of interruptions in 2018.

### **Cause Code 08 - Customer Equipment**

There were no Customer Equipment interruptions in 2018.

### **Cause Code 09 - Lightning**

In 2018, Lightning accounted for 4% of interruptions, 2% of customers interrupted, and 2% of Customer-Hours Interrupted.

Interruptions due to Lightning were down 47% from 2017, and down 32% over the 5 year average. Customers interrupted due to Lightning were down 38% from 2017, and down 31% over the 5 year average. Customer-Hours interrupted were down 54% from 2017 and down 57% over the 5 year average.

Lightning was the 5th largest cause of interruptions in 2018.

**Cause Code 10 - Unknown**

In 2018, Unknown causes accounted for 24% of interruptions, 18% of customers interrupted, and 13% of Customer-Hours Interrupted.

Interruptions due to Unknown causes were up 23% from 2017, and up 22% over the 5 year average. Customers interrupted due to Unknown causes were up 11% from 2017, and up 19% over the 5 year average. Customer-Hours interrupted were down 26% from 2017 and down 2% over the 5 year average.

Unknown causes were the 3rd largest cause of interruptions in 2018.

f. DISCUSSION OF REGIONAL CAPEX PROJECTS WITH 2018/2019 SPENDS:

The Northern Region continues to work on capital projects in order to maintain customer satisfaction and future reliability. Some specific projects that were constructed in either CY18 or will be constructed in CY19 are listed below, in addition to a description of a major infrastructure project.

There are load relief projects scheduled to be completed throughout the Northern Region. Most of these load relief projects are ratio transformer replacements or voltage conversions. Line reconductoring is also included in the voltage conversions where appropriate.

There are projects where lines are being rebuilt or reconductored. These projects are either the result of the company's Storm Hardening program, engineering reliability reviews (ERRs) conducted on the Worst Performing Circuits, or are the responses to customer inquiries via the Quick Resolution System (QRS).

**Major Capital Projects for Northern Region:**

<b>Region</b>	<b>Project Name</b>	<b>Project Type</b>	<b>Fin Sys Proj. No.</b>	<b>Finish</b>	<b>Total Spend</b>
Northern	NR-Higley 92451-NYSHwy56_Number9	Specific	C046865	01/2018	\$1,087,000



g. DISCUSSION OF REGIONAL PERFORMANCE OF LVAC NETWORK DISTRIBUTION SYSTEM(S):

**City of Watertown – Mill Street LVAC Network**

The Watertown LVAC Network serves the Public Square area of the City of Watertown as well as one or two blocks of the following streets: Court Street, Arsenal Street, Stone Street, Washington Street, Clinton Street, Franklin Street, and State Street. This network is supplied by 5 – 4.8kV feeders, all from the Mill Street Substation. This system serves approximately 400 customer accounts and experienced a peak load of approximately 3.584 MVA in 2018.

The table below lists the breaker operations in 2018 that were a result of a fault and/or failure.

<b>Substation</b>	<b>Feeder Number</b>	<b>Breaker Number</b>	<b># Breaker Operations from Failures</b>
Mill Street	74860	R600	0
Mill Street	74871	R710	0
Mill Street	74872	R720	0
Mill Street	74873	R730	0
Mill Street	74874	R740	0

As shown above, the Watertown LVAC Network experienced zero feeder outages in 2018. There were not any customer interruptions and at no time was the network operated beyond its single contingency (N-1) design criteria.

No major events associated with the network occurred in 2018.

Annual maintenance consisted of manhole and vault inspections, network protector and transformer inspections, and network protector operation checks. Equipment maintenance in 2018 consisted of manhole and vault inspections, network protector and transformer inspections, and network protector operation checks.

There are two major projects:

**1. Mill Street - 2014 Upgrades - N-1 Project**

Resulting from the 04/2014 Network Study, 4.8kV Feeders 74872 and 74875 are to be reconnected onto Bus "E" to eliminate the loss of 3 network feeders for a 4.8kV station Bus "D" failure. In addition, N7322, N7403, & Vault 104 (Feeder 74860 source) will be transferred onto 74875 so the feeder relay settings can be changed for Arc Flash Mitigation at the station. The project is scheduled to start in FY2019.

## **2. Mill Street - 2014 Upgrades - N-2 Project**

Resulting from the 04/2014 Network Study, two 500kVA network transformers will be installed to support the general network during a double contingency condition: (1) install N6005 near the corner of Mill Street & Factory Avenue (2) install N7405 near the corner of Franklin Street & Public Square. The project is scheduled to start in 2020.

## 2. OPERATING CIRCUIT LISTS

This section includes the following three tables and Worst Performing Circuit analysis for the Northern Region.

- a. Worst Performing Circuit List
- b. Worst Performing Circuits with 3 Year History for CAIDI and SAIFI Indices
- c. Worst Performing Circuits by number of Momentary Interruptions

D WORST PERFORMING CIRCUIT LIST

NORTHERN REGION

#	A CUST. SERVED	B TOTAL INTER.	C # CUST. INTER.	D CUST. HRS. INTER.	C/A SAIFI	D/A SAIDI	D/C CAIDI	NUMBER OF MOMENTARIES
	2,141	47	7,986	23,948	3.73	11.19	3.00	3
	2,785	28	11,880	16,963	4.27	6.09	1.43	7
	857	33	3,571	7,692	4.17	8.98	2.15	3
	817	25	2,402	10,222	2.94	12.51	4.26	1
	2,671	81	6,219	14,143	2.33	5.30	2.27	1
1	267	24	737	7,193	2.76	26.94	9.76	3
	594	18	2,788	6,770	4.69	11.40	2.43	3
	2,303	31	8,885	9,244	3.86	4.01	1.04	4
	659	15	2,063	7,800	3.13	11.84	3.78	1
	2,233	23	5,979	8,397	2.68	3.76	1.40	3
	1,458	17	5,104	6,995	3.50	4.80	1.37	2
	1,686	46	3,356	7,181	1.99	4.26	2.14	2
1652	2,257	42	3,722	9,522	1.65	4.22	2.56	2
	1,186	12	4,139	7,311	3.49	6.16	1.77	4
52	829	16	2,883	4,147	3.48	5.00	1.44	4
	308	27	1,300	1,744	4.22	5.66	1.34	3
	161	16	824	1,942	5.12	12.06	2.36	4
55	1,360	22	2,927	4,982	2.15	3.66	1.70	1

Regional Goals:  
CAIDI Min. 2.111  
SAIFI Min. 1.412

b. NATIONAL GRID WORST PERFORMING CIRCUITS WITH 3 YEAR HISTORY FOR CAIDI AND SAIFI INDICES

NORTHERN REGION

FEEDER #	2018 CAIDI	2017 CAIDI	2016 CAIDI	2015 CAIDI	2018 SAIFI	2017 SAIFI	2016 SAIFI	2015 SAIFI
THOUSAND ISL 81452	3.00	4.33	2.20	2.46	3.73	1.96	1.71	4.44
LYME 73352	1.43	2.30	3.26	2.56	4.27	0.57	1.22	0.34
GILPIN BAY 95661	2.15	2.43	2.26	1.57	4.17	2.96	2.40	0.82
STAR LAKE 72761	4.26	5.23	4.45	2.04	2.94	0.43	1.76	0.97
LOWVILLE 77354	2.27	1.87	1.89	1.33	2.33	4.30	2.12	3.06
SUNDAY CREEK 87651	9.76	3.02	3.35	2.12	2.76	2.38	1.53	4.03
GABRIELS 83561	2.43	1.39	1.41	1.34	4.69	2.42	2.41	1.21
THOUSAND ISL 81458	1.04	2.07	4.09	2.16	3.86	1.86	1.36	2.54
STAR LAKE 72762	3.78	7.21	5.16	1.61	3.13	1.01	2.15	2.37
LYME 73351	1.40	1.04	1.74	0.79	2.68	2.04	0.16	0.95
LITTLE RIVER 95554	1.37	2.81	2.07	0.48	3.50	0.60	0.89	1.51
BREMEN 81556	2.14	2.75	2.98	0.94	1.99	1.55	1.86	7.41
NORTH CARTHAGE 81652	2.56	3.91	1.98	2.76	1.65	1.68	3.52	3.60
THOUSAND ISL 81454	1.77	1.62	1.10	1.11	3.49	1.04	2.10	1.91
BLOOMINGDALE 84162	1.44	2.19	1.31	1.02	3.48	0.83	6.20	3.40
PAUL SMITHS 83462	1.34	1.47	1.30	1.92	4.22	3.96	2.70	3.42
FRANKLIN 84361	2.36	2.63	1.96	0.95	5.12	1.33	9.41	5.83
LAWRENCE AVE 97655	1.70	1.53	1.08	1.03	2.15	0.59	1.62	3.94

Regional Goals:  
CAIDI Min. 2.111  
SAIFI Min. 1.412

c. NATIONAL GRID WORST PERFORMING CIRCUITS BY # OF MOMENTARY INTERRUPTIONS

NORTHERN REGION

Feeders			Customer Momentaries				Ranks		
Volts (kV)	Station Name	Ckt/F No.	Substation	Transmission	Distribution	Total	Within Region	Within System	Reliability Ranking
No circuits experienced 10 or more momentary interruptions in 2018.									

d. WORST PERFORMING CIRCUIT ANALYSIS

For 2018, the Company identified eighteen Worst Performing Circuits in the Northern Region. The list consists of eleven 13.2kV circuits and seven 4.8kV circuits.

For the Northern Region, the PSC minimum CAIDI is 2.111 hours and the PSC minimum SAIFI is 1.412 interruptions.

## 1. THOUSAND ISL 81452 – 13.2kV

Profile: 2,141 Customers, 112.5 Circuit Miles  
 Indices: CAIDI = 3.00, SAIFI = 3.73

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	8	17.02%	362	4.53%	2,308	9.64%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	17	36.17%	4,766	59.68%	14,317	59.78%
6	ACCIDENTS	10	21.28%	1,156	14.48%	3,886	16.23%
7	PREARRANGED	2	4.26%	919	11.51%	1,160	4.84%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	2.13%	13	0.16%	28	0.12%
10	UNKNOWN	9	19.15%	770	9.64%	2,250	9.39%
Totals		47	100.00%	7,986	100.00%	23,948	100.00%

### **Problem Analysis:**

- There were 47 interruptions on the Thousand Isl 81452 in 2018.
- There was 1 transmission interruption.
  - This Transmission interruption occurred on January 15, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 28% of the total customers interrupted (2,232 of 7,986), and 16% of the total customer-hours interrupted (3,869 of 23,948).
- There were no substation interruptions.
- The remaining 46 events occurred at the distribution level.
- The distribution circuit breaker for the Thousand Isl 81452 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Thousand Isl 81452 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Thousand Isl 81452 in 2018, accounting for 36% of total interruptions (17 of 47). Accidents were the 2nd leading cause of interruptions, accounting for 21% of total interruptions (10 of 47). Unknown were the 3rd leading cause of interruptions, accounting for 19% of total interruptions (9 of 47).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Thousand Isl 81452 in 2018, accounting for 60% of total customers interrupted (4,766 of 7,986). Accidents were the 2nd leading cause of customers interrupted, accounting for 14% of total customers interrupted (1,156 of 7,986). Prearranged were the 3rd leading cause of customers interrupted, accounting for 12% of total customers interrupted (919 of 7,986).



- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Thousand Isl 81452 in 2018, accounting for 60% of total customer-hours interrupted (14,317 of 23,948). Accidents were the 2nd leading cause of customer-hours interrupted, accounting for 16% of total customer-hours interrupted (3,886 of 23,948). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 10% of total customer-hours interrupted (2,308 of 23,948).
- Of the 47 interruptions on this circuit, 24 affected 10 customers or less, with 7 being single customer outages.

**Action Taken:**

- In 2016, the Regional Forestry Department completed scheduled distribution cycle pruning.
- In 2017, the Regional Forestry Department completed the extended hazard tree maintenance.
- In July 2017, an I&M foot patrol was completed.
- The level 2 maintenance work identified from the feeder inspection was completed in July 2018.

**Action Plan:**

- The next scheduled distribution cycle pruning will be completed in 2022.
- The level 3 maintenance work identified from the feeder inspection will be completed by July 2020.
- This feeder is scheduled to be inspected again in 2022.
- No further action is required.

## 2. LYME 73352 - 13.2kV

Profile: 2,785 Customers, 129.6 Circuit Miles  
 Indices: CAIDI = 1.43, SAIFI = 4.27

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	3	10.71%	2,182	18.37%	4,297	25.33%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	2	7.14%	92	0.77%	213	1.26%
5	EQUIPMENT	10	35.71%	5,588	47.04%	9,108	53.69%
6	ACCIDENTS	8	28.57%	2,894	24.36%	1,777	10.48%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	3.57%	2	0.02%	2	0.01%
10	UNKNOWN	4	14.29%	1,122	9.44%	1,566	9.23%
Totals		28	100.00%	11,880	100.00%	16,963	100.00%

### Problem Analysis:

- There were 28 interruptions on the Lyme 73352 in 2018.
- There was 1 transmission interruption.
  - This Transmission interruption occurred on January 15, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 23% of the total customers interrupted (2,733 of 11,880), and 28% of the total customer-hours interrupted (4,828 of 16,963).
- There were no substation interruptions.
- The remaining 27 events occurred at the distribution level.
- The distribution circuit breaker for the Lyme 73352 experienced 7 momentary operations in 2018.
- The distribution circuit breaker for the Lyme 73352 experienced 1 sustained operation (lockout) in 2018 due to an Osprey. This interruption accounted for 24% of the total amount of customers interrupted (2,836 out of 8,005) and 8% of the total amount of the customer-hours interrupted (1,426 out of 12,134).
  - This lockout occurred on August 01, 2018, coded as a cause of animal (PSC cause code 06). This lockout accounted for 24% of the total customers interrupted (2,836 of 11,880), and 8% of the total customer-hours interrupted (1,426 of 16,963).
- Equipment Failures were the leading cause of interruptions on the Lyme 73352 in 2018, accounting for 36% of total interruptions (10 of 28). Accidents were the 2nd leading cause of interruptions, accounting for 29% of total interruptions (8 of 28). Unknown were the 3rd leading cause of interruptions, accounting for 14% of total interruptions (4 of 28).

- Equipment Failures were the leading cause of customers interrupted (CI) on the Lyme 73352 in 2018, accounting for 47% of total customers interrupted (5,588 of 11,880). Accidents were the 2nd leading cause of customers interrupted, accounting for 24% of total customers interrupted (2,894 of 11,880). Trees were the 3rd leading cause of customers interrupted, accounting for 18% of total customers interrupted (2,182 of 11,880).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Lyme 73352 in 2018, accounting for 54% of total customer-hours interrupted (9,108 of 16,963). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 25% of total customer-hours interrupted (4,297 of 16,963). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 10% of total customer-hours interrupted (1,777 of 16,963).
- Of the 28 interruptions on this circuit, 14 affected 10 customers or less, with 6 being single customer outages.

**Action Taken:**

- In 2015, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2015, the Regional Forestry Department completed the scheduled extended hazard tree removal.
- In December 2015, an I&M foot patrol was completed.
- All level 2 maintenance work identified from the feeder inspection was completed by December 2018.
- All level 3 maintenance work identified from the feeder inspection was completed by December 2018.

**Action Plan:**

- The next I&M foot patrol is scheduled for 2020.
- The next distribution cycle pruning is scheduled for 2021.
- There are no further actions required.

### 3. GILPIN BAY 95661 – 4.8kV

*Profile: 857 Customers, 56.4 Circuit Miles*  
*Indices: CAIDI = 2.15, SAIFI = 4.17*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	18	54.55%	1,507	42.20%	2,635	34.26%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	10	30.30%	283	7.93%	1,256	16.33%
6	ACCIDENTS	1	3.03%	30	0.84%	4	0.05%
7	PREARRANGED	2	6.06%	875	24.50%	1,493	19.41%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	2	6.06%	876	24.53%	2,303	29.94%
Totals		33	100.00%	3,571	100.00%	7,692	100.00%

**Problem Analysis:**

- There were 33 interruptions on the Gilpin Bay 95661 in 2018.
- There were 2 transmission interruptions in 2018.
  - The first Transmission interruption occurred on June 18, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 24% of the total customers interrupted (874 of 3,571), and 5% of the total customer-hours interrupted (364 of 7,692).
  - The second Transmission interruption occurred on August 18, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 24% of the total customers interrupted (873 of 3,571), and 30% of the total customer-hours interrupted (2,299 of 7,692).
- There were no substation interruptions.
- The remaining 31 events occurred at the distribution level.
- The distribution circuit breaker for the Gilpin Bay 95661 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Gilpin Bay 95661 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Gilpin Bay 95661 in 2018, accounting for 55% of total interruptions (18 of 33). Equipment Failures were the 2nd leading cause of interruptions, accounting for 30% of total interruptions (10 of 33). Prearranged were the 3rd leading cause of interruptions, accounting for 6% of total interruptions (2 of 33).
- Trees were the leading cause of customers interrupted (CI) on the Gilpin Bay 95661 in 2018, accounting for 42% of total customers interrupted (1,507 of 3,571). Unknown

- were the 2nd leading cause of customers interrupted, accounting for 25% of total customers interrupted (876 of 3,571). Prearranged were the 3rd leading cause of customers interrupted, accounting for 25% of total customers interrupted (875 of 3,571).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Gilpin Bay 95661 in 2018, accounting for 34% of total customer-hours interrupted (2,635 of 7,692). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 30% of total customer-hours interrupted (2,303 of 7,692). Prearranged were the 3rd leading cause of customer-hours interrupted, accounting for 19% of total customer-hours interrupted (1,493 of 7,692).
  - Of the 33 interruptions on this circuit, 8 affected 10 customers or less, with 3 being single customer outages.

**Action Taken:**

- In October 2018, an I&M foot patrol was completed.
- In 2017, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2009, the Regional Forestry Department performed hazard tree removal.
- TripSavers were installed in FY19.

**Action Plan:**

- All level 2 maintenance work identified from the feeder inspection will be completed by October 2019.
- All level 3 maintenance work identified from the feeder inspection will be completed by October 2021.
- The next I&M foot patrol will be completed in 2023.
- The next distribution cycle pruning is scheduled for 2022.
- There are no further actions required.

#### 4. STAR LAKE 72761 – 4.8kV

Profile: 817 Customers, 45.8 Circuit Miles  
 Indices: CAIDI = 4.26, SAIFI = 2.94

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	12	48.00%	523	21.77%	2,514	24.59%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	20.00%	827	34.43%	4,054	39.65%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	1	4.00%	815	33.93%	3,083	30.16%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	7	28.00%	237	9.87%	572	5.59%
Totals		25	100.00%	2,402	100.00%	10,222	100.00%

**Problem Analysis:**

- There were 25 interruptions on the Star Lake 72761 in 2018.
- There were 2 transmission interruptions.
  - The first Transmission interruption occurred on April 09, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 34% of the total customers interrupted (810 of 2,402), and 38% of the total customer-hours interrupted (3,929 of 10,222).
  - The second Transmission interruption occurred on November 03, 2018, coded as a cause of unknown (PSC cause code 07). This lockout accounted for 34% of the total customers interrupted (815 of 2,402), and 30% of the total customer-hours interrupted (3,083 of 10,222).
- There were no substation interruptions.
- The remaining 23 events occurred at the distribution level.
- The distribution circuit breaker for the Star Lake 72761 experienced 1 momentary operation in 2018.
- The distribution circuit breaker for the Star Lake 72761 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Star Lake 72761 in 2018, accounting for 48% of total interruptions (12 of 25). Unknown were the 2nd leading cause of interruptions, accounting for 28% of total interruptions (7 of 25). Equipment Failures were the 3rd leading cause of interruptions, accounting for 20% of total interruptions (5 of 25).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Star Lake 72761 in 2018, accounting for 34% of total customers interrupted (827 of 2,402). Prearranged were the 2nd leading cause of customers interrupted, accounting for 34% of

total customers interrupted (815 of 2,402). Trees were the 3rd leading cause of customers interrupted, accounting for 22% of total customers interrupted (523 of 2,402).

- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Star Lake 72761 in 2018, accounting for 40% of total customer-hours interrupted (4,054 of 10,222). Prearranged were the 2nd leading cause of customer-hours interrupted, accounting for 30% of total customer-hours interrupted (3,083 of 10,222). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 25% of total customer-hours interrupted (2,514 of 10,222).
- Of the 25 interruptions on this circuit, 12 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- In 2015, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2014, the Regional Forestry Department completed the scheduled hazard tree removal.
- An I&M foot patrol was completed in October 2018.

**Action Plan:**

- All level 2 maintenance work identified from the feeder inspection will be completed by October 2019.
- All level 3 maintenance work identified from the feeder inspection will be completed by October 2021.
- The next I&M foot patrol will be completed in 2023.
- The next scheduled distribution cycle pruning will be completed in 2021.

## 5. LOWVILLE 77354 - 13.2kV

Profile: 2,671 Customers, 172 Circuit Miles  
 Indices: CAIDI = 2.27, SAIFI = 2.33

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	45	55.56%	4,462	71.75%	12,015	84.95%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	15	18.52%	1,572	25.28%	1,714	12.12%
6	ACCIDENTS	7	8.64%	13	0.21%	27	0.19%
7	PREARRANGED	1	1.23%	43	0.69%	24	0.17%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	1.23%	1	0.02%	3	0.02%
10	UNKNOWN	12	14.81%	128	2.06%	361	2.56%
Totals		81	100.00%	6,219	100.00%	14,143	100.00%

### **Problem Analysis:**

- There were 81 interruptions on the Lowville 77354 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 81 events occurred at the distribution level.
- The distribution circuit breaker for the Lowville 77354 experienced 1 momentary operation in 2018.
- The distribution circuit breaker for the Lowville 77354 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Lowville 77354 in 2018, accounting for 56% of total interruptions (45 of 81). Equipment Failures were the 2nd leading cause of interruptions, accounting for 19% of total interruptions (15 of 81). Unknown were the 3rd leading cause of interruptions, accounting for 15% of total interruptions (12 of 81).
- Trees were the leading cause of customers interrupted (CI) on the Lowville 77354 in 2018, accounting for 72% of total customers interrupted (4,462 of 6,219). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 25% of total customers interrupted (1,572 of 6,219). Unknown were the 3rd leading cause of customers interrupted, accounting for 2% of total customers interrupted (128 of 6,219).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Lowville 77354 in 2018, accounting for 85% of total customer-hours interrupted (12,015 of 14,143). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 12% of total customer-hours interrupted (1,714 of 14,143). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 3% of total customer-hours interrupted (361 of 14,143).



- Of the 81 interruptions on this circuit, 33 affected 10 customers or less, with 19 being single customer outages.

**Action Taken:**

- In 2014, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2014, the Regional Forestry Department completed the scheduled hazard tree removal.
- In September 2016, an I&M foot patrol was completed.
- The level 2 maintenance work identified from the feeder inspection was completed by September 2017.
- TripSavers were installed in FY19.

**Action Plan:**

- The level 3 maintenance work identified from the feeder inspection will be completed by September 2019.
- The next I&M foot patrol is scheduled for 2021.
- The next distribution cycle pruning is scheduled for 2020.
- At this time, no further action is required.

## 6. SUNDAY CREEK 87651 - 13.2kV

*Profile:* 267 Customers, 26.7 Circuit Miles  
*Indices:* CAIDI = 9.76, SAIFI = 2.76

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	10	41.67%	566	76.80%	6,184	85.97%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	12.50%	123	16.69%	857	11.92%
6	ACCIDENTS	1	4.17%	3	0.41%	7	0.09%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	10	41.67%	45	6.11%	145	2.02%
Totals		24	100.00%	737	100.00%	7,193	100.00%

### Problem Analysis:

- There were 24 interruptions on the Sunday Creek 87651 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 24 events occurred at the distribution level.
- The distribution circuit breaker for the Sunday Creek 87651 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Sunday Creek 87651 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Sunday Creek 87651 in 2018, accounting for 42% of total interruptions (10 of 24). Unknown were the 2nd leading cause of interruptions, accounting for 42% of total interruptions (10 of 24). Equipment Failures were the 3rd leading cause of interruptions, accounting for 13% of total interruptions (3 of 24).
- Trees were the leading cause of customers interrupted (CI) on the Sunday Creek 87651 in 2018, accounting for 77% of total customers interrupted (566 of 737). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 17% of total customers interrupted (123 of 737). Unknown were the 3rd leading cause of customers interrupted, accounting for 6% of total customers interrupted (45 of 737).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Sunday Creek 87651 in 2018, accounting for 86% of total customer-hours interrupted (6,184 of 7,193). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 12% of total customer-hours interrupted (857 of 7,193). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 2% of total customer-hours interrupted (145 of 7,193).

- Of the 24 interruptions on this circuit, 15 affected 10 customers or less, with 1 being single customer outages.

**Action Taken:**

- In 2015, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In November 2014, an I&M foot patrol was completed.
- The level 2 maintenance work identified was completed by November 2015.
- The level 3 maintenance work identified was completed by November 2017.
- TripSavers were installed in FY19.

**Action Plan:**

- The next I&M foot patrol is scheduled for 2019.
- The next distribution cycle pruning is scheduled for 2021.
- No further actions are required.

## 7. GABRIELS 83561 – 4.8kV

*Profile: 594 Customers, 36.2 Circuit Miles*  
*Indices: CAIDI = 2.43, SAIFI = 4.69*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	11	61.11%	1,397	50.11%	4,421	65.30%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	2	11.11%	758	27.19%	1,655	24.45%
6	ACCIDENTS	1	5.56%	7	0.25%	15	0.22%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	22.22%	626	22.45%	679	10.03%
Totals		18	100.00%	2,788	100.00%	6,770	100.00%

### **Problem Analysis:**

- There were 18 interruptions on the Gabriels 83561 in 2018.
- There were 3 transmission interruptions.
  - The first Transmission interruption occurred on June 18, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 22% of the total customers interrupted (601 of 2,788), and 4% of the total customer-hours interrupted (250 of 6,770).
  - The second Transmission interruption occurred on August 18, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 22% of the total customers interrupted (600 of 2,788), and 9% of the total customer-hours interrupted (610 of 6,770).
  - The third Transmission interruption occurred on April 25, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 21% of the total customers interrupted (589 of 2,788), and 23% of the total customer-hours interrupted (1,551 of 6,770).
- There were no substation interruptions.
- The remaining 15 events occurred at the distribution level.
- The distribution circuit breaker for the Gabriels 83561 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Gabriels 83561 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Gabriels 83561 in 2018, accounting for 61% of total interruptions (11 of 18). Unknown were the 2nd leading cause of interruptions, accounting for 22% of total interruptions (4 of 18). Equipment Failures

were the 3rd leading cause of interruptions, accounting for 11% of total interruptions (2 of 18).

- Trees were the leading cause of customers interrupted (CI) on the Gabriels 83561 in 2018, accounting for 50% of total customers interrupted (1,397 of 2,788). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 27% of total customers interrupted (758 of 2,788). Unknown were the 3rd leading cause of customers interrupted, accounting for 22% of total customers interrupted (626 of 2,788).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Gabriels 83561 in 2018, accounting for 65% of total customer-hours interrupted (4,421 of 6,770). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 24% of total customer-hours interrupted (1,655 of 6,770). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 10% of total customer-hours interrupted (679 of 6,770).
- Of the 18 interruptions on this circuit, 7 affected 10 customers or less, with 0 being single customer outages.

**Action Taken:**

- In 2013, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2009, the Regional Forestry Department completed the scheduled hazard tree maintenance.
- In September 2017, an I&M foot patrol was completed.
- The level 2 maintenance work identified from the feeder inspection was completed by September 2018.

**Action Plan:**

- The level 3 maintenance work identified from the feeder inspection will be completed by September 2020.
- The next I&M foot patrol will be completed in 2022.
- The next distribution cycle pruning is scheduled for 2019.

## 8. THOUSAND ISL 81458 - 13.2kV

Profile: 2,303 Customers, 135 Circuit Miles  
 Indices: CAIDI = 1.04, SAIFI = 3.86

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	22.58%	1,193	13.43%	1,276	13.80%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	8	25.81%	5,061	56.96%	5,998	64.89%
6	ACCIDENTS	6	19.35%	62	0.70%	194	2.10%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	3.23%	9	0.10%	19	0.20%
10	UNKNOWN	9	29.03%	2,560	28.81%	1,758	19.01%
Totals		31	100.00%	8,885	100.00%	9,244	100.00%

### Problems Analysis:

- There were 31 interruptions on the Thousand Isl 81458 in 2018.
- There was 1 transmission interruption.
  - This Transmission interruption occurred on January 15, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 26% of the total customers interrupted (2,295 of 8,885), and 43% of the total customer-hours interrupted (4,016 of 9,244).
- There was 1 substation interruption.
  - This Substation interruption occurred on April 16, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 26% of the total customers interrupted (2,305 of 8,885), and 12% of the total customer-hours interrupted (1,153 of 9,244).
- The remaining 29 events occurred at the distribution level.
- The distribution circuit breaker for the Thousand Isl 81458 experienced 4 momentary operations in 2018.
- The distribution circuit breaker for the Thousand Isl 81458 experienced 0 sustained operations (lockouts) in 2018.
- Unknown were the leading cause of interruptions on the Thousand Isl 81458 in 2018, accounting for 29% of total interruptions (9 of 31). Equipment Failures were the 2nd leading cause of interruptions, accounting for 26% of total interruptions (8 of 31). Trees were the 3rd leading cause of interruptions, accounting for 23% of total interruptions (7 of 31).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Thousand Isl 81458 in 2018, accounting for 57% of total customers interrupted (5,061 of

8,885). Unknown were the 2nd leading cause of customers interrupted, accounting for 29% of total customers interrupted (2,560 of 8,885). Trees were the 3rd leading cause of customers interrupted, accounting for 13% of total customers interrupted (1,193 of 8,885).

- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Thousand Isl 81458 in 2018, accounting for 65% of total customer-hours interrupted (5,998 of 9,244). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 19% of total customer-hours interrupted (1,758 of 9,244). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 14% of total customer-hours interrupted (1,276 of 9,244).
- Of the 31 interruptions on this circuit, 9 affected 10 customers or less, with 6 being single customer outages.

**Action Taken:**

- An I&M foot patrol was completed in October 2014.
- The level 2 maintenance work identified from the feeder inspection was completed by October 2015.
- The level 3 maintenance work identified from the feeder inspection was completed by October 2017.
- In 2017, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2015, the Regional Forestry Department completed the hazard tree removal.

**Action Plan:**

- The next I&M foot patrol is scheduled to be completed in 2019.
- The next distribution cycle pruning is scheduled for 2022.
- No further actions are required.

## 9. STAR LAKE 72762 – 4.8kV

Profile: 659 Customers, 36.4 Circuit Miles  
 Indices: CAIDI = 3.78, SAIFI = 3.13

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	46.67%	261	12.65%	721	9.25%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	4	26.67%	874	42.37%	4,109	52.68%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	1	6.67%	653	31.65%	2,471	31.67%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	2	13.33%	210	10.18%	384	4.92%
10	UNKNOWN	1	6.67%	65	3.15%	115	1.47%
Totals		15	100.00%	2,063	100.00%	7,800	100.00%

### Problem Analysis:

- There were 15 interruptions on the Star Lake 72762 in 2018.
- There were 2 transmission interruptions.
  - The first Transmission interruption occurred on April 09, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 32% of the total customers interrupted (652 of 2,063), and 41% of the total customer-hours interrupted (3,162 of 7,800).
  - The second Transmission interruption occurred on November 03, 2018, coded as a cause of unknown (PSC cause code 07). This lockout accounted for 32% of the total customers interrupted (653 of 2,063), and 32% of the total customer-hours interrupted (2,471 of 7,800).
- There were no substation interruptions.
- The remaining 13 events occurred at the distribution level.
- The distribution circuit breaker for the Star Lake 72762 experienced 1 momentary operation in 2018.
- The distribution circuit breaker for the Star Lake 72762 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Star Lake 72762 in 2018, accounting for 47% of total interruptions (7 of 15). Equipment Failures were the 2nd leading cause of interruptions, accounting for 27% of total interruptions (4 of 15). Lightning were the 3rd leading cause of interruptions, accounting for 13% of total interruptions (2 of 15).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Star Lake 72762 in 2018, accounting for 42% of total customers interrupted (874 of 2,063). Prearranged were the 2nd leading cause of customers interrupted, accounting for 32% of



total customers interrupted (653 of 2,063). Trees were the 3rd leading cause of customers interrupted, accounting for 13% of total customers interrupted (261 of 2,063).

- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Star Lake 72762 in 2018, accounting for 53% of total customer-hours interrupted (4,109 of 7,800). Prearranged were the 2nd leading cause of customer-hours interrupted, accounting for 32% of total customer-hours interrupted (2,471 of 7,800). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 9% of total customer-hours interrupted (721 of 7,800).
- Of the 15 interruptions on this circuit, 6 affected 10 customers or less, with 2 being single customer outages.

**Action Taken:**

- In 2015, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2014, the Regional Forestry Department completed the extended hazard tree maintenance.
- An I&M foot patrol was completed in July 2017.
- The level 2 maintenance work identified from the feeder inspection was completed by July 2018.

**Action Plan:**

- The level 3 maintenance work identified from the feeder inspection will be completed by July 2020.
- The next I&M foot patrol is scheduled for 2022.
- The next distribution cycle pruning is scheduled for 2021.
- There are no further actions required.

## 10. LYME 73351 - 13.2kV

Profile: 2,233 Customers, 122.3 Circuit Miles  
 Indices: CAIDI = 1.40, SAIFI = 2.68

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	5	21.74%	273	4.57%	745	8.88%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	12	52.17%	5,690	95.17%	7,564	90.08%
6	ACCIDENTS	4	17.39%	13	0.22%	80	0.96%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	4.35%	1	0.02%	2	0.02%
10	UNKNOWN	1	4.35%	2	0.03%	6	0.07%
Totals		23	100.00%	5,979	100.00%	8,397	100.00%

### Problem Analysis:

- There were 23 interruptions on the Lyme 73351 in 2018.
- There was 1 transmission interruption.
  - This Transmission interruption occurred on January 15, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 36% of the total customers interrupted (2,179 of 5,979), and 46% of the total customer-hours interrupted (3,850 of 8,397).
- There were no substation interruptions.
- The remaining 22 events occurred at the distribution level.
- The distribution circuit breaker for the Lyme 73351 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Lyme 73351 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Lyme 73351 in 2018, accounting for 52% of total interruptions (12 of 23). Trees were the 2nd leading cause of interruptions, accounting for 22% of total interruptions (5 of 23). Accidents were the 3rd leading cause of interruptions, accounting for 17% of total interruptions (4 of 23).
- Equipment Failures were the leading cause of customers interrupted (CI) on the Lyme 73351 in 2018, accounting for 95% of total customers interrupted (5,690 of 5,979). Trees were the 2nd leading cause of customers interrupted, accounting for 5% of total customers interrupted (273 of 5,979). Accidents were the 3rd leading cause of customers interrupted, accounting for 0% of total customers interrupted (13 of 5,979).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Lyme 73351 in 2018, accounting for 90% of total customer-hours interrupted (7,564 of 8,397). Trees were the 2nd leading cause of customer-hours interrupted, accounting for

9% of total customer-hours interrupted (745 of 8,397). Accidents were the 3rd leading cause of customer-hours interrupted, accounting for 1% of total customer-hours interrupted (80 of 8,397).

- Of the 23 interruptions on this circuit, 15 affected 10 customers or less, with 6 being single customer outages.

**Action Taken:**

- In 2018, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- An I&M foot patrol was completed in August 2016.
- All level 2 maintenance work identified during the inspection was completed by August 2017.

**Action Plan:**

- All level 3 maintenance work identified during the inspection will be completed by August 2019.
- The next I&M foot patrol is scheduled for 2022.
- The next distribution cycle pruning is scheduled for 2024.
- No further actions are required.

## 11. LITTLE RIVER 95554 - 13.2kV

Profile: 1,458 Customers, 108.4 Circuit Miles  
 Indices: CAIDI = 1.37, SAIFI = 3.50

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	6	35.29%	399	7.82%	1,143	16.34%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	1	5.88%	1,463	28.66%	3,190	45.60%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	5.88%	1	0.02%	1	0.02%
10	UNKNOWN	9	52.94%	3,241	63.50%	2,661	38.04%
Totals		17	100.00%	5,104	100.00%	6,995	100.00%

### Problem Analysis:

- There were 17 interruptions on the Little River 95554 in 2018.
- There were 2 transmission interruptions.
  - The first Transmission interruption occurred on July 17, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 29% of the total customers interrupted (1,461 of 5,104), and 21% of the total customer-hours interrupted (1,461 of 6,995).
  - The second Transmission interruption occurred on September 02, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 28% of the total customers interrupted (1,452 of 5,104), and 4% of the total customer-hours interrupted (290 of 6,995).
- There was 1 substation interruption.
  - This Substation interruption occurred on April 15, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 29% of the total customers interrupted (1,463 of 5,104), and 46% of the total customer-hours interrupted (3,190 of 6,995).
- The remaining 14 events occurred at the distribution level.
- The distribution circuit breaker for the Little River 95554 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the Little River 95554 experienced 0 sustained operations (lockouts) in 2018.
- Unknown were the leading cause of interruptions on the Little River 95554 in 2018, accounting for 53% of total interruptions (9 of 17). Trees were the 2nd leading cause of interruptions, accounting for 35% of total interruptions (6 of 17). Equipment Failures were the 3rd leading cause of interruptions, accounting for 6% of total interruptions (1 of 17).

- Unknown were the leading cause of customers interrupted (CI) on the Little River 95554 in 2018, accounting for 63% of total customers interrupted (3,241 of 5,104). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 29% of total customers interrupted (1,463 of 5,104). Trees were the 3rd leading cause of customers interrupted, accounting for 8% of total customers interrupted (399 of 5,104).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Little River 95554 in 2018, accounting for 46% of total customer-hours interrupted (3,190 of 6,995). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 38% of total customer-hours interrupted (2,661 of 6,995). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 16% of total customer-hours interrupted (1,143 of 6,995).
- Of the 17 interruptions on this circuit, 2 affected 10 customers or less, with 1 being single customer outages.

**Action Taken:**

- In 2016, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2014, the Regional Forestry Department completed the scheduled hazard tree maintenance.
- An I&M foot patrol was completed in December 2015.
- All level 2 maintenance work identified during the inspection was completed by December 2016.
- All level 3 maintenance work identified during the inspection was completed by December 2018.

**Action Plan:**

- The next I&M foot patrol is scheduled for 2020.
- The next distribution cycle pruning is scheduled for 2022.
- No further actions are required.

## 12. BREMEN 81556 - 13.2kV

Profile: 1,686 Customers, 129.4 Circuit Miles  
 Indices: CAIDI = 2.14, SAIFI = 1.99

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	16	34.78%	1,234	36.77%	2,123	29.57%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	4	8.70%	129	3.84%	478	6.66%
6	ACCIDENTS	3	6.52%	139	4.14%	613	8.53%
7	PREARRANGED	2	4.35%	614	18.30%	1,270	17.68%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	3	6.52%	83	2.47%	135	1.88%
10	UNKNOWN	18	39.13%	1,157	34.48%	2,562	35.68%
Totals		46	100.00%	3,356	100.00%	7,181	100.00%

**Problem Analysis:**

- There were 46 interruptions on the Bremen 81556 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 46 events occurred at the distribution level.
- The distribution circuit breaker for the Bremen 81556 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the Bremen 81556 experienced 0 sustained operations (lockouts) in 2018.
- Unknown were the leading cause of interruptions on the Bremen 81556 in 2018, accounting for 39% of total interruptions (18 of 46). Trees were the 2nd leading cause of interruptions, accounting for 35% of total interruptions (16 of 46). Equipment Failures were the 3rd leading cause of interruptions, accounting for 9% of total interruptions (4 of 46).
- Trees were the leading cause of customers interrupted (CI) on the Bremen 81556 in 2018, accounting for 37% of total customers interrupted (1,234 of 3,356). Unknown were the 2nd leading cause of customers interrupted, accounting for 34% of total customers interrupted (1,157 of 3,356). Prearranged were the 3rd leading cause of customers interrupted, accounting for 18% of total customers interrupted (614 of 3,356).
- Unknown were the leading cause of customer-hours interrupted (CHI) on the Bremen 81556 in 2018, accounting for 36% of total customer-hours interrupted (2,562 of 7,181). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 30% of total customer-hours interrupted (2,123 of 7,181). Prearranged were the 3rd leading cause of customer-hours interrupted, accounting for 18% of total customer-hours interrupted (1,270 of 7,181).

- Of the 46 interruptions on this circuit, 11 affected 10 customers or less, with 5 being single customer outages.

**Action Taken:**

- In 2017, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2014, the Regional Forestry Department completed the hazard tree removals.
- An I&M foot patrol was completed in August 2017.
- The level 2 maintenance work identified from the feeder inspection was completed by August 2018.

**Action Plan:**

- The level 3 maintenance work identified from the feeder inspection will be completed by August 2020.
- The next I&M foot patrol is scheduled for 2022.
- The next distribution cycle pruning is scheduled for 2022.
- No further actions are required.

### 13. NORTH CARTHAGE 81652 - 13.2kV

Profile: 2,257 Customers, 158.9 Circuit Miles  
 Indices: CAIDI = 2.56, SAIFI = 1.65

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	17	40.48%	2,177	58.49%	7,570	79.51%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	14.29%	957	25.71%	817	8.58%
6	ACCIDENTS	4	9.52%	16	0.43%	72	0.76%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	4	9.52%	222	5.96%	398	4.18%
10	UNKNOWN	11	26.19%	350	9.40%	665	6.99%
Totals		42	100.00%	3,722	100.00%	9,522	100.00%

**Problem Analysis:**

- There were 42 interruptions on the North Carthage 81652 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 42 events occurred at the distribution level.
- The distribution circuit breaker for the North Carthage 81652 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the North Carthage 81652 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the North Carthage 81652 in 2018, accounting for 40% of total interruptions (17 of 42). Unknown were the 2nd leading cause of interruptions, accounting for 26% of total interruptions (11 of 42). Equipment Failures were the 3rd leading cause of interruptions, accounting for 14% of total interruptions (6 of 42).
- Trees were the leading cause of customers interrupted (CI) on the North Carthage 81652 in 2018, accounting for 58% of total customers interrupted (2,177 of 3,722). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 26% of total customers interrupted (957 of 3,722). Unknown were the 3rd leading cause of customers interrupted, accounting for 9% of total customers interrupted (350 of 3,722).
- Trees were the leading cause of customer-hours interrupted (CHI) on the North Carthage 81652 in 2018, accounting for 80% of total customer-hours interrupted (7,570 of 9,522). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 9% of total customer-hours interrupted (817 of 9,522). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 7% of total customer-hours interrupted (665 of 9,522).



- Of the 42 interruptions on this circuit, 21 affected 10 customers or less, with 6 being single customer outages.

**Action Taken:**

- In 2016, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2014, the Regional Forestry Department completed the scheduled hazard tree maintenance.
- An I&M foot patrol was completed in August 2014.
- The level 2 maintenance work identified during the inspection was completed by August 2015.
- The level 3 maintenance work identified during the inspection was completed by August 2017.
- TripSavers were installed in FY19.

**Action Plan:**

- The next distribution cycle pruning is scheduled for 2022.
- The next I&M foot patrol is scheduled for 2019.
- No further actions are required.

#### 14. THOUSAND ISL 81454 - 13.2kV

Profile: 1,186 Customers, 26.8 Circuit Miles  
 Indices: CAIDI = 1.77, SAIFI = 3.49

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	1	8.33%	13	0.31%	17	0.24%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	2	16.67%	1,286	31.07%	2,264	30.97%
6	ACCIDENTS	6	50.00%	2,817	68.06%	4,981	68.13%
7	PREARRANGED	2	16.67%	16	0.39%	30	0.41%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	1	8.33%	7	0.17%	19	0.26%
Totals		12	100.00%	4,139	100.00%	7,311	100.00%

**Problem Analysis:**

- There were 12 interruptions on the Thousand Isl 81454 in 2018.
- There was 1 transmission interruption.
  - This Transmission interruption occurred on January 15, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 30% of the total customers interrupted (1,255 of 4,139), and 30% of the total customer-hours interrupted (2,196 of 7,311).
- There was 1 substation interruption.
  - This Substation interruption occurred on July 23, 2018, coded as a cause of animal (PSC cause code 06). This lockout accounted for 31% of the total customers interrupted (1,294 of 4,139), and 30% of the total customer-hours interrupted (2,198 of 7,311).
- The remaining 10 events occurred at the distribution level.
- The distribution circuit breaker for the Thousand Isl 81454 experienced 4 momentary operations in 2018.
- The distribution circuit breaker for the Thousand Isl 81454 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 31% of the total amount of customers interrupted (1,273 out of 4,139) and 25% of the total amount of the customer-hours interrupted (1,846 out of 7,311).
  - This lockout occurred on May 15, 2018, coded as a cause of animal (PSC cause code 06). This lockout accounted for 31% of the total customers interrupted (1,273 of 4,139), and 25% of the total customer-hours interrupted (1,846 of 7,311). This outage was due to an Osprey building a nest.
- Accidents were the leading cause of interruptions on the Thousand Isl 81454 in 2018, accounting for 50% of total interruptions (6 of 12). Equipment Failures were the 2nd leading cause of interruptions, accounting for 17% of total interruptions (2 of 12).

Prearranged were the 3rd leading cause of interruptions, accounting for 17% of total interruptions (2 of 12).

- Accidents were the leading cause of customers interrupted (CI) on the Thousand Isl 81454 in 2018, accounting for 68% of total customers interrupted (2,817 of 4,139). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 31% of total customers interrupted (1,286 of 4,139). Prearranged were the 3rd leading cause of customers interrupted, accounting for 0% of total customers interrupted (16 of 4,139).
- Accidents were the leading cause of customer-hours interrupted (CHI) on the Thousand Isl 81454 in 2018, accounting for 68% of total customer-hours interrupted (4,981 of 7,311). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 31% of total customer-hours interrupted (2,264 of 7,311). Prearranged were the 3rd leading cause of customer-hours interrupted, accounting for 0% of total customer-hours interrupted (30 of 7,311).
- Of the 12 interruptions on this circuit, 3 affected 10 customers or less, with 0 being single customer outages.

**Action Taken:**

- In 2016, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- An I&M foot patrol was completed in June 2017.
- The level 2 maintenance work identified during the inspection was completed by June 2018.

**Action Plan:**

- The next distribution cycle pruning is scheduled for 2022.
- The level 3 maintenance work identified during the inspection will be completed by June 2020.
- The next I&M foot patrol is scheduled for 2022.
- No further actions are required.

## 15. BLOOMINGDALE 84162 – 4.8kV

*Profile:* 829 Customers, 38.4 Circuit Miles  
*Indices:* CAIDI = 1.44, SAIFI = 3.48

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	7	43.75%	232	8.05%	312	7.51%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	4	25.00%	1,699	58.93%	2,724	65.70%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	1	6.25%	828	28.72%	869	20.97%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	25.00%	124	4.30%	241	5.82%
Totals		16	100.00%	2,883	100.00%	4,147	100.00%

### **Problem Analysis:**

- There were 16 interruptions on the Bloomingdale 84162 in 2018.
- There were 3 transmission interruptions.
  - The first Transmission interruption occurred on February 25, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 29% of the total customers interrupted (832 of 2,883), and 31% of the total customer-hours interrupted (1,303 of 4,147).
  - The second Transmission interruption occurred on March 31, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 29% of the total customers interrupted (830 of 2,883), and 34% of the total customer-hours interrupted (1,397 of 4,147).
  - The third Transmission interruption occurred on May 16, 2018, coded as a cause of unknown (PSC cause code 07). This lockout accounted for 29% of the total customers interrupted (828 of 2,883), and 21% of the total customer-hours interrupted (869 of 4,147).
- There were no substation interruptions.
- The remaining 13 events occurred at the distribution level.
- The distribution circuit breaker for the Bloomingdale 84162 experienced 4 momentary operations in 2018.
- The distribution circuit breaker for the Bloomingdale 84162 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Bloomingdale 84162 in 2018, accounting for 44% of total interruptions (7 of 16). Equipment Failures were the 2nd leading cause of interruptions, accounting for 25% of total interruptions (4 of 16). Unknown were the 3rd leading cause of interruptions, accounting for 25% of total interruptions (4 of 16).

- Equipment Failures were the leading cause of customers interrupted (CI) on the Bloomingdale 84162 in 2018, accounting for 59% of total customers interrupted (1,699 of 2,883). Prearranged were the 2nd leading cause of customers interrupted, accounting for 29% of total customers interrupted (828 of 2,883). Trees were the 3rd leading cause of customers interrupted, accounting for 8% of total customers interrupted (232 of 2,883).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Bloomingdale 84162 in 2018, accounting for 66% of total customer-hours interrupted (2,724 of 4,147). Prearranged were the 2nd leading cause of customer-hours interrupted, accounting for 21% of total customer-hours interrupted (869 of 4,147). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (312 of 4,147).
- Of the 16 interruptions on this circuit, 4 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- In 2015, the Regional Forestry Department completed scheduled distribution cycle pruning.
- In 2008, the Regional Forestry Department completed hazard tree removals.
- An I&M foot patrol was completed in August 2017.
- The maintenance work identified as level 2 from the feeder inspection was completed by August 2018.

**Action Plan:**

- The next scheduled distribution cycle pruning is 2021.
- The maintenance work identified as level 3 from the feeder inspection will be completed by August 2020.
- The next I&M foot patrol is scheduled for 2022.
- At this time, no further action is required.

## 16. PAUL SMITHS 83462 – 4.8kV

Profile: 308 Customers, 57.6 Circuit Miles  
 Indices: CAIDI = 1.34, SAIFI = 4.22

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	15	55.56%	522	40.15%	751	43.08%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	3	11.11%	329	25.31%	467	26.77%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	2	7.41%	54	4.15%	49	2.82%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	1	3.70%	24	1.85%	47	2.68%
10	UNKNOWN	6	22.22%	371	28.54%	430	24.65%
Totals		27	100.00%	1,300	100.00%	1,744	100.00%

**Problem Analysis:**

- There were 27 interruptions on the Paul Smiths 83462 in 2018.
- There were 3 transmission interruptions.
  - The first Transmission interruption occurred on June 18, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 22% of the total customers interrupted (281 of 1,300), and 7% of the total customer-hours interrupted (117 of 1,744).
  - The second Transmission interruption occurred on August 18, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 24% of the total customers interrupted (310 of 1,300), and 18% of the total customer-hours interrupted (315 of 1,744).
  - The third Transmission interruption occurred on April 25, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 24% of the total customers interrupted (307 of 1,300), and 23% of the total customer-hours interrupted (409 of 1,744).
- There were no substation interruptions.
- The remaining 24 events occurred at the distribution level.
- The distribution circuit breaker for the Paul Smiths 83462 experienced 3 momentary operations in 2018.
- The distribution circuit breaker for the Paul Smiths 83462 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Paul Smiths 83462 in 2018, accounting for 56% of total interruptions (15 of 27). Unknown were the 2nd leading cause of interruptions, accounting for 22% of total interruptions (6 of 27). Equipment Failures were the 3rd leading cause of interruptions, accounting for 11% of total interruptions (3 of 27).

- Trees were the leading cause of customers interrupted (CI) on the Paul Smiths 83462 in 2018, accounting for 40% of total customers interrupted (522 of 1,300). Unknown were the 2nd leading cause of customers interrupted, accounting for 29% of total customers interrupted (371 of 1,300). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 25% of total customers interrupted (329 of 1,300).
- Trees were the leading cause of customer-hours interrupted (CHI) on the Paul Smiths 83462 in 2018, accounting for 43% of total customer-hours interrupted (751 of 1,744). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 27% of total customer-hours interrupted (467 of 1,744). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 25% of total customer-hours interrupted (430 of 1,744).
- Of the 27 interruptions on this circuit, 10 affected 10 customers or less, with 6 being single customer outages.

**Action Taken:**

- In 2016, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2009, the Regional Forestry Department completed the extended hazard tree maintenance.
- An I&M foot patrol was completed in September 2017.
- All level 2 maintenance work identified from the feeder inspection was completed by September 2018.

**Action Plan:**

- All level 3 maintenance work identified from the feeder inspection will be completed by September 2020.
- The next I&M foot patrol is scheduled for 2022.
- The next distribution cycle pruning is scheduled for 2022.
- No further actions are required.

## 17. FRANKLIN 84361 – 4.8kV

*Profile: 161 Customers, 26.1 Circuit Miles*  
*Indices: CAIDI = 2.36, SAIFI = 5.12*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	4	25.00%	46	5.58%	125	6.42%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	8	50.00%	615	74.64%	1,351	69.57%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	25.00%	163	19.78%	466	24.00%
Totals		16	100.00%	824	100.00%	1,942	100.00%

### **Problem Analysis:**

- There were 16 interruptions on the Franklin 84361 in 2018.
- There were 3 transmission interruptions.
  - The first Transmission interruption occurred on February 25, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 20% of the total customers interrupted (162 of 824), and 6% of the total customer-hours interrupted (108 of 1,942).
  - The second Transmission interruption occurred on March 31, 2018, coded as a cause of device failed (PSC cause code 05). This lockout accounted for 20% of the total customers interrupted (162 of 824), and 15% of the total customer-hours interrupted (289 of 1,942).
  - The third Transmission interruption occurred on March 31, 2018, coded as a cause of deterioration (PSC cause code 05). This lockout accounted for 20% of the total customers interrupted (162 of 824), and 16% of the total customer-hours interrupted (302 of 1,942).
- There were no substation interruptions.
- The remaining 13 events occurred at the distribution level.
- The distribution circuit breaker for the Franklin 84361 experienced 4 momentary operations in 2018.
- The distribution circuit breaker for the Franklin 84361 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Franklin 84361 in 2018, accounting for 50% of total interruptions (8 of 16). Trees were the 2nd leading cause of interruptions, accounting for 25% of total interruptions (4 of 16). Unknown were the 3rd leading cause of interruptions, accounting for 25% of total interruptions (4 of 16).



- Equipment Failures were the leading cause of customers interrupted (CI) on the Franklin 84361 in 2018, accounting for 75% of total customers interrupted (615 of 824). Unknown were the 2nd leading cause of customers interrupted, accounting for 20% of total customers interrupted (163 of 824). Trees were the 3rd leading cause of customers interrupted, accounting for 6% of total customers interrupted (46 of 824).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Franklin 84361 in 2018, accounting for 70% of total customer-hours interrupted (1,351 of 1,942). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 24% of total customer-hours interrupted (466 of 1,942). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 6% of total customer-hours interrupted (125 of 1,942).
- Of the 16 interruptions on this circuit, 3 affected 10 customers or less, with 1 being single customer outages.

**Action Taken:**

- In 2015, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- In 2009, the Regional Forestry Department completed the scheduled hazard tree maintenance.
- An I&M foot patrol was completed in October 2018.

**Action Plan:**

- The next distribution cycle pruning is scheduled for 2021.
- All the level 2 maintenance work identified during the inspection will be completed by October 2019.
- All the level 3 maintenance work identified during the inspection will be completed by October 2021.
- The next I&M foot patrol is scheduled for 2023.
- No further actions are required.

## 18. LAWRENCE AVE 97655 - 13.2kV

Profile: 1,360 Customers, 81.2 Circuit Miles  
 Indices: CAIDI = 1.70, SAIFI = 2.15

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	3	13.64%	129	4.41%	251	5.04%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	5	22.73%	1,014	34.64%	1,507	30.25%
6	ACCIDENTS	6	27.27%	1,512	51.66%	2,932	58.86%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	2	9.09%	52	1.78%	39	0.79%
10	UNKNOWN	6	27.27%	220	7.52%	252	5.05%
Totals		22	100.00%	2,927	100.00%	4,982	100.00%

**Problem Analysis:**

- There were 22 interruptions on the Lawrence Ave 97655 in 2018.
- There were no transmission interruptions.
- There were no substation interruptions.
- All 22 events occurred at the distribution level.
- The distribution circuit breaker for the Lawrence Ave 97655 experienced 1 momentary operation in 2018.
- The distribution circuit breaker for the Lawrence Ave 97655 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 46% of the total amount of customers interrupted (1,359 out of 2,927) and 51% of the total amount of the customer-hours interrupted (2,550 out of 4,982).
  - This lockout occurred on July 29, 2018, coded as a cause of vehicle (PSC cause code 06). This lockout accounted for 46% of the total customers interrupted (1,359 of 2,927), and 51% of the total customer-hours interrupted (2,550 of 4,982). This outage was the result in a motor vehicle accident on River Road.
- Accidents were the leading cause of interruptions on the Lawrence Ave 97655 in 2018, accounting for 27% of total interruptions (6 of 22). Unknown were the 2nd leading cause of interruptions, accounting for 27% of total interruptions (6 of 22). Equipment Failures were the 3rd leading cause of interruptions, accounting for 23% of total interruptions (5 of 22).
- Accidents were the leading cause of customers interrupted (CI) on the Lawrence Ave 97655 in 2018, accounting for 52% of total customers interrupted (1,512 of 2,927). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 35% of total customers interrupted (1,014 of 2,927). Unknown were the 3rd leading

cause of customers interrupted, accounting for 8% of total customers interrupted (220 of 2,927).

- Accidents were the leading cause of customer-hours interrupted (CHI) on the Lawrence Ave 97655 in 2018, accounting for 59% of total customer-hours interrupted (2,932 of 4,982). Equipment Failures were the 2nd leading cause of customer-hours interrupted, accounting for 30% of total customer-hours interrupted (1,507 of 4,982). Unknown were the 3rd leading cause of customer-hours interrupted, accounting for 5% of total customer-hours interrupted (252 of 4,982).
- Of the 22 interruptions on this circuit, 7 affected 10 customers or less, with 2 being single customer outages.

**Action Taken:**

- In 2016, the Regional Forestry Department completed the scheduled distribution cycle pruning.
- An I&M foot patrol was completed in September 2016.
- The level 2 maintenance work identified from the feeder inspection was completed by September 2017.

**Action Plan:**

- The level 3 maintenance work identified from the feeder inspection will be completed by September 2019.
- The next I&M foot patrol is scheduled for 2021.
- The next distribution cycle pruning is scheduled for 2022.
- No further actions are required.

3. ACTION PLAN SUMMARIES

- a. SUMMARY OF ACTION ITEM PLANS FOR 2018 WORST PERFORMING CIRCUITS

Station	Circuit	Report Year	Action Plan	Projected Completion Date	Estimated Cost	Comments
Thousand Islands	81452	2018	The next scheduled distribution cycle pruning will be completed in 2022.	2022	-----	-----
Thousand Islands	81452	2018	The level 3 maintenance work identified from the feeder inspection will be completed by July 2020.	2020	-----	-----
Thousand Islands	81452	2018	This feeder is scheduled to be inspected again in 2022.	2022	-----	-----
Lyme	73352	2018	The next distribution cycle pruning is scheduled for 2021.	2021	-----	-----
Lyme	73352	2018	The next I&M foot patrol is scheduled for 2020.	2020	-----	-----
Gilpin Bay	95661	2018	The next distribution cycle pruning is scheduled for 2022.	2022	-----	-----
Gilpin Bay	95661	2018	All level 3 maintenance work identified from the feeder inspection will be completed by October 2021.	2021	-----	-----
Gilpin Bay	95661	2018	The next I&M foot patrol will be completed in 2023.	2023	-----	-----
Gilpin Bay	95661	2018	The level 2 maintenance work identified from the feeder inspection will be completed by October 2019.	2019	-----	-----
Star Lake	72761	2018	All level 3 maintenance work identified from the feeder inspection will be completed by October 2021.	2021	-----	-----
Star Lake	72761	2018	The next I&M foot patrol will be completed in 2023.	2023	-----	-----
Star Lake	72761	2018	The next scheduled distribution cycle pruning will be completed in 2021.	2021	-----	-----
Star Lake	72761	2018	The level 2 maintenance work identified from the feeder inspection will be completed by October 2019.	2019	-----	-----
Lowville	77354	2018	The next distribution cycle pruning is scheduled for 2020.	2020	-----	-----
Lowville	77354	2018	The next I&M foot patrol is scheduled for 2021.	2021	-----	-----
Lowville	77354	2018	All level 3 maintenance work identified from the feeder inspection will be completed by September 2019.	2019	-----	-----
Sunday Creek	87651	2018	The next distribution cycle pruning is scheduled for 2021.	2021	-----	-----
Sunday Creek	87651	2018	The next I&M foot patrol will be completed in 2019.	2019	-----	-----
Gabriels	83561	2018	The next distribution cycle pruning is scheduled for 2019.	2019	-----	-----
Gabriels	83561	2018	The level 3 maintenance work identified from the feeder inspection will be completed by September 2020.	2020	-----	-----
Gabriels	83561	2018	The next I&M foot patrol will be completed in 2022.	2022	-----	-----
Thousand Islands	81458	2018	The next I&M foot patrol is scheduled to be completed in 2019.	2019	-----	-----
Thousand Islands	81458	2018	The next distribution cycle pruning is scheduled for 2022.	2022	-----	-----
Star Lake	72762	2018	The next I&M foot patrol is scheduled for 2022.	2022	-----	-----
Star Lake	72762	2018	The next distribution cycle pruning is scheduled for 2021	2021	-----	-----
Star Lake	72762	2018	The level 3 maintenance work identified from the feeder inspection will be completed by July 2020.	2020	-----	-----
Lyme	73351	2018	The next distribution cycle pruning is scheduled for 2024.	2024	-----	-----
Lyme	73351	2018	The next I&M foot patrol is scheduled for 2022.	2022	-----	-----
Lyme	73351	2018	The level 3 maintenance work identified from the feeder inspection will be completed by August 2019	2019	-----	-----
Little River	95554	2018	The next I&M foot patrol is scheduled for 2020.	2020	-----	-----
Little River	95554	2018	The next distribution cycle pruning is scheduled for 2022.	2022	-----	-----
Bremen	81556	2018	The next I&M foot patrol is scheduled for 2022.	2022	-----	-----



b. STATUS OF ACTION PLANS FOR 2017 WORST PERFORMING CIRCUITS

Station	Circuit	Report Year	Action Plan	Actual Completion Date	Actual Cost	Comments
West Adams	87554	2017	The next scheduled distribution cycle pruning will be completed in 2019.	2019	-----	-----
West Adams	87554	2017	The level 3 maintenance work identified from the feeder inspection will be completed by August 2019.	2019	-----	-----
West Adams	87554	2017	This feeder is scheduled to be inspected again in 2021.	2021	-----	-----
Chasm Falls	85251	2017	All level 3 maintenance work identified from the feeder inspection will be completed by September, 2019.	2019	-----	-----
Chasm Falls	85251	2017	The next I&M foot patrol is scheduled for 2021.	2021	-----	-----
Chasm Falls	85251	2017	The next distribution cycle pruning is scheduled for 2021.	2021	-----	-----
Lowville	77354	2017	All level 3 maintenance work identified from the feeder inspection will be completed by September 2019.	2019	-----	-----
Lowville	77354	2017	The next I&M foot patrol will be completed in 2021.	2021	-----	-----
Lowville	77354	2017	The next distribution cycle pruning is scheduled for 2020.	2020	-----	-----
West Adams	87551	2017	All level 3 maintenance work identified from the feeder inspection will be completed by October 2018.	2018	-----	Completed
West Adams	87551	2017	The next I&M foot patrol will be completed in 2020.	2020	-----	-----
West Adams	87551	2017	The next scheduled distribution cycle pruning will be completed in 2018.	2018	-----	Completed
West Adams	87552	2017	The next I&M foot patrol is scheduled for 2018.	2018	-----	Completed
West Adams	87552	2017	The next distribution cycle pruning is scheduled for 2023.	2023	-----	-----
West Adams	87553	2017	The next I&M foot patrol is scheduled for 2019.	2019	-----	-----
West Adams	87553	2017	The next distribution cycle pruning is scheduled for 2019.	2019	-----	-----
East Watertown	81757	2017	The level 3 maintenance work identified from the feeder inspection will be completed by August 2018.	2018	-----	Completed
East Watertown	81757	2017	The next I&M foot patrol will be completed in 2020.	2020	-----	-----
East Watertown	81757	2017	The next distribution cycle pruning is scheduled for 2020.	2020	-----	-----
Thousand Islands	81452	2017	The level 2 maintenance work identified from the feeder inspection will be completed by July 2018.	2018	-----	Completed
Thousand Islands	81452	2017	The level 3 maintenance work identified from the feeder inspection will be completed by July 2020.	2020	-----	-----
Thousand Islands	81452	2017	The next I&M foot patrol is scheduled to be completed in 2022.	2022	-----	-----
Thousand Islands	81452	2017	The next distribution cycle pruning is scheduled for 2022.	2022	-----	-----
Nicholville	86062	2017	The next I&M foot patrol is scheduled for 2019.	2019	-----	-----
Nicholville	86062	2017	The next distribution cycle pruning is scheduled for 2023	2023	-----	-----
Gilpin Bay	95661	2017	The next I&M foot patrol is scheduled for 2018.	2018	-----	Completed
Gilpin Bay	95661	2017	The next distribution cycle pruning is scheduled for 2023.	2023	-----	-----
North Carthage	81652	2017	The next I&M foot patrol is scheduled for 2019.	2019	-----	-----
North Carthage	81652	2017	The next distribution cycle pruning is scheduled for 2022.	2022	-----	-----
DeKalb	98455	2017	The level 2 maintenance work identified from the feeder inspection will be completed by June 2018.	2018	-----	Completed
DeKalb	98455	2017	The level 3 maintenance work identified from the feeder inspection will be completed by June 2020.	2020	-----	-----



Station	Circuit	Report Year	Action Plan	Actual Completion Date	Actual Cost	Comments
DeKalb	98455	2017	The next I&M foot patrol is scheduled for 2022.	2022	-----	-----
DeKalb	98455	2017	The next distribution cycle pruning is scheduled for 2019.	2019	-----	-----
Raybrook	83951	2017	The next distribution cycle pruning is scheduled for 2019.	2019	-----	-----
Raybrook	83951	2017	The level 3 maintenance work identified during the inspection will be completed by December 2018.	2018	-----	Completed
Raybrook	83951	2017	The next I&M foot patrol is scheduled for 2020.	2020	-----	-----
Thousand Islands	81458	2017	The next distribution cycle pruning is scheduled for 2023.	2023	-----	-----
Thousand Islands	81458	2017	The next I&M foot patrol is scheduled for 2019.	2019	-----	-----
Higley	92451	2017	The next scheduled distribution cycle pruning is 2020.	2020	-----	-----
Higley	92451	2017	The maintenance work identified as level 3 from the feeder inspection will be completed by September 2018.	2018	-----	Completed
Higley	92451	2017	The next I&M foot patrol is scheduled for 2020.	2020	-----	-----
Bremen	81556	2017	All level 2 maintenance work identified from the feeder inspection will be completed by August 2018.	2018	-----	Completed
Bremen	81556	2017	All level 3 maintenance work identified from the feeder inspection will be completed by August 2020.	2020	-----	-----
Bremen	81556	2017	The next I&M foot patrol is scheduled for 2022.	2022	-----	-----
Bremen	81556	2017	The next distribution cycle pruning is scheduled for 2023.	2023	-----	-----
North Carthage	81653	2017	The next distribution cycle pruning is scheduled for 2020.	2020	-----	-----
North Carthage	81653	2017	All the level 3 maintenance work identified during the inspection will be completed by April 2019.	2019	-----	-----
North Carthage	81653	2017	The next I&M foot patrol is scheduled for 2021.	2021	-----	-----
Port Leyden	75563	2017	The next I&M foot patrol is scheduled for 2019.	2019	-----	-----
Port Leyden	75563	2017	The next distribution cycle pruning is scheduled for 2019.	2019	-----	-----
Paul Smiths	83462	2017	The level 3 maintenance work identified during the inspection is scheduled to be completed by September 2019.	2019	-----	-----
Paul Smiths	83462	2017	The next I&M foot patrol is scheduled for 2021.	2021	-----	-----
Paul Smiths	83462	2017	The next distribution cycle pruning is scheduled for 2022.	2022	-----	-----
South Philadelphia	76462	2017	The next I&M foot patrol is scheduled for 2019.	2019	-----	-----
South Philadelphia	76462	2017	The next distribution cycle pruning is scheduled for 2024.	2024	-----	-----

## J. SOUTHWEST REGION

### 1. OPERATING REGIONAL PERFORMANCE

#### a. HISTORIC CAIDI AND SAIFI INDICES

IDS Info:

	2018	2017	2016	2015	2014	2013
CAIDI (Target 1.950)	1.86	2.04	1.91	2.47	1.91	2.02
SAIFI (Target 1.181)	1.02	1.13	1.01	0.94	0.96	1.21
SAIDI	1.90	2.30	1.93	2.31	1.82	2.43
Interruptions	1,050	1,318	1,146	1,106	1,090	1,154
Customers Interrupted	106,962	117,713	104,786	97,534	99,976	126,814
Customer-Hours Interrupted	198,886	239,895	200,502	241,053	190,481	255,709
Customers Served	104,824	104,199	103,764	104,190	104,610	105,044
Customers Per Interruption	101.87	89.31	91.44	88.19	91.72	109.89
Availability Index	99.9783	99.9737	99.9780	99.9736	99.9792	99.9722
Interruptions/1000 Customers	10.02	12.65	11.04	10.62	10.42	10.99

#### b. DISCUSSION OF REGIONAL PERFORMANCE

In 2018, the Southwest Region met its CAIDI reliability target and met its SAIFI reliability target as set forth by the New York Public Service Commission (PSC). The final System Average Interruption Frequency Index (SAIFI) result was 1.02 interruptions, 14% below the PSC goal of 1.181 interruptions. As shown in the table above, the Customer Average Interruption Duration index (CAIDI) was 1.86 in 2018, 5% below the PSC's regional target of 1.950 hours.

The 2018 CAIDI result was 9% below the 2017 result of 2.04 hours, and 10% below the previous 5-year average of 2.06 hours. The 2018 SAIFI was 10% below the 2017 result of 1.13 interruptions, and 3% below the previous 5-year average of 1.05 interruptions.

In 2018, excluding major storms, the Southwest Region experienced 17 transmission interruptions. These interruptions accounted for 2% of the region's total interruptions (17 of 1,050), 40% of the region's total customers interrupted (CI), (42,812 of 106,962), and 18% (34,951 of 198,888) of the region's total customer-hours interrupted (CHI). Overall, transmission interruptions had a CAIDI of .82 hours, and a SAIFI of 0.41 interruptions.

The number of transmission-related interruptions decreased from 18 in 2017 to 17 in 2018 (a decrease of 6%). The number of customers interrupted increased from 26,076 in 2017, to 42,812 in 2018 (an increase of 64%), while the customer-hours interrupted increased from 22,642 in 2017, to 34,951 in 2018 (an increase of 54%).

In 2018, excluding major storms, the Southwest Region experienced 2 substation interruptions. These interruptions accounted for 0.2% of the region's total interruptions (2 of 1,050), 2% of the region's total customers interrupted, (2,565 of 106,962), and 20% (39,445 of 198,888) of the region's total customer-hours interrupted. Overall, substation interruptions had a CAIDI of 15.38 hours, and a SAIFI of 0.02 interruptions.

The number of substation-related interruptions decreased from 3 to 2 from 2017 to 2018 (a decrease of 33%). The number of customers interrupted decreased from 5,341 in 2017, to 2,565 in 2018 (a decrease of 52%), while the customer-hours interrupted increased from 2,160 in 2017, to 39,445 in 2018 (an increase of 1,726%).

In 2018, excluding major storms, the Southwest Region experienced 1,031 distribution interruptions. These interruptions accounted for 98% of the region's total interruptions (1,031 of 1,050), 58% of the region's total customers interrupted, (61,585 of 106,962), and 63% (124,492 of 198,888) of the region's total customer-hours interrupted. Overall, distribution interruptions had a CAIDI of 2.02 hours, and a SAIFI of 0.59 interruptions.

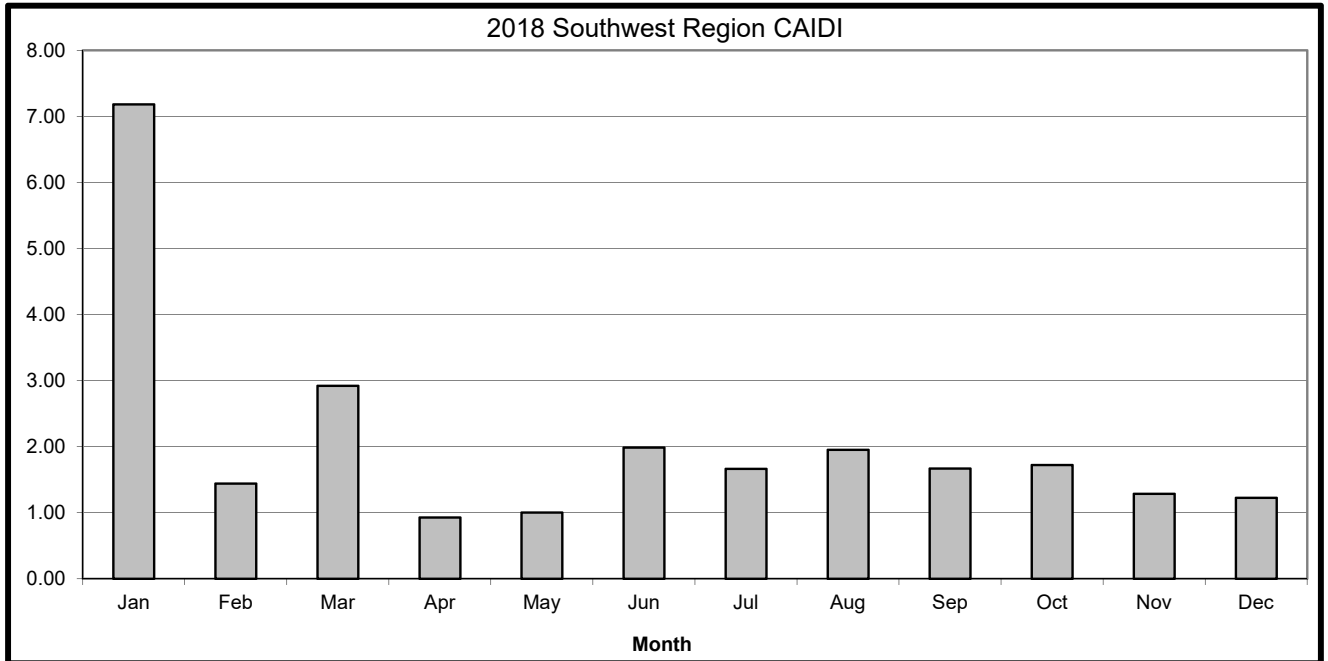
The number of distribution-related interruptions decreased from 1,297 to 1,031 from 2017 to 2018 (a decrease of 21%). The number of customers interrupted decreased from 86,296 in 2017, to 61,585 in 2018 (a decrease of 29%), while the customer-hours interrupted decreased from 215,092 in 2017, to 124,492 in 2018 (a decrease of 42%).

c. MONTHLY CAIDI AND SAIFI GRAPHS

The graphs on the following page show the monthly CAIDI and SAIFI for the Southwest Region for 2018. The Southwest Region met the CAIDI target during nine months, with the lowest two months being April (0.93) and May (1.00). CAIDI was above the PSC minimum for three months in 2018: January (7.18), Feb (3.43), March (2.92), and June (1.99).

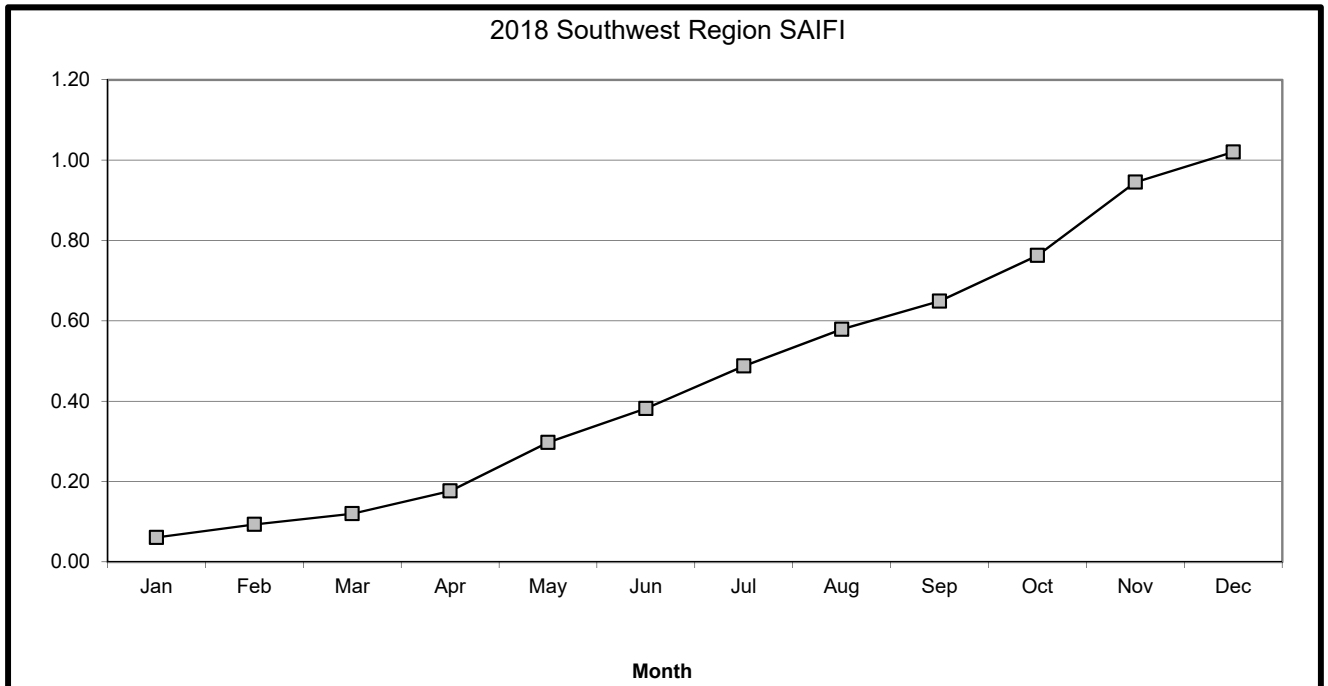
The year-end SAIFI for 2018 met the PSC minimum level for the Southwest Region. It showed the greatest increase during the months of May (0.12), and November (0.19); 30% of the SAIFI was accrued during these two months. The lowest four months for SAIFI were January (0.06), February (0.03), March (0.06), and April (0.06); the interruptions which occurred during these four months contributed only 24% of the total SAIFI.

# GRAPH OF MONTHLY CAIDI AND SAIFI FOR THE SOUTHWEST REGION



PSC CAIDI Goal:	
Minimum	1.950
2018 Actual	1.86

PSC SAIFI Goal:	
Minimum	1.181
2018 Actual	1.02



d. PSC CAUSE CODES

1) Number of Events by Cause – Historical

IDS Info:

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	809	347	52	91	48	0
<b>02</b> Tree Contacts	391	596	495	460	391	404
<b>03</b> Overloads	11	3	5	7	9	3
<b>04</b> Oper. Error	6	4	5	7	10	7
<b>05</b> Equipment	235	266	253	275	274	310
<b>06</b> Accidents	120	165	130	136	124	112
<b>07</b> Prearranged	22	17	18	7	21	28
<b>08</b> Cust. Equip.	0	0	0	0	0	0
<b>09</b> Lightning	82	108	98	69	139	135
<b>10</b> Unknown	183	159	142	145	122	155
<b>Total</b>	<b>1,859</b>	<b>1,665</b>	<b>1,198</b>	<b>1,197</b>	<b>1,138</b>	<b>1,154</b>

2) Customers Interrupted by Cause – Historical

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	58,846	37,960	10,626	11,145	12,137	0
<b>02</b> Tree Contacts	32,021	39,946	40,125	32,423	28,730	42,659
<b>03</b> Overloads	839	73	13	188	1,679	57
<b>04</b> Oper. Error	84	856	2,498	419	1,305	1,499
<b>05</b> Equipment	18,232	29,519	27,475	34,471	30,777	51,680
<b>06</b> Accidents	11,418	13,087	12,340	9,110	7,263	4,814
<b>07</b> Prearranged	1,778	7,031	3,297	404	2,230	2,165
<b>08</b> Cust. Equip.	0	0	0	0	0	0
<b>09</b> Lightning	3,614	7,404	11,284	4,834	10,728	13,637
<b>10</b> Unknown	38,976	19,797	7,754	15,685	17,264	10,303
<b>Total</b>	<b>165,808</b>	<b>155,673</b>	<b>115,412</b>	<b>108,679</b>	<b>112,113</b>	<b>126,814</b>

3) Customer-Hours Interrupted by Cause – Historical

<b>Cause Code</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
<b>01</b> Major Storms	890,163	377,373	28,094	23,779	37,466	0
<b>02</b> Tree Contacts	61,644	116,292	99,144	98,678	64,340	105,621
<b>03</b> Overloads	1,073	293	38	360	4,930	188
<b>04</b> Oper. Error	36	1,133	308	399	457	617
<b>05</b> Equipment	67,679	51,858	43,388	85,464	49,377	96,258
<b>06</b> Accidents	19,995	17,279	22,068	25,389	16,939	8,367
<b>07</b> Prearranged	2,460	5,966	3,203	748	4,069	2,031
<b>08</b> Cust. Equip.	0	0	0	0	0	0
<b>09</b> Lightning	6,615	16,571	20,843	7,889	25,743	23,612
<b>10</b> Unknown	39,385	30,504	11,512	22,127	24,624	19,015
<b>Total</b>	<b>1,089,050</b>	<b>617,269</b>	<b>228,597</b>	<b>264,832</b>	<b>227,945</b>	<b>255,709</b>

4) Interruptions, Customers Interrupted, and Customer-Hours Interrupted – 2018

<b>Cause Code</b>	<b>Interruptions</b>		<b>Customers Interrupted</b>		<b>Customer Hours Interrupted</b>	
	<b>Number</b>	<b>% Total</b>	<b>Number</b>	<b>% Total</b>	<b>Number</b>	<b>% Total</b>
<b>01</b> Major Storms	809	43.5%	58,846	35.5%	890,163	81.7%
<b>02</b> Tree Contacts	391	21.0%	32,021	19.3%	61,644	5.7%
<b>03</b> Overloads	11	0.6%	839	0.5%	1,073	0.1%
<b>04</b> Oper. Error	6	0.3%	84	0.1%	36	0.0%
<b>05</b> Equipment	235	12.6%	18,232	11.0%	67,679	6.2%
<b>06</b> Accidents	120	6.5%	11,418	6.9%	19,995	1.8%
<b>07</b> Prearranged	22	1.2%	1,778	1.1%	2,460	0.2%
<b>08</b> Cust. Equip.	0	0.0%	0	0.0%	0	0.0%
<b>09</b> Lightning	82	4.4%	3,614	2.2%	6,615	0.6%
<b>10</b> Unknown	183	9.8%	38,976	23.5%	39,385	3.6%
<b>Total</b>	<b>1,859</b>	<b>100.0%</b>	<b>165,808</b>	<b>100.0%</b>	<b>1,089,050</b>	<b>100.0%</b>

e. **INTERRUPTION REVIEW BY PSC CAUSE CODES**

**Cause Code 01 - Major Storms**

In 2018, Major Storms accounted for 44% of interruptions, 35% of customers interrupted, and 82% of Customer-Hours Interrupted.

Interruptions due to Major Storm were up 133% from 2017, and up 649% over the 5 year average. Customers interrupted due to Major Storms were up 55% from 2017, and up 309% over the 5 year average. Customer-Hours interrupted were up 136% from 2017 and up 854% over the 5 year average.

The remaining PSC code descriptions do not include Major Storms in the percentages.

**Cause Code 02 - Tree Contacts**

In 2018, Tree Contacts accounted for 37% of interruptions, 30% of customers interrupted, and 31% of Customer-Hours Interrupted.

Interruptions due to Tree Contacts were down 34% from 2017, and down 17% over the 5 year average. Customers interrupted due to Tree Contacts were down 20% from 2017, and down 13% over the 5 year average. Customer-Hours interrupted were down 47% from 2017 and down 36% over the 5 year average.

Tree Contacts were the largest cause of interruptions in 2018.

**Cause Code 03 - Overloads**

In 2018, Overloads accounted for 1% of interruptions, 1% of customers interrupted, and 1% of Customer-Hours Interrupted.

Interruptions due to Overloads were up 267% from 2017, and up 120% over the 5 year average. Customers interrupted due to Overloads were up 1049% from 2017, and up 109% over the 5 year average. Customer-Hours interrupted were up 266% from 2017 and down 8% over the 5 year average.

Overloads were the 7th largest cause of interruptions in 2018.

**Cause Code 04 - Operator Error**

In 2018, Operator Error accounted for 1% of interruptions, 0% of customers interrupted, and 0% of Customer-Hours Interrupted.

Interruptions due to Operator Error were up 50% from 2017, and down 14% over the 5 year average. Customers interrupted due to Operator Error were down 90% from 2017, and down 94% over the 5 year average. Customer-Hours interrupted were down 97% from 2017 and down 94% over the 5 year average.

Operator Error was the 8th largest cause of interruptions in 2018.



### **Cause Code 05 - Equipment Failure**

In 2018, Equipment Failures accounted for 22% of interruptions, 17% of customers interrupted, and 34% of Customer-Hours Interrupted.

Interruptions due to Equipment Failure were down 12% from 2017, and down 15% over the 5 year average. Customers interrupted due to Equipment Failure were down 38% from 2017, and down 48% over the 5 year average. Customer-Hours interrupted were up 31% from 2017 and up 4% over the 5 year average.

Equipment Failures were the 2nd largest cause of interruptions in 2018.

### **Cause Code 06 - Accidents**

In 2018, Accidents accounted for 11% of interruptions, 11% of customers interrupted, and 10% of Customer-Hours Interrupted.

Interruptions due to Accidents were down 27% from 2017, and down 10% over the 5 year average. Customers interrupted due to Accidents were down 13% from 2017, and up 22% over the 5 year average. Customer-Hours interrupted were up 16% from 2017 and up 11% over the 5 year average.

Accidents were the 4th largest cause of interruptions in 2018.

### **Cause Code 07 - Prearranged**

In 2018, Prearranged accounted for 2% of interruptions, 2% of customers interrupted, and 1% of Customer-Hours Interrupted.

Interruptions due to Prearranged were up 29% from 2017, and up 22% over the 5 year average. Customers interrupted due to Prearranged were down 75% from 2017, and down 41% over the 5 year average. Customer-Hours interrupted were down 59% from 2017 and down 23% over the 5 year average.

Prearranged was the 6th largest cause of interruptions in 2018.

### **Cause Code 08 - Customer Equipment**

There were no Customer Equipment interruptions in 2018.

### **Cause Code 09 - Lightning**

In 2018, Lightning accounted for 8% of interruptions, 3% of customers interrupted, and 3% of Customer-Hours Interrupted.

Interruptions due to Lightning were down 24% from 2017, and down 25% over the 5 year average. Customers interrupted due to Lightning were down 51% from 2017, and down 62% over the 5 year average. Customer-Hours interrupted were down 60% from 2017 and down 65% over the 5 year average.

Lightning was the 5th largest cause of interruptions in 2018.

**Cause Code 10 - Unknown**

In 2018, Unknown causes accounted for 17% of interruptions, 36% of customers interrupted, and 20% of Customer-Hours Interrupted.

Interruptions due to Unknown causes were up 15% from 2017, and up 26% over the 5 year average. Customers interrupted due to Unknown causes were up 97% from 2017, and up 175% over the 5 year average. Customer-Hours interrupted were up 29% from 2017 and up 83% over the 5 year average.

Unknown causes were the 3rd largest cause of interruptions in 2018.

f. DISCUSSION OF REGIONAL CAPEX PROJECTS WITH 2018/19 SPENDS:

The Southwest Region continues to work on capital-related projects in order to maintain customer satisfaction and future reliability. Some specific projects constructed either in 2018 or planned for construction in 2019 are discussed below. An additional table of major infrastructure projects follows and includes distribution, sub-transmission, and transmission-related projects.

Some projects on the list or discussed below are substation-related projects located throughout the Region intended to address loading concerns or equipment condition issues, including Delameter #93 and East Dunkirk #63.

There are numerous distribution projects where lines are being rebuilt or reconductored. These projects resulted from reliability reviews, responses to QRS inquiries, results of implementing asset strategies, and/or responses to load-related issues.

Some specific reliability-related projects in the Southwest Region follow below:

**Delameter Substation #93**

Delameter substation is an 115kV/13.2kV substation with two transformer banks, which serves over 9,342 customers. A project is underway to replace one transformer bank due to age and asset condition, add another for reliability and reconfigure a feeder. Transformer bank #1 is leaking and violates the 240MWhr criteria. The station has only one tie to an adjacent 13.2kV station (Lakeview). This project will improve asset condition and reliability. The project is expected to be completed by the end of 2020.

**Eden Switch Structure Substation**

Eden Switch Structure substation will be a 34.5kV/13.2kV substation with two transformer banks, which serves customers from North Eden, Delameter, Eden Center, and North Collins. A project is underway to purchase the land nearby the existing structures and create a standard 13.2 distribution station. This project will improve surround area system capacity and reliability. The project is expected to be completed by the end of 2020.

### **Sub-Transmission Infrastructure Projects:**

The 34.5kV system in the Southwest Region consists of several very long loops, which traverse through some of the most rugged terrain in the Western Division. Additionally, there are numerous distribution circuits built below the sub-transmission circuits on shared poles. If either circuit fails, often times both are affected. The following sub-transmission projects were completed in 2017: Line 811 (Olean - Nile), Line 803/817 (N. Ashford – Nuclear Fuel Services), Line 817 (N. Ashford – Nuclear Fuels), Line 809 (Homer Hill – Ceres), and Line 857 (N. Angola – Baghdad). A number of the projects planned for 2019/2020 will maintain and upgrade the system, including the projects on the following sub-transmission lines: Line 859 (Hartfield - S. Dow), Line 863 Tap (Sherman - Ashville), Line 868 & 863 Taps (W. Ashville - Ashville), Line 610 (Ridge - Shaleton), Line 856 (Shaleton – North Angola), and Line 867 (W.Portland – Sherman). These projects will improve asset condition and reliability.

Furthermore, there are designs to install Sub-Transmission Automation switches on Line 801 (Delevan - Machias) in the Southwest Region in 2018. The DA switches will improve reliability by sectionalizing portions of the lines during interruptions.

**Major Capital Projects for Southwest Region:**

<b>Region</b>	<b>Project Name</b>	<b>Project Type</b>	<b>Fin Sys Proj No.</b>	<b>Finish</b>	<b>Total Spend</b>
Southwest	East Dunkirk Sta 63 TB replacements	Substations	C066266	10/09/18	\$4,297,544
Southwest	Falconer-HH 153-154 Pinco Ins Repl	Sub T Line	C027422	02/20/18	\$1,195,611

## 2. OPERATING CIRCUIT LISTS

This section includes the following three (3) tables and Worst Performing Circuit analysis for the Southwest Region.

- a. Worst Performing Circuit List
- b. Worst Performing Circuits with Three-Year History for CAIDI and SAIFI Indices
- c. Worst Performing Circuits by number of Momentary Interruptions

a. NATIONAL GRID WORST PERFORMING CIRCUIT LIST

**SOUTHWEST REGION**

<b>FEEDER #</b>	<b>A CUST. SERVED</b>	<b>B TOTAL INTER.</b>	<b>C #CUST. INTER.</b>	<b>D CUST. HRS. INTER.</b>	<b>C/A SAIFI</b>	<b>D/A SAIDI</b>	<b>D/C CAIDI</b>	<b>NUMBER OF MOMENTARIES</b>
HARTFIELD 7955	1,537	19	6,219	35,679	4.05	23.21	5.74	1
DELAMETER 9353	3,031	16	9,438	10,342	3.11	3.41	1.10	6
HARTFIELD 7958	363	8	1,623	11,191	4.47	30.83	6.90	2
VALLEY 4457	1,325	17	2,828	6,033	2.13	4.55	2.13	0

Regional Goals:  
 CAIDI Min. 1.95  
 SAIFI Min. 1.181

b. NATIONAL GRID WORST PERFORMING CIRCUITS WITH A 3 YEAR HISTORY FOR CAIDI AND SAIFI INDICES.

SOUTHWEST REGION

<b>FEEDER #</b>	<b>2018 CAIDI</b>	<b>2017 CAIDI</b>	<b>2016 CAIDI</b>	<b>2015 CAIDI</b>	<b>2018 SAIFI</b>	<b>2017 SAIFI</b>	<b>2016 SAIFI</b>	<b>2015 SAIFI</b>
HARTFIELD 7955	5.74	1.28	1.89	3.27	4.05	1.49	3.86	0.74
DELAMETER 9353	1.10	1.93	1.85	1.70	3.11	2.03	0.81	0.73
HARTFIELD 7958	6.90	1.93	0.32	5.52	4.47	1.01	2.44	0.85
VALLEY 4457	2.13	2.40	3.42	0.97	2.13	1.47	0.47	2.07

Regional Goals:  
 CAIDI Min. 1.95  
 SAIFI Min. 1.181



c. NATIONAL GRID WORST PERFORMING CIRCUITS BY # OF MOMENTARY INTERRUPTIONS

SOUTHWEST REGION

Feeders			Customer Momentaries				Ranks		
Volts (kV)	Station Name	Ckt/F No.	Substation	Transmission	Distribution	Total	Within Region	Within System	Reliability Ranking
No circuits experienced 10 or more momentary interruptions in 2018.									

d. WORST PERFORMING CIRCUIT ANALYSIS

For 2018, the Company is reporting on the five worst performing feeders in the Southwest Region. The list consists of four 13.2kV feeders and zero 4.8kV feeders.

For the Southwest Region, the PSC minimum CAIDI is 1.95 hours and the PSC minimum SAIFI is 1.181 interruptions.

## 1. HARTFIELD 7955 - 13.2kV

*Profile:* 1,537 Customers, 52.2 Circuit Miles

*Indices:* CAIDI = 5.74, SAIFI = 4.05

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	4	21.05%	696	11.19%	1,280	3.59%
3	OVERLOADS	1	5.26%	36	0.58%	45	0.13%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	4	21.05%	1,636	26.31%	28,785	80.68%
6	ACCIDENTS	2	10.53%	17	0.27%	5	0.02%
7	PREARRANGED	1	5.26%	438	7.04%	51	0.14%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	7	36.84%	3,396	54.61%	5,514	15.45%
Totals		19	100.00%	6,219	100.00%	35,679	100.00%

### **Problem Analysis:**

- There were 19 interruptions on the Hartfield 7955 in 2018.
- There was 1 transmission interruption.
  - This Transmission interruption occurred on November 24, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 25% of the total customers interrupted (1,534 of 6,219), and 7% of the total customer-hours interrupted (2,608 of 35,679).
- There was 1 substation interruption.
  - This Substation interruption occurred on January 30, 2018, coded as a cause of deterioration (PSC cause code 05). This lockout accounted for 25% of the total customers interrupted (1,530 of 6,219), and 80% of the total customer-hours interrupted (28,637 of 35,679).
- The remaining 17 events occurred at the distribution level.
- The distribution circuit breaker for the Hartfield 7955 experienced 1 momentary operation in 2018.
- The circuit breaker for the Hartfield 7955 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 25% of the total amount of customers interrupted (1,528 out of 6,219) and 7% of the total amount of the customer-hours interrupted (2,419 out of 35,679).
  - This lockout occurred on February 26, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 25% of the total customers interrupted (1,528 of 6,219), and 7% of the total customer-hours interrupted (2,419 of 35,679). This occurred from a broken substation breaker and eventually the time it took to bring a mobile transformer in after 3 events culminated into one outage.

- Unknown were the leading cause of interruptions on the Hartfield 7955 in 2018, accounting for 37% of total interruptions (7 of 19). Trees were the 2nd leading cause of interruptions, accounting for 21% of total interruptions (4 of 19). Equipment Failures were the 3rd leading cause of interruptions, accounting for 21% of total interruptions (4 of 19).
- Unknown were the leading cause of customers interrupted (CI) on the Hartfield 7955 in 2018, accounting for 55% of total customers interrupted (3,396 of 6,219). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 26% of total customers interrupted (1,636 of 6,219). Trees were the 3rd leading cause of customers interrupted, accounting for 11% of total customers interrupted (696 of 6,219).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Hartfield 7955 in 2018, accounting for 81% of total customer-hours interrupted (28,785 of 35,679). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 15% of total customer-hours interrupted (5,514 of 35,679). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 4% of total customer-hours interrupted (1,280 of 35,679).
- Of the 19 interruptions on this circuit, 6 affected 10 customers or less, with 3 being single customer outages.

**Action Taken:**

- Distribution hazardous tree removal was completed in 2014.
- An I&M foot patrol of the distribution line inspection was completed in August 2018.
- Minor storm hardening and feeder tie projects have been submitted into the capital plan.

**Action Plan:**

- Placing spare parts at Hartfield Substation.
- Complete Level 2 Distribution Line Inspection work by September of 2019.
- Complete Level 3 Distribution Line Inspection work by September of 2020.
- Distribution cycle tree trimming scheduled for FY2019.

## 2. DELAMETER 9353 - 13.2kV

*Profile: 3,031 Customers, 74.6 Circuit Miles*  
*Indices: CAIDI = 1.10, SAIFI = 3.11*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	3	18.75%	684	7.25%	2,823	27.29%
3	OVERLOADS	1	6.25%	684	7.25%	682	6.59%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	6	37.50%	993	10.52%	1,006	9.73%
6	ACCIDENTS	3	18.75%	1,020	10.81%	4,866	47.05%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	3	18.75%	6,057	64.18%	965	9.33%
Totals		16	100.00%	9,438	100.00%	10,342	100.00%

### Problem Analysis:

- There were 16 interruptions on the Delameter 9353 in 2018.
- There were 2 transmission interruptions.
  - The first Transmission interruption occurred on May 03, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 32% of the total customers interrupted (3,022 of 9,438), and 6% of the total customer-hours interrupted (604 of 10,342).
  - The second Transmission interruption occurred on November 06, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 32% of the total customers interrupted (3,034 of 9,438), and 3% of the total customer-hours interrupted (354 of 10,342).
- There were no substation interruptions.
- The remaining 14 events occurred at the distribution level.
- The distribution circuit breaker for the Delameter 9353 experienced 6 momentary operations in 2018.
- The distribution circuit breaker for the Delameter 9353 experienced 0 sustained operations (lockouts) in 2018.
- Equipment Failures were the leading cause of interruptions on the Delameter 9353 in 2018, accounting for 38% of total interruptions (6 of 16). Trees were the 2nd leading cause of interruptions, accounting for 19% of total interruptions (3 of 16). Accidents were the 3rd leading cause of interruptions, accounting for 19% of total interruptions (3 of 16).

- Unknown were the leading cause of customers interrupted (CI) on the Delameter 9353 in 2018, accounting for 64% of total customers interrupted (6,057 of 9,438). Accidents were the 2nd leading cause of customers interrupted, accounting for 11% of total customers interrupted (1,020 of 9,438). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 11% of total customers interrupted (993 of 9,438).
- Accidents were the leading cause of customer-hours interrupted (CHI) on the Delameter 9353 in 2018, accounting for 47% of total customer-hours interrupted (4,866 of 10,342). Trees were the 2nd leading cause of customer-hours interrupted, accounting for 27% of total customer-hours interrupted (2,823 of 10,342). Equipment Failures were the 3rd leading cause of customer-hours interrupted, accounting for 10% of total customer-hours interrupted (1,006 of 10,342).
- Of the 16 interruptions on this circuit, 8 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- Minor storm hardening and feeder tie projects have been submitted into the capital plan.
- Distribution cycle tree trimming was completed in FY 2017.
- A distribution line inspection was completed in November of 2017.
- Complete Level 2 Distribution Line Inspection work in November of 2018.

**Action Plan:**

- Complete Level 3 Distribution Line Inspection work by November of 2019.
- Distribution cycle tree pruning due again in FY 2022.

### 3. HARTFIELD 7958 - 13.2kV

*Profile: 363 Customers, 31.9 Circuit Miles*

*Indices: CAIDI = 6.90, SAIFI = 4.47*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	2	25.00%	447	27.54%	938	8.38%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	0	0.00%	0	0.00%	0	0.00%
5	EQUIPMENT	2	25.00%	405	24.95%	9,022	80.62%
6	ACCIDENTS	0	0.00%	0	0.00%	0	0.00%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	4	50.00%	771	47.50%	1,231	11.00%
Totals		8	100.00%	1,623	100.00%	11,191	100.00%

**Problem Analysis:**

- There were 8 interruptions on the Hartfield 7958 in 2018.
- There were 2 transmission interruptions.
  - The first Transmission interruption occurred on November 24, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 22% of the total customers interrupted (365 of 1,623), and 6% of the total customer-hours interrupted (621 of 11,191).
  - The second Transmission interruption occurred on November 16, 2018, coded as a cause of tree fell (PSC cause code 02). This lockout accounted for 22% of the total customers interrupted (364 of 1,623), and 7% of the total customer-hours interrupted (819 of 11,191).
- There was 1 substation interruption.
  - This Substation interruption occurred on January 30, 2018, coded as a cause of deterioration (PSC cause code 05). This lockout accounted for 22% of the total customers interrupted (361 of 1,623), and 79% of the total customer-hours interrupted (8,887 of 11,191).
- The remaining 5 events occurred at the distribution level.
- The distribution circuit breaker for the Hartfield 7958 experienced 2 momentary operations in 2018.
- The distribution circuit breaker for the Hartfield 7958 experienced 1 sustained operation (lockout) in 2018. This interruption accounted for 22% of the total amount of customers interrupted (361 out of 1,623) and 5% of the total amount of the customer-hours interrupted (572 out of 11,191).

- This lockout occurred on February 26, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 22% of the total customers interrupted (361 of 1,623), and 5% of the total customer-hours interrupted (572 of 11,191). This occurred from a broken substation breaker and eventually the time it took to bring a mobile transformer in after 3 events culminated into one outage.
- Unknown were the leading cause of interruptions on the Hartfield 7958 in 2018, accounting for 50% of total interruptions (4 of 8). Trees were the 2nd leading cause of interruptions, accounting for 25% of total interruptions (2 of 8). Equipment Failures were the 3rd leading cause of interruptions, accounting for 25% of total interruptions (2 of 8).
- Unknown were the leading cause of customers interrupted (CI) on the Hartfield 7958 in 2018, accounting for 48% of total customers interrupted (771 of 1,623). Trees were the 2nd leading cause of customers interrupted, accounting for 28% of total customers interrupted (447 of 1,623). Equipment Failures were the 3rd leading cause of customers interrupted, accounting for 25% of total customers interrupted (405 of 1,623).
- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Hartfield 7958 in 2018, accounting for 81% of total customer-hours interrupted (9,022 of 11,191). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 11% of total customer-hours interrupted (1,231 of 11,191). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (938 of 11,191).
- Of the 8 interruptions on this circuit, 1 affected 10 customers or less, with 0 being single customer outages.

**Action Taken:**

- Spare substation components stored on site.
- Minor storm hardening and feeder tie projects have been submitted into the capital plan.
- Distribution cycle tree trimming was completed in FY 2018.
- A distribution line Level 3 inspection was completed in May of 2017.

**Action Plan:**

- Distribution cycle tree pruning due in FY 2019.
- Complete Level 1 Distribution Line Inspection work due in 2020.



#### 4. VALLEY 4457 - 13.2kV

*Profile: 1,325 Customers, 96.6 Circuit Miles*  
*Indices: CAIDI = 2.13, SAIFI = 2.13*

**CAUSE CODE PERFORMANCE TABLE**

Code	Category	Interruptions		Customers Interrupted		Customer Hours	
		Number	% Total	Number	% Total	Number	% Total
2	TREE	5	29.41%	107	3.78%	465	7.71%
3	OVERLOADS	0	0.00%	0	0.00%	0	0.00%
4	OPER. ERROR	1	5.88%	36	1.27%	4	0.07%
5	EQUIPMENT	5	29.41%	1,329	46.99%	4,634	76.81%
6	ACCIDENTS	1	5.88%	17	0.60%	16	0.27%
7	PREARRANGED	0	0.00%	0	0.00%	0	0.00%
8	CUST. EQUIP.	0	0.00%	0	0.00%	0	0.00%
9	LIGHTNING	0	0.00%	0	0.00%	0	0.00%
10	UNKNOWN	5	29.41%	1,339	47.35%	913	15.14%
Totals		17	100.00%	2,828	100.00%	6,033	100.00%

**Problem Analysis:**

- There were 17 interruptions on the Valley 4457 in 2018.
- There was 1 transmission interruption.
  - This Transmission interruption occurred on October 16, 2018, coded as a cause of unknown (PSC cause code 10). This lockout accounted for 47% of the total customers interrupted (1,321 of 2,828), and 15% of the total customer-hours interrupted (881 of 6,033).
- There were no substation interruptions.
- The remaining 16 events occurred at the distribution level.
- The distribution circuit breaker for the Valley 4457 experienced 0 momentary operations in 2018.
- The distribution circuit breaker for the Valley 4457 experienced 0 sustained operations (lockouts) in 2018.
- Trees were the leading cause of interruptions on the Valley 4457 in 2018, accounting for 29% of total interruptions (5 of 17). Equipment Failures were the 2nd leading cause of interruptions, accounting for 29% of total interruptions (5 of 17). Unknown were the 3rd leading cause of interruptions, accounting for 29% of total interruptions (5 of 17).
- Unknown were the leading cause of customers interrupted (CI) on the Valley 4457 in 2018, accounting for 47% of total customers interrupted (1,339 of 2,828). Equipment Failures were the 2nd leading cause of customers interrupted, accounting for 47% of total customers interrupted (1,329 of 2,828). Trees were the 3rd leading cause of customers interrupted, accounting for 4% of total customers interrupted (107 of 2,828).

- Equipment Failures were the leading cause of customer-hours interrupted (CHI) on the Valley 4457 in 2018, accounting for 77% of total customer-hours interrupted (4,634 of 6,033). Unknown were the 2nd leading cause of customer-hours interrupted, accounting for 15% of total customer-hours interrupted (913 of 6,033). Trees were the 3rd leading cause of customer-hours interrupted, accounting for 8% of total customer-hours interrupted (465 of 6,033).
- Of the 17 interruptions on this circuit, 7 affected 10 customers or less, with 4 being single customer outages.

**Action Taken:**

- Distribution cycle tree trimming was completed in FY 2015.
- Minor storm hardening and feeder tie projects have been submitted into the capital plan.
- A distribution line Level 3 inspection was completed in June on 2018.

**Action Plan:**

- Distribution cycle tree pruning will be due in FY 2020.
- A distribution line Level 1 inspection will be completed in 2020.

3. ACTION PLAN SUMMARIES

a. SUMMARY OF ACTION PLANS FOR 2018 WORST PERFORMING CIRCUITS

Station	Feeder	Report Year	Action Plan	Estimated Compl. Date	Estimated Cost	Comments
Hartfield	09-7955	2018	Complete Level 2 Distribution Line Inspection work by September of 2019.	2019	TBD	
Hartfield	09-7955	2018	Complete Level 1 Distribution Line Inspection work by September of 2020.	2020	TBD	
Hartfield	09-7955	2018	Cycle tree pruning scheduled for FY2020.	2020	TBD	
Delameter	07-9353	2018	Complete Level 3 Distribution Line Inspection work by November of 2019.	2019	TBD	
Delameter	07-9353	2018	Distribution cycle tree pruning scheduled for FY2022.	2022	TBD	
Hartfield	09-7958	2018	Cycle tree pruning scheduled for FY2019	2019	TBD	
Hartfield	09-7955	2018	Complete Level 1 Distribution Line Inspection work due in 2020.	2020	TBD	
Valley	10-4457	2018	Distribution cycle tree pruning will be due in FY 2020.	2020	TBD	
Valley	10-4457	2018	A distribution line Level 1 inspection will be completed in 2020.	2020	TBD	

b. STATUS OF ACTION PLANS FOR 2017 WORST PERFORMING CIRCUITS

Station	Feeder	Report Year	Action Plan	Actual Compl. Date	Actual Cost	Comments
Dugan Rd.	10-2253	2018	New Recloser as replacement for damaged unit from September 8th lightning.	10/18/2018	\$56,341.48	WR# 25832074
Dugan Rd.	10-2253	2018	Complete Level 2 Distribution Line Inspection work by September of 2018.	2018	Blanket	
Dugan Rd.	10-2253	2018	Complete Level 3 Distribution Line Inspection work by September of 2020.	2020	TBD	
Dugan Rd.	10-2253	2018	Distribution cycle tree trimming scheduled for FY2019.	2019	TBD	
Vandalia	10-10451	2018	Complete Level 2 Distribution Line Inspection work by March of 2018.	2018	Blanket	
Vandalia	10-10451	2018	Complete Level 3 Distribution Line Inspection work by March of 2020.	2020	TBD	
Berry Rd.	08-15351	2018	Complete voltage conversion, reconductoring, and feeder tie additions by 2019.	2019	\$720,000	WR# 16819499
Berry Rd.	08-15351	2018	Complete Level 2 Distribution Line Inspection work by March of 2018.	2018	Blanket	
Berry Rd.	08-15351	2018	Complete Level 3 Distribution Line Inspection work by March of 2020.	2020	TBD	
Cassadaga	08-6161	2018	Perform New Feeder Tie and Trip Saver Study in 2018.	2018	Blanket	
Maplehurst	10-0461	2018	Complete Level 3 Distribution Inspection work by October of 2018.	2018	Blanket	
Maplehurst	10-0461	2018	Distribution cycle tree trimming scheduled for FY 2019.	2019	TBD	
Bennett Rd.	08-9954	2018	Complete Level 3 inspection work by March of 2019.	2019	TBD	
Bennett Rd.	08-9954	2018	Study and monitor feeder in 2018.	2018	Blanket	
West Perrysburg	07-18151	2018	Inspection and Maintenance scheduled for before June of 2018.	2018	Blanket	
Delameter	07-9353	2018	Complete Level 2 Distribution Inspection work by June of 2018.	2018	Blanket	
Delameter	07-9353	2018	Complete Level 3 Distribution Inspection work by June of 2020.	2020	TBD	
Delameter	07-9395	2018	Substation Transformers and additional feeders to be completed by 2020.	2020	\$1,750,000	C046536
Price Corners	10-1452	2018	Complete distribution hazard tree trimming in FY 2019.	2018	Blanket	
Price Corners	10-1452	2018	Complete Level 1 of inspection and Maintenance by December of 2018.	2018	Blanket	
Price Corners	10-1452	2018	Complete Level 2 & 3 Distribution Inspection work by December 2019 and 2021, respectively.	2021	TBD	
Reservoir	10-10361	2018	Complete distribution hazard tree trimming in FY 2019.	2018	Blanket	
Reservoir	10-10361	2018	Complete Level 1 of inspection and Maintenance by December of 2019.	2019	TBD	
Reservoir	10-10361	2018	Complete Level 2 & 3 Distribution Inspection work by December 2019 and 2021, respectively.	2021	TBD	
Cattaraugus	10-1562	2018	Complete Level 3 Distribution Inspection work by December of 2019.	2019	TBD	
North Eden	07-8251	2018	Study and monitor feeder by 2019.	2019	TBD	

## K. GLOSSARY

**CAIDI** - Customer Average Interruption Duration Index is the average service restoration time for customers interrupted. It is determined by dividing the sum of all customer interruption durations by the total number of customers interrupted in a year.

**Customer Hours of Interruption** - The hours of interruption duration multiplied by the number of customers interrupted for a given interruption.

**Distribution Circuit** - An electric feeder line serving customers and operating at voltage levels below 23,000 volts - Typically, 4.16, 4.8 or 13.2kV.

**Failed Region** - Any region whose indices exceed minimum level of CAIDI or SAIFI as set for that region by the Public Service Commission (PSC).

**Fiscal Year** – Beginning in 2002 the Company changed the cycle of its annual budgeting and reporting process from a calendar year beginning January 1<sup>st</sup> and ending December 31<sup>st</sup> to a fiscal year beginning April 1<sup>st</sup> and ending March 31<sup>st</sup> of the following year. Budget estimates for work to be performed on worst performing feeders will most likely reflect this shift in fiscal year budgeting while actual costs typically reflect work completed by the end of the calendar year.

**Interruption** - Loss of electric service for five minutes or more to one or more customers. This is a reliability issue rather than a power quality issue.

**Major Storm** - A storm that causes at least 10% of the metered customers in a region to be without service or a storm that results in metered customers to be without service for 24 hours or more.

**Minimum Goal** - As defined by the Company and the PSC, this is the level of service reliability below which a region fails and additional analysis is required.

**Momentary Interruption** - Loss of electric service for less than five minutes to one customer or more. This a power quality rather than a reliability issue.

**Objective Goal** - The target level of service reliability as defined by the Company and the PSC.

**Power Quality** - The performance of a circuit other than that defined by reliability. It is characterized by parameters such as the number of momentary (less than 5 minute) interruptions, steady state voltage sags, swells, surges, noise and harmonics.

**Recloser** - A loadbreak device that operates when a fault current of pre-determined level and duration flows through it.

**Region** - One of eight geographic areas within the Company's electric territory. For the purpose of this report, the eight regions are: Capital (Albany, Troy, Schenectady, Hudson); Central (Syracuse, Fulton, Oswego, Pulaski, Cortland); Frontier (Buffalo, Niagara Falls); Genesee (Batavia, Avon,

Albion, Medina); Mohawk Valley (Utica, Rome, Oneida, Herkimer); Northeast (Glens Falls, Saratoga, Ticonderoga); Northern (Watertown, Ogdensburg, Malone, Potsdam); And Southwest (Angola, Fredonia, Stow, Olean).

**Reliability** - The electric performance of a distribution circuit as experienced by its customers. It is based on interruptions of five (5) minutes or longer, their duration, frequency and number of customers affected.

**SAI** - System Availability Index is the percent of time that service was available during the year. The SAI is derived from the ratio of the total number of customer hours that service was available during the year (24/hour/day x 365 days/year - SAIDI) to the total customer hours available per year (8,760 = 24 hours/day x 365 days/year) multiplied by 100 percent.

**SAIDI** - System Average Interruption Duration Index is an average interruption duration per customers served per year. It is the ratio of the customer hours interrupted to the total number of customers served.

**SAIFI** - System Average Interruption Frequency Index is the average number of times that a customer is interrupted in a year. It is determined by dividing the number of customers interrupted in a year by the average number of customers connected during the year.

**SECTIONALIZER** - A non-loadbreak circuit device that works with substation breaker or a recloser to minimize the number of customers involved in an interruption.

**Worst-Performing Circuits** - Circuits in the system or a given region that are the worst performing based on the Company's combined rankings of:

- a. SAIFI
- b. SAIDI
- c. Number of Interruptions
- d. Number of Customer Hours Interrupted



**NATIONALGRID**  
**ELECTRIC SERVICE INTERRUPTION - ACTIVE FEEDER RANKING**  
**DURING TIME PERIOD JAN 01, 2018 TO DEC 31, 2018**  
**FACILITY TYPE(S) INCLUDE: DISTRIBUTION, SUBSTATION, AND TRANSMISSION**  
**EXCLUDING PSC CODE(S): 01**  
**REPORT # 4**  
**SYSTEM REPORT**

Region	Station Name	Ckt/F No.	No. Cst. Served	No. Intr.	Intr. Rank	Tot. Dur. Hours	Avg. Dur.	Max. Dur.	Cust. Intr.	Max. Cust.	Tot. Cust. Hours	Tot. CH Rank	SAIFI	SAIFI Rank	SAIDI	SAIDI Rank	CAIDI	Fdr Rank	Mmty Intr.
Central	Lighthouse Hill	16-6144	2212	70	2088	269.1	3.8	15.4	14250	2214	27600.8	2085	6.44	2085	12.48	2064	1.94	8322	0
Northeast	Hague Road	41-41853	2205	37	2061	172.8	4.7	21	13330	2233	36207.85	2089	6.05	2083	16.42	2076	2.72	8309	4
Mohawk	Eagle Bay	17-38272	1119	31	2045	156.4	5	31.5	8106	1152	28443.65	2086	7.24	2088	25.42	2085	3.51	8304	5
Mohawk	Lehigh	18-66952	1973	30	2042	184.4	6.1	35.1	7835	1975	38180.05	2090	3.97	2048	19.35	2079	4.87	8259	1
Northeast	Fort Gage	40-31954	1902	45	2076	171.9	3.8	23.4	8391	1880	17481.57	2072	4.41	2064	9.19	2045	2.08	8257	2
Northern	Thousand Isl	26-81452	2141	47	2079	258.8	5.5	28.3	7986	2232	23948.1	2082	3.73	2038	11.19	2056	3	8255	3
Mohawk	Old Forge	17-38361	612	25	2003	113.4	4.5	18	4026	616	17646.6	2074	6.58	2087	28.83	2088	4.38	8252	3
Mohawk	Old Forge	17-38362	731	27	2021	197.3	7.3	17.4	3296	738	17877.65	2077	4.51	2067	24.46	2082	5.42	8247	3
Mohawk	Poland - Utica	17-62258	1585	58	2084	277.2	4.8	15.3	4894	668	21666.93	2081	3.09	2007	13.67	2069	4.43	8241	5
Northeast	Port Henry	41-38551	1741	28	2030	145.2	5.2	21.9	7172	1776	21108.85	2080	4.12	2050	12.12	2063	2.94	8223	8
Mohawk	Sherman	17-33351	1448	30	2042	122.1	4.1	10.3	6779	1669	12414.48	2050	4.68	2070	8.57	2035	1.83	8197	5
Northeast	Vail Mills	35-39253	3091	61	2086	279.4	4.6	21.3	8262	1851	27515.82	2084	2.67	1970	8.9	2040	3.33	8180	0
Northeast	Burgoyne	38-33751	1813	52	2081	221	4.3	23.2	6397	1845	13418.17	2055	3.53	2031	7.4	2010	2.1	8177	5
Northeast	Gilmantown	35-15451	2042	32	2048	164.9	5.2	22.3	6172	2050	19327.55	2079	3.02	2000	9.47	2049	3.13	8176	5
Mohawk	Eagle Bay	17-38271	892	20	1907	108.7	5.4	12.7	7449	911	25661.33	2083	8.35	2089	28.77	2087	3.44	8166	5
Central	West Monroe	11-27451	1978	45	2076	158.7	3.5	12.2	7550	1981	12885.55	2054	3.82	2041	6.51	1991	1.71	8162	7
Northeast	Bolton	40-28451	2034	37	2061	215.2	5.8	19.6	5499	2124	17729.25	2076	2.7	1975	8.72	2036	3.22	8148	1
Northeast	Hague Road	41-41852	1724	25	2003	143.7	5.7	24.6	6029	1707	16211.05	2066	3.5	2030	9.4	2048	2.69	8147	3
Northern	Lyme	13-73352	2785	28	2030	97.6	3.5	15.6	11880	2836	16962.62	2070	4.27	2057	6.09	1976	1.43	8133	7
Mohawk	Lehigh	18-66954	2157	77	2089	296.9	3.9	16.1	5713	2134	15369.48	2062	2.65	1969	7.13	2005	2.69	8125	0
Northern	Gilpin Bay	24-95661	857	33	2052	109.9	3.3	10.8	3571	874	7692	1980	4.17	2052	8.98	2041	2.15	8125	3
Northeast	Wilton	38-32952	1575	23	1970	89.6	3.9	8.9	7654	1583	12674.08	2052	4.86	2074	8.05	2027	1.66	8123	1
Northeast	Otten	41-41213	542	21	1928	141.6	6.7	17.8	3089	728	10396.93	2025	5.7	2081	19.18	2078	3.37	8112	5
Central	Gilbert Mills	11-24751	2135	22	1948	57.9	2.6	9.4	11503	2133	16185.27	2065	5.39	2079	7.58	2017	1.41	8109	1
Southwest	Hartfield	09-7955	1537	19	1891	61	3.2	24.6	6219	1534	35679.28	2088	4.05	2049	23.21	2081	5.74	8109	1
Northern	Star Lake	29-72761	817	25	2003	87.9	3.5	8	2402	815	10222.32	2022	2.94	1992	12.51	2065	4.26	8082	1
Mohawk	Alder Creek	17-70161	978	28	2030	146.6	5.2	14.2	3116	987	8702.6	1997	3.19	2012	8.9	2040	2.79	8079	0
Northeast	Middleburg	37-39051	1251	44	2073	166.5	3.8	14.4	3941	796	8113.52	1991	3.15	2011	6.49	1990	2.06	8065	3
Capital	Greenbush	30-07852	2325	25	2003	107.5	4.3	10	5586	2326	18250.32	2078	2.4	1943	7.85	2025	3.27	8049	0
Capital	Blue Stores	33-30353	1399	28	2030	105.5	3.8	12.4	6116	1402	8058.93	1990	4.37	2061	5.76	1965	1.32	8046	7
Central	Tully Center	12-27851	2124	39	2066	120.4	3.1	8.4	7617	2125	10419.7	2027	3.59	2033	4.91	1916	1.37	8042	3
Northern	Lowville	23-77354	2671	81	2090	307.1	3.8	25.8	6219	1449	14143.45	2059	2.33	1934	5.3	1940	2.27	8023	1
Northern	Sunday Creek	23-87651	267	24	1986	103.5	4.3	17.5	737	266	7193.23	1969	2.76	1981	26.94	2086	9.76	8022	3
Northeast	Port Henry	41-38552	1642	17	1851	59.8	3.5	11.6	6356	1656	17578.43	2073	3.87	2045	10.71	2053	2.77	8022	6
Northeast	E J West	35-03851	1469	34	2054	149.2	4.4	14.9	3105	1485	11262.69	2040	2.11	1885	7.67	2021	3.63	8000	1

Region	Station Name	Ckt/F No.	No. Cst. Served	No. Intra.	Intra. Rank	Tot. Dur. Hours	Avg. Dur.	Max. Dur.	Cust. Intra.	Max. Cust.	Tot. Cust. Hours	Tot. CH Rank	SAIFI	SAIFI Rank	SAIDI	SAIDI Rank	CAIDI	Fdr Rank	Mmtly Intra.
Northeast	Wilton	39-32951	1538	23	1970	80.7	3.5	12.6	7167	1540	8696.57	1996	4.66	2069	5.65	1960	1.21	7995	3
Central	Tully Center	12-27853	1229	22	1948	60	2.7	6.9	7187	1234	7609.77	1979	5.85	2082	6.19	1981	1.06	7990	3
Central	Bartell Rd	11-32555	2205	24	1986	122.4	5.1	21.9	6107	2205	12726.1	2053	2.77	1982	5.77	1967	2.08	7988	7
Capital	Voorheesville	30-17851	2052	44	2073	235.5	5.4	17.9	3974	1863	16598.83	2069	1.94	1811	8.09	2029	4.18	7982	8
Central	Whitaker	14-29653	2274	20	1907	89.8	4.5	20.9	8169	2270	14136.17	2058	3.59	2033	6.22	1984	1.73	7982	3
Northeast	Burgoyne	38-33752	2091	33	2052	134.9	4.1	11.4	5669	2119	10392.57	2024	2.71	1976	4.97	1920	1.83	7972	1
Mohawk	Raquette Lake	17-39861	494	14	1750	95.4	6.8	17.3	3220	502	12210.52	2047	6.52	2086	24.72	2083	3.79	7966	5
Northeast	Crown Point	41-24951	1094	22	1948	95.7	4.3	12.6	2567	1093	10469.45	2029	2.35	1938	9.57	2050	4.08	7965	5
Northern	Gabriels	24-83561	594	18	1872	58.2	3.2	9.3	2788	601	6769.75	1959	4.69	2071	11.4	2059	2.43	7961	3
Northern	Thousand Isl	26-81458	2303	31	2045	106.3	3.4	12.5	8885	2305	9243.97	2005	3.86	2044	4.01	1850	1.04	7944	4
Genesee	Brockport Sta 74	06-7459	1798	26	2010	121.2	4.7	21.1	4472	1829	10159.72	2018	2.49	1953	5.65	1960	2.27	7941	5
Genesee	W Hamlin	06-8254	1865	20	1907	61.5	3.1	17.5	3864	1868	35653.12	2087	2.07	1868	19.12	2077	9.23	7939	0
Capital	Swaggertown	32-36453	2148	23	1970	79.9	3.5	11.8	4403	2156	16371.32	2068	2.05	1859	7.62	2019	3.72	7916	1
Capital	Grooms Road	32-34552	1684	22	1948	137.3	6.2	20.1	4862	1687	9590.13	2010	2.89	1989	5.69	1963	1.97	7910	2
Central	Lighthouse Hill	16-6141	858	25	2003	147.4	5.9	16.7	2307	848	5857.18	1933	2.69	1974	6.83	1999	2.54	7909	0
Northeast	Schoharie	37-23452	1626	29	2037	120.7	4.2	13.4	2787	968	13733.85	2056	1.71	1777	8.45	2034	4.93	7904	3
Mohawk	Old Forge	17-38364	796	12	1680	67.8	5.6	12.7	3496	999	17711.25	2075	4.39	2063	22.25	2080	5.07	7898	3
Capital	Menands	30-10156	982	21	1928	109.3	5.2	22.7	2695	978	7333.93	1974	2.74	1977	7.47	2014	2.72	7893	3
Capital	Pinebush	30-37153	1653	25	2003	138.6	5.5	19.5	3791	1651	9314.38	2006	2.29	1925	5.63	1958	2.46	7892	4
Northeast	East Springfield	37-47751	996	22	1948	95.5	4.3	12.5	3425	987	6095.25	1939	3.44	2025	6.12	1978	1.78	7890	2
Central	West Cleveland	11-32651	737	14	1750	74.4	5.3	16.4	2735	737	10208.27	2020	3.71	2037	13.85	2072	3.73	7879	5
Central	New Haven	14-25653	1992	19	1891	71.2	3.7	12	4848	1988	12295.4	2049	2.43	1946	6.17	1980	2.54	7866	1
Mohawk	Peterboro	20-51453	2076	28	2030	84.9	3	11.7	3350	2101	15405.35	2063	1.61	1755	7.42	2011	4.6	7859	2
Mohawk	Stittville	17-67053	1064	21	1928	82	3.9	19.5	3169	1060	6603.78	1955	2.98	1994	6.21	1982	2.08	7859	0
Genesee	Brockport Sta 74	06-7452	2140	27	2021	83.1	3.1	8.9	4434	2143	11038.15	2037	2.07	1868	5.16	1930	2.49	7856	3
Mohawk	Sherman	17-33352	1469	21	1928	100.1	4.8	15.2	4129	1477	8006.02	1989	2.81	1985	5.45	1948	1.94	7850	4
Capital	Blue Stores	33-30351	2147	47	2079	303.7	6.5	25.5	2955	701	16268.73	2067	1.38	1684	7.58	2017	5.51	7847	1
Central	Sorrell Hill	11-26952	2669	24	1986	94.4	3.9	13.6	6101	2451	11992.05	2045	2.29	1925	4.49	1890	1.97	7846	0
Northern	Star Lake	29-72762	659	15	1787	47.7	3.2	7.7	2063	653	7799.8	1983	3.13	2010	11.84	2061	3.78	7841	1
Northeast	Butler	38-36251	2926	35	2056	116.5	3.3	14.4	6427	2927	11132.63	2038	2.2	1911	3.8	1834	1.73	7839	2
Genesee	Brockport Sta 74	06-7458	2211	18	1872	37.4	2.1	4.6	6107	2266	11580.52	2043	2.76	1981	5.24	1936	1.9	7832	5
Central	Paloma (Fulton)	14-25456	1757	24	1986	104.4	4.4	11.9	3367	1756	11595.72	2044	1.92	1806	6.6	1993	3.44	7829	0
Capital	Valkin	33-42752	2414	39	2066	174.4	4.5	18.8	6135	2414	8371.63	1992	2.54	1958	3.47	1808	1.36	7824	2
Northeast	Delanson	37-26951	2007	38	2064	195.4	5.1	22.3	4166	2132	8762.47	1999	2.08	1877	4.37	1880	2.1	7820	3
Capital	Grooms Road	32-34556	1831	18	1872	90.1	5	14.8	4497	1542	10148.75	2017	2.46	1951	5.54	1952	2.26	7792	0
Capital	Elnora	32-44258	1768	22	1948	121.3	5.5	22.7	3773	1742	9196.9	2004	2.13	1892	5.2	1933	2.44	7777	3
Capital	Trinity Place	30-16452	1539	14	1750	110	7.9	28.8	3899	1524	12001.07	2046	2.53	1956	7.8	2024	3.08	7776	2
Mohawk	Lehigh	18-66953	737	20	1907	116.1	5.8	11.9	1268	730	10138.38	2016	1.72	1780	13.76	2070	8	7773	0
Capital	Boydtonville	31-33351	1992	66	2087	323.4	4.9	25	3454	1212	9174.3	2003	1.73	1782	4.61	1897	2.66	7769	0
Northern	Lyme	13-73351	2233	23	1970	94.2	4.1	24.8	5979	3320	8397.35	1993	2.68	1971	3.76	1830	1.4	7764	3
Mohawk	Salisbury	19-67857	1012	22	1948	74	3.4	8.1	2853	991	5082.73	1906	2.82	1986	5.02	1924	1.78	7764	0
Capital	Voorheesville	30-17853	1906	25	2003	164.4	6.6	22.7	3520	1920	10169.38	2019	1.85	1797	5.34	1943	2.89	7762	6
Northern	Little River	25-95554	1458	17	1851	36.2	2.1	5.9	5104	1463	6995.35	1967	3.5	2030	4.8	1912	1.37	7760	2

Region	Station Name	Ckt/F No.	No. Cst. Served	No. Intr.	Intr. Rank	Tot. Dur. Hours	Avg. Dur.	Max. Dur.	Cust. Intr.	Max. Cust.	Tot. Cust. Hours	Tot. CH Rank	SAIFI	SAIFI Rank	SAIDI	SAIDI Rank	CAIDI	Fdr Rank	Mmty Intr.
Genesee	Conesus Sta 52	05-5261	1305	11	1641	25.1	2.3	5.3	4932	1311	11579.53	2042	3.78	2040	8.87	2037	2.35	7760	2
Central	Temple	11-24347	2408	19	1891	49.8	2.6	6.5	8059	2416	9165.12	2002	3.35	2019	3.81	1836	1.14	7748	12
Capital	Swaggertown	32-36452	2411	27	2021	187.9	7	31.4	3109	2161	17030.13	2071	1.29	1650	7.06	2003	5.48	7745	3
Central	Niles	11-29451	1298	36	2057	207.9	5.8	20.1	2257	1295	6836.1	1964	1.74	1785	5.27	1938	3.03	7744	2
Central	Sandy Creek	16-6651	1738	38	2064	140.6	3.7	12.1	3207	538	7901.28	1987	1.85	1797	4.55	1892	2.46	7740	5
Northern	Bremen	23-81556	1686	46	2077	116.1	2.5	6.4	3356	352	7181.4	1968	1.99	1820	4.26	1873	2.14	7738	2
Northern	North Carthage	23-81652	2257	42	2070	124.6	3	6.9	3722	1501	9521.8	2008	1.65	1767	4.22	1872	2.56	7717	2
Genesee	W Hamlin	06-8253	2341	23	1970	57.4	2.5	5.6	3631	2343	12440.67	2051	1.55	1745	5.31	1942	3.43	7708	0
Central	Phoenix	11-5164	1010	10	1588	34.4	3.4	16.6	3634	1014	10615.65	2033	3.6	2034	10.51	2051	2.92	7706	3
Capital	Swaggertown	32-36451	969	19	1891	105.8	5.6	28.7	2210	967	5444.43	1924	2.28	1923	5.62	1957	2.46	7695	6
Central	Colosse	16-32151	2559	30	2042	122.3	4.1	14.8	4121	2564	10519.3	2030	1.61	1755	4.11	1861	2.55	7688	7
Capital	Grooms Road	32-34557	1890	15	1787	87.6	5.8	21.5	7077	1895	7725.9	1981	3.74	2039	4.09	1858	1.09	7665	2
Northern	Thousand Isl	26-81454	1186	12	1680	33.4	2.8	7	4139	1294	7311.45	1972	3.49	2028	6.16	1979	1.77	7659	4
Southwest	Delameter	07-9353	3031	16	1826	63.7	4	18.6	9438	3034	10342.37	2023	3.11	2008	3.41	1800	1.1	7657	6
Southwest	Hartfield	09-7958	363	8	1464	39	4.9	24.6	1623	365	11191.13	2039	4.47	2065	30.83	2089	6.9	7657	2
Capital	Brunswick	31-26452	1956	26	2010	157.3	6	31.9	4555	1953	6154.68	1945	2.33	1934	3.15	1767	1.35	7656	0
Capital	Blue Stores	33-30352	1111	24	1986	146.3	6.1	22.5	2589	1113	4483.58	1881	2.33	1934	4.04	1852	1.73	7653	0
Central	Granby Center	14-29351	1838	20	1907	65	3.2	13	2846	541	10605.27	2032	1.55	1745	5.77	1967	3.73	7651	0
Central	Constantia	11-1923	739	16	1826	57.1	3.6	8.6	2115	742	4224.57	1867	2.86	1988	5.72	1964	2	7645	7
Northern	Bloomingtondale	24-84162	829	16	1826	29.9	1.9	4.1	2883	832	4146.85	1861	3.48	2027	5	1921	1.44	7635	4
Northern	Paul Smiths	24-83462	308	27	2021	63.8	2.4	6.5	1300	310	1743.53	1593	4.22	2055	5.66	1962	1.34	7631	3
Capital	Hoosick	31-31451	1747	26	2010	111.1	4.3	11.3	3459	1742	6764.53	1958	1.98	1816	3.87	1842	1.96	7626	2
Central	Bartell Rd	11-32554	2742	14	1750	60.7	4.3	21.9	5729	2741	14329.75	2060	2.09	1881	5.23	1935	2.5	7626	2
Northern	Franklin	24-84361	161	16	1826	54.6	3.4	9.1	824	162	1941.98	1632	5.12	2077	12.06	2062	2.36	7597	4
Mohawk	Oneida	20-50151	1823	13	1714	36.5	2.8	6.3	5333	1817	7966.48	1988	2.93	1991	4.37	1880	1.49	7573	3
Northern	Lawrence Ave	25-97655	1360	22	1948	44.8	2	7.1	2927	1359	4981.53	1903	2.15	1899	3.66	1822	1.7	7572	1
Southwest	Valley	10-4457	1325	17	1851	54.5	3.2	6.7	2828	1324	6032.73	1936	2.13	1892	4.55	1892	2.13	7571	0

**2018 HIGHEST NUMBER OF MOMENTARIES CIRCUIT LIST**  
**(Circuits with 10 or more Momentaries)**

Region	Station Name	Ckt/F No.	Circuit kV	# of MI's	Rank		
					Within Region	Within System	Reliability Ranking
Central	Temple	11-24347	13.2	12	1	2	82