June 28, 2022

Planning Advisory Group Presentation – Chapter 330 Summary

Agenda:

- Rebuild Plan – Chapter 330
- Reliability Performance
- Grid Planning

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Rebuild Plan – Chapter 330

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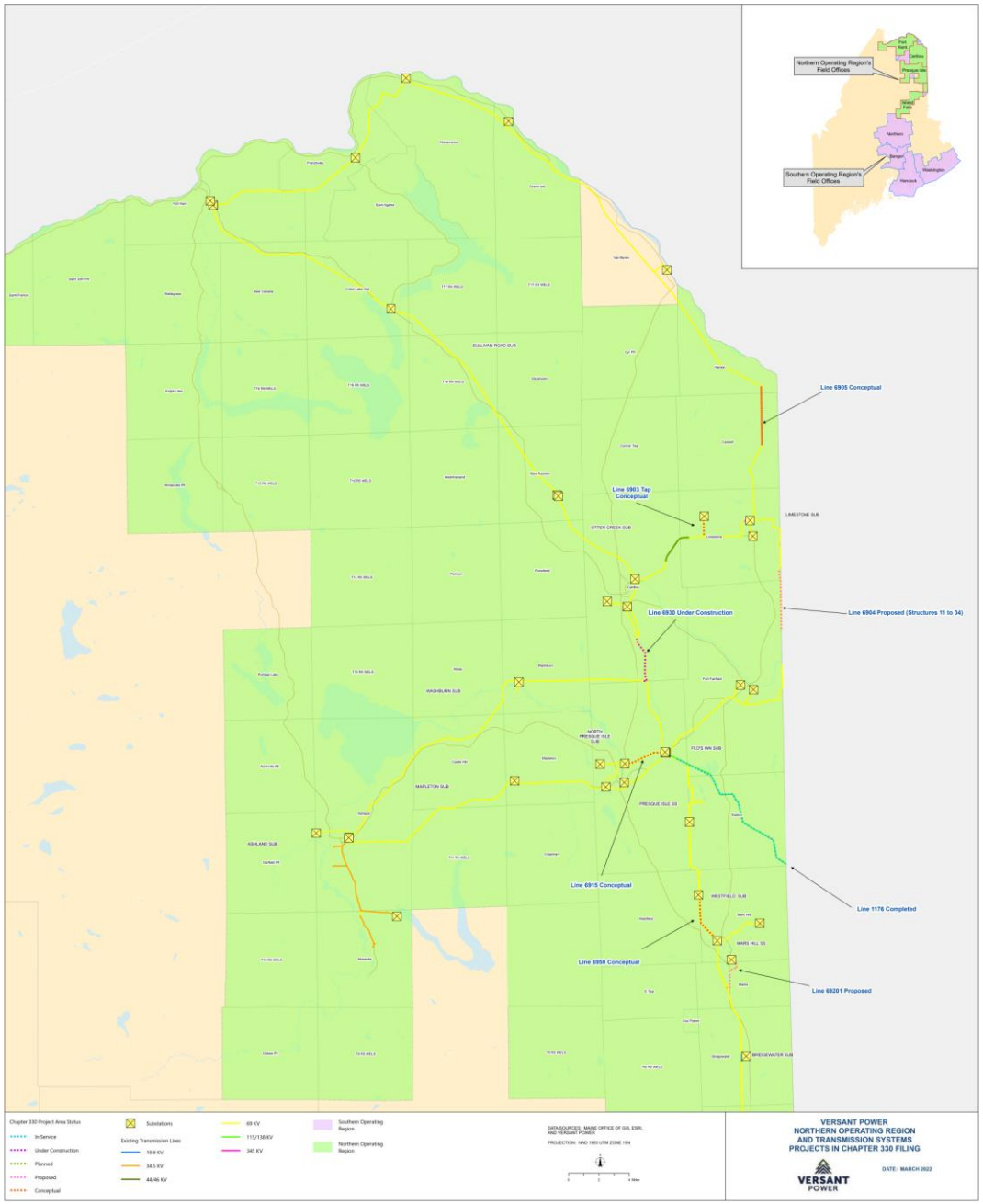
Northern Maine Transmission System



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Transmission Planning Collaboration

- Adjusted based on customer feedback
- Intent: spread out remaining required MPD rebuild plan over 15-20 years (total rebuild program will span nearly 30 years)
- Final plan subject to enhanced inspection findings (drone, resistograph, climbing, ultrasonic, thermal)
- Line and targeted line segment rebuilds will be necessary

Chapter 330 Plans & Adjustments

Summary of Past and Present Chapter 330 Reports												
	2019 Report			2020 Report			2021 Report			2022 Report		
Year	Project	Miles	Cost Range ($M)	Project	Miles	Cost Range ($M)	Project	Miles	Cost Range ($M)	Project	Miles	Cost Range ($M)
2019	6901 FF Tap	1.2	0.5 - 0.7									
	6903 Pole 57 - 126	3.8	2.8 - 3.8									
	6913 PISS to Pole 160	1.8	1.0 - 1.5									
	1176 Str 98 to Border	0.8	0.65 - 0.85									
2020	6930 Dow to Maysville	3.0	2.0 - 2.4	6903 Pole 57 - 126	3.8	2.85 - 3.8						
	1176 Str 41 to 97	6.4	4.1 - 5.1	1176 Str 42 - Border	7.2	5.5 - 6.0						
2021	1176 Str 3 to 41	4.8	3.1 - 3.8	6930 Dow to Maysville	3.0	2.0 - 2.4	6930 Dow to Maysville	2.5	1.2 - 1.3			
				1176 Str 3 to 41	4.8	3.1 - 3.8	1176 Str 42 - Border	7.2	6.0 - 6.5			
							1176 Str 3 to 41	4.8	3.3 - 3.8			
2022	6915 Flos to NPI	3.0	1.5 - 2.0	69053 Van Buren Tap	1.2	0.8 - 1.2	69053 Van Buren Tap	1.2	0.8 - 1.2	69201 Mars Hill Tap	1.0	1.3 - 1.4
				69201 Mars Hill Tap	1.6	2.0 - 2.6	69201 Mars Hill Tap	1.6	2.2 - 2.6	6930 Dow to Maysville	0.5	0.2 - 0.3
2023	69032 Loring Tap	1.6	0.88 - 1.1	69032 Loring Tap	1.6	0.88 - 1.1	69032 Loring Tap	1.6	0.88 - 1.1	6904 Str 11 to 34	3.5	1.8 - 2.0
	6905 Phase 1	4.0	2.2 - 2.6	6905 Phase 1	4.0	2.2 - 2.6	6915 Flos to NPI	3.0	1.5 - 2.0	69032 Loring Tap	1.6	1.0 - 1.2
2024				6915 Flos to NPI	3.0	1.5 - 2.0	6950 Westfield to MHSS	3.4	3.0 - 3.5	6915 Flos to NPI	2.5	2.0 - 2.5
				6950 Westfield to MHSS	3.4	3.0 - 3.5						
2025							6905 Phase 1	4.0	2.2 - 2.6	6950 Westfield to MHSS	3.4	3.0 - 3.5
2026										6905 Phase 1	4.0	2.6 - 3.0
Total		30.4	18.7 - 23.0		33.6	23.8 - 29.0		29.3	21.1 - 24.6		16.5	11.9 - 13.9
Avg/Yr		6.1	3.7 - 4.6		6.7	4.8 - 5.8		5.9	4.2 - 4.9		3.3	2.4 - 2.8

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2021 Project Work Completed

- Line 1176 Phase 2: Structures 42 to Border
  (Border – Ladner Rd. to 1A – Easton)

- Line 1176 Phase 3: Structures 3 to 41
  (Easton to Flos Inn, Presque Isle)

- Line 6930 Dow to Maysville Siding Roads
  (Caribou – west bank of river;
  construction more than 3/4 complete)

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Line 1176 Pre-Rebuild Condition

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Line 1176 Post Rebuild

Structure rebuilt with an in-line switch for sectionalizing, ROW widened, lightning protection installed.

Notice the fir tree that fell from outside of the cleared ROW with no affect

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Line 1176 Pre-Rebuild Condition

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Line 1176 Post Rebuild

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Line 1176 Pre-Rebuild

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Line 1176 Post Rebuild

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Emerging Issues

System Condition

- **Line 6904 (Limestone to Tinker)**
- **Line 6920 (Mars Hill to Mullen)**

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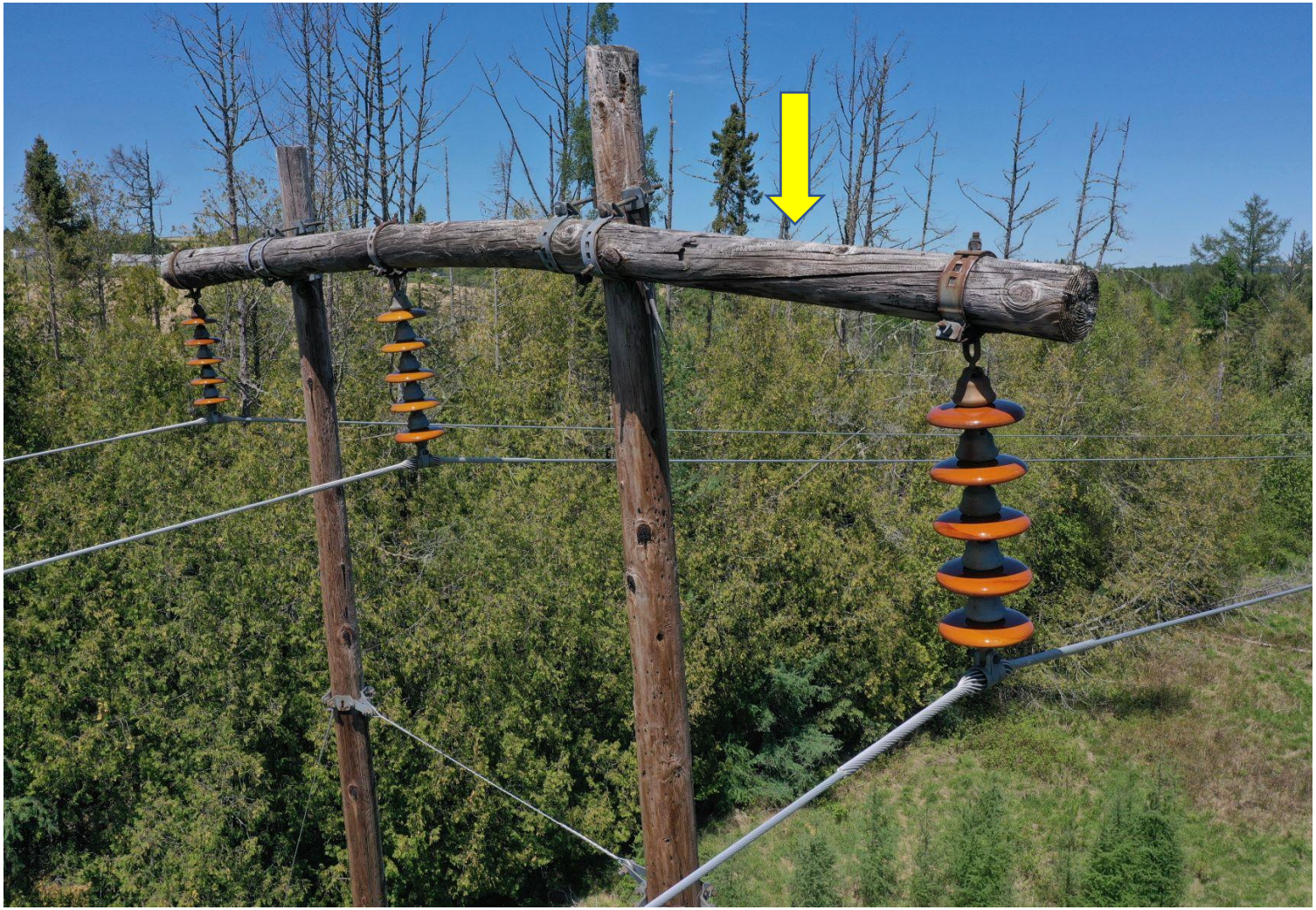
Line 6904 Emergency Crossarm Replacements



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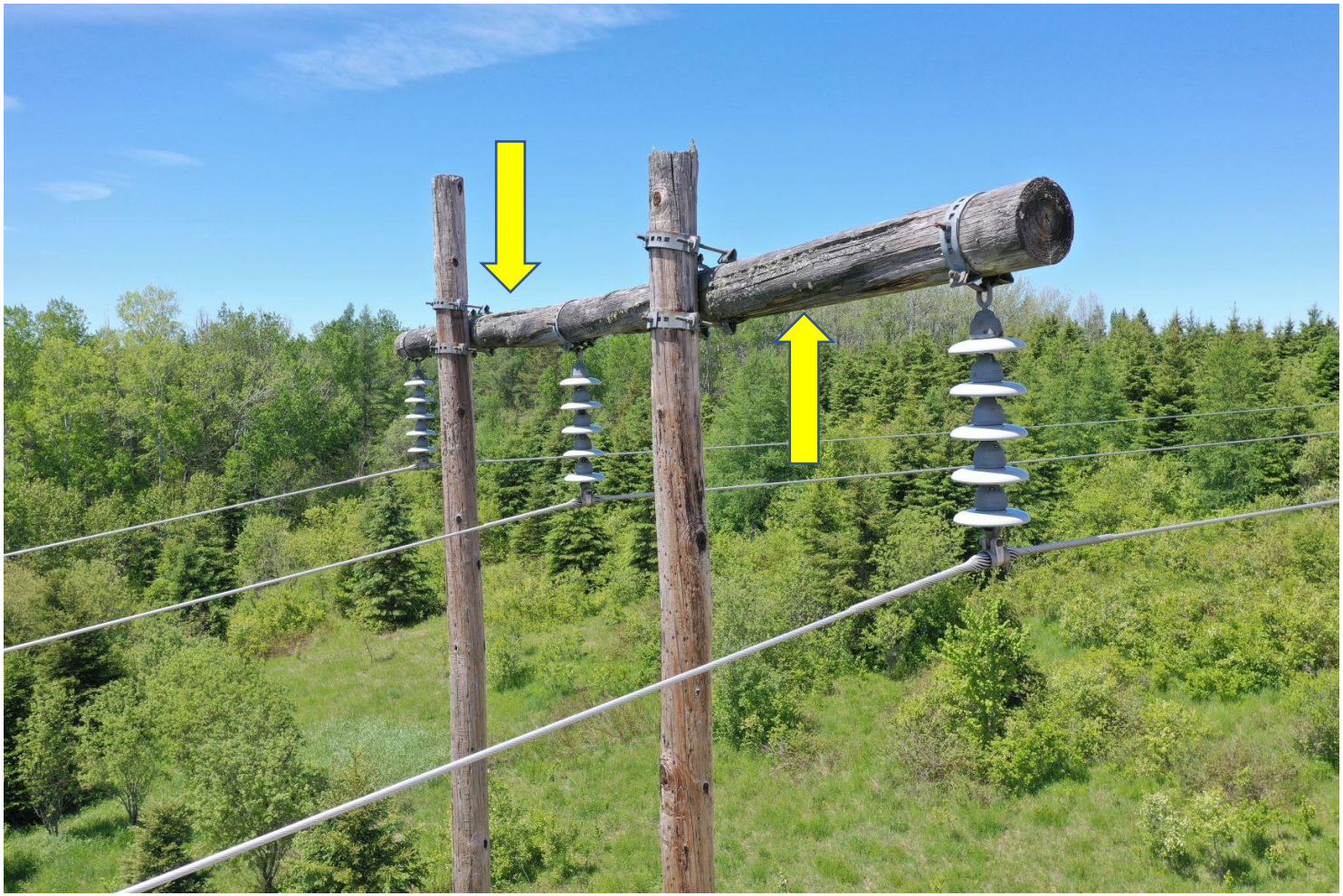
Line 6904 Condition continued…



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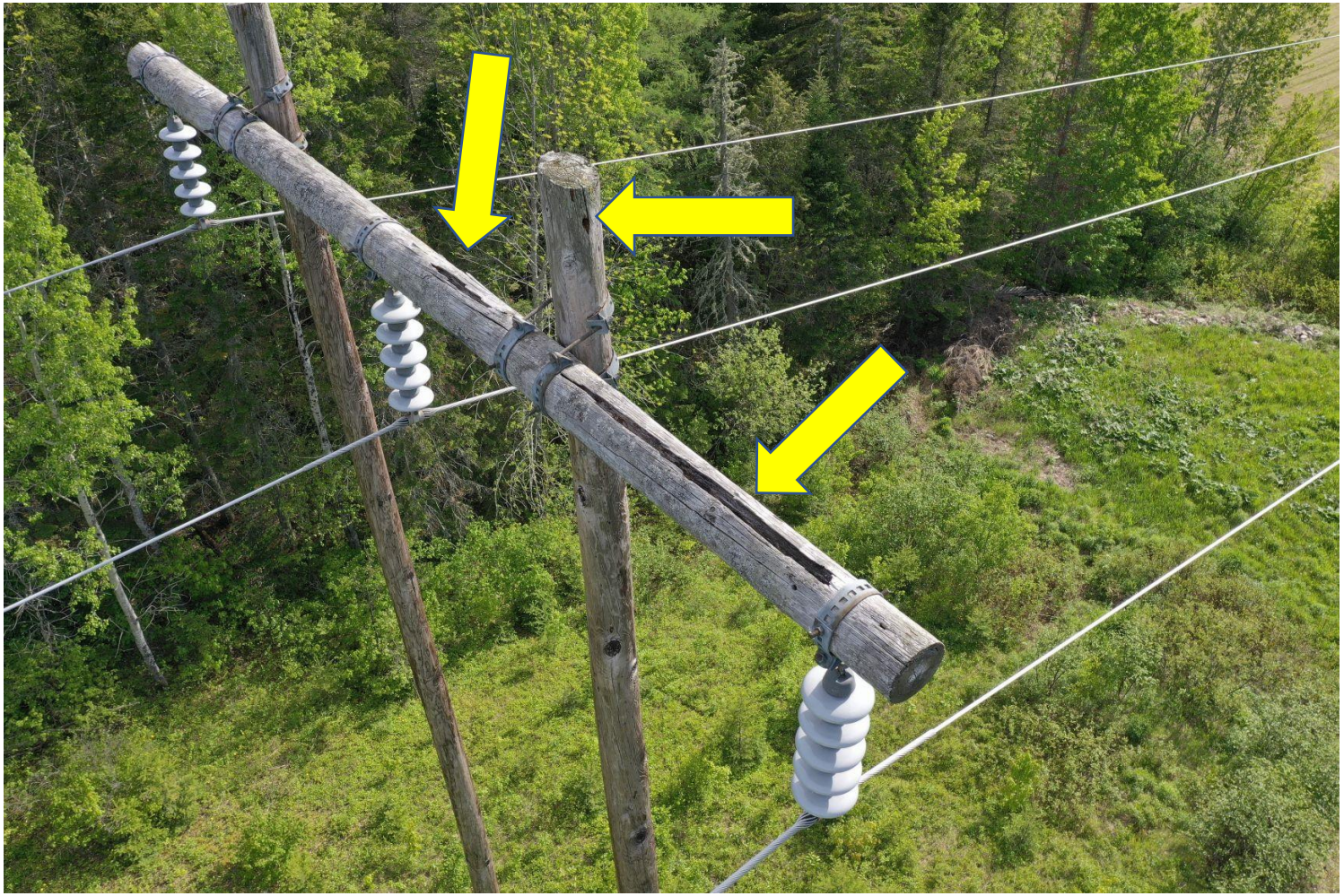
Line 6904 Condition continued…



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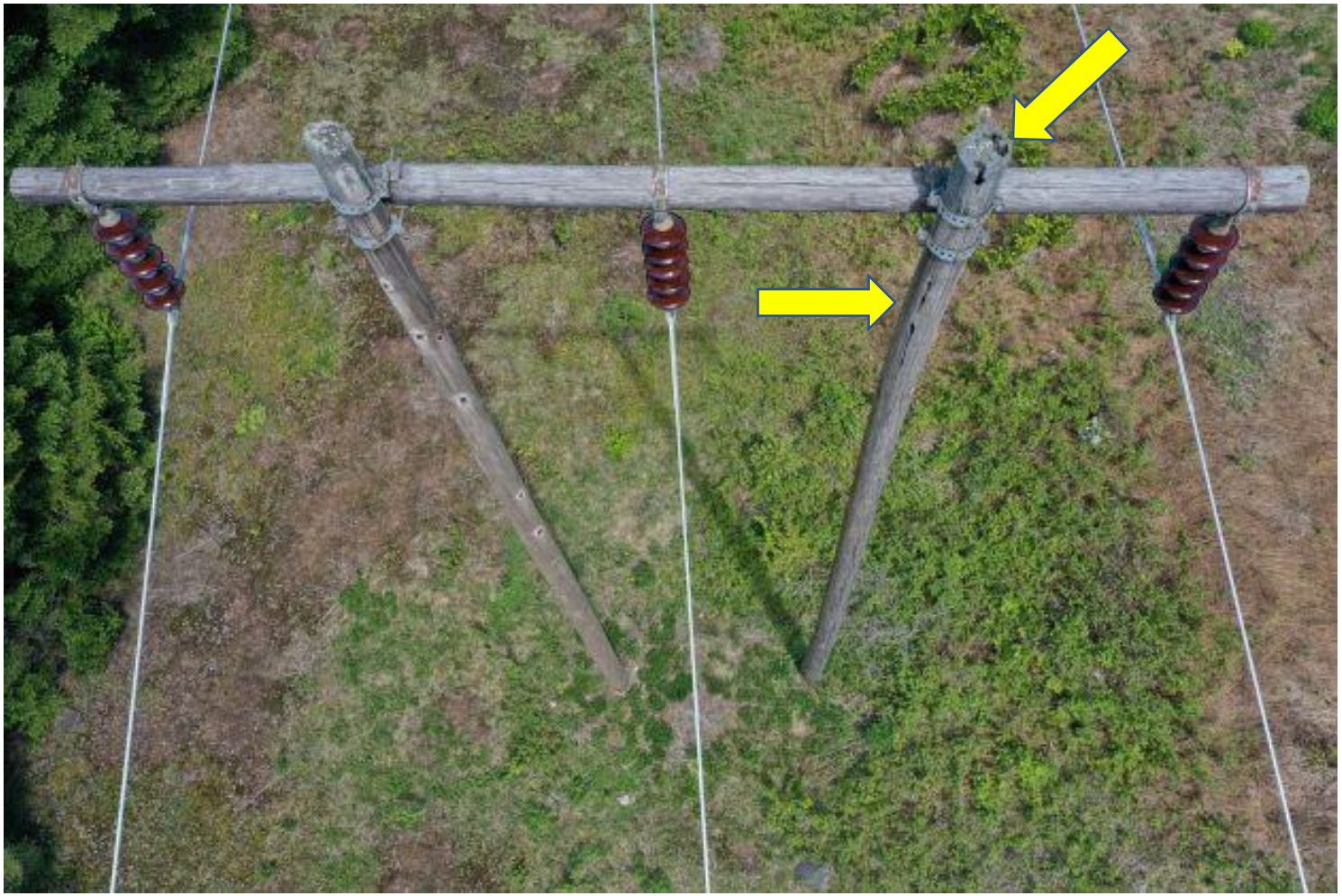
Line 6920 Condition



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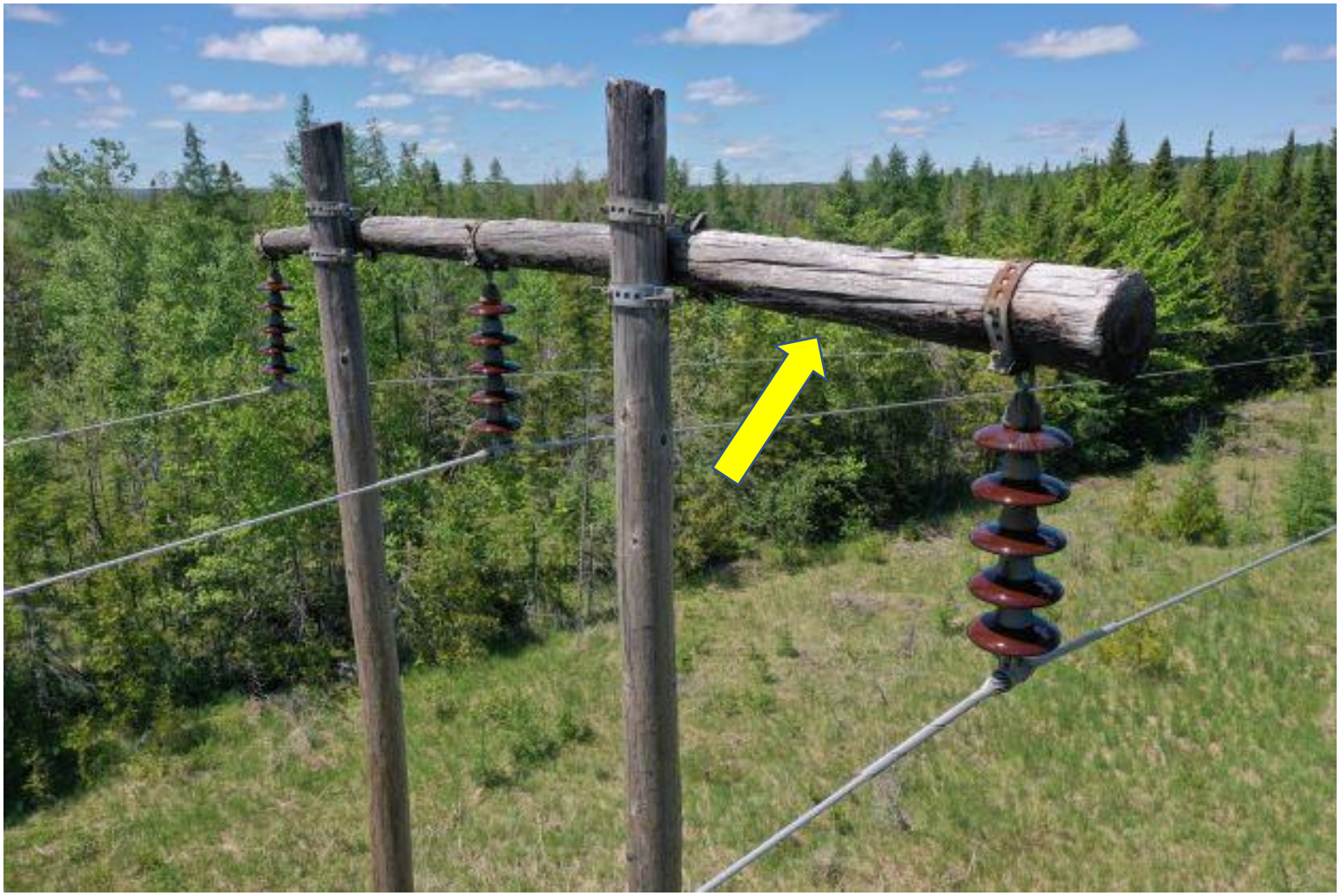
Line 6920 Condition continued…



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Line 6920 Condition continued…

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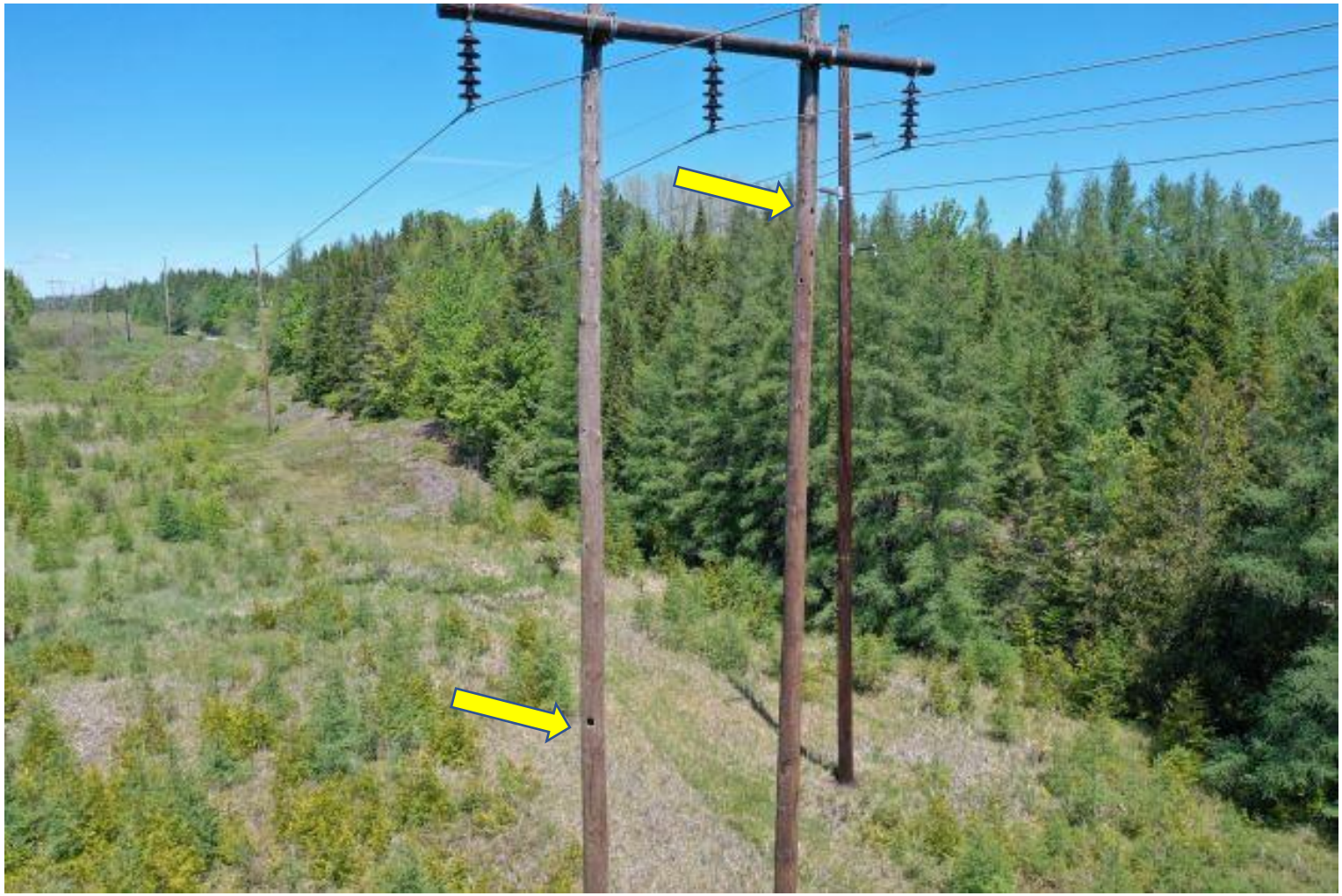
Line 6920 Condition continued…



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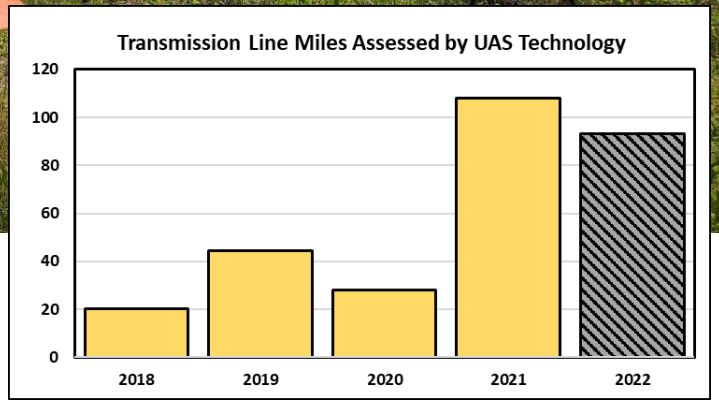
Enhanced Inspection Methods - Drones

Overhead images provided by drones are providing asset managers with a new and different way of assessing asset condition



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Example of a Closeup Drone Inspection Photo

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Enhanced Inspection Methods continued…Wood Pole Strength Assessment using Resistograph

Using a long thin needle the electric power consumption of the resistograph drilling device is measured and recorded. The resistance data gathered provides a high linear correlation between the measured values and the density of the penetrated wood.

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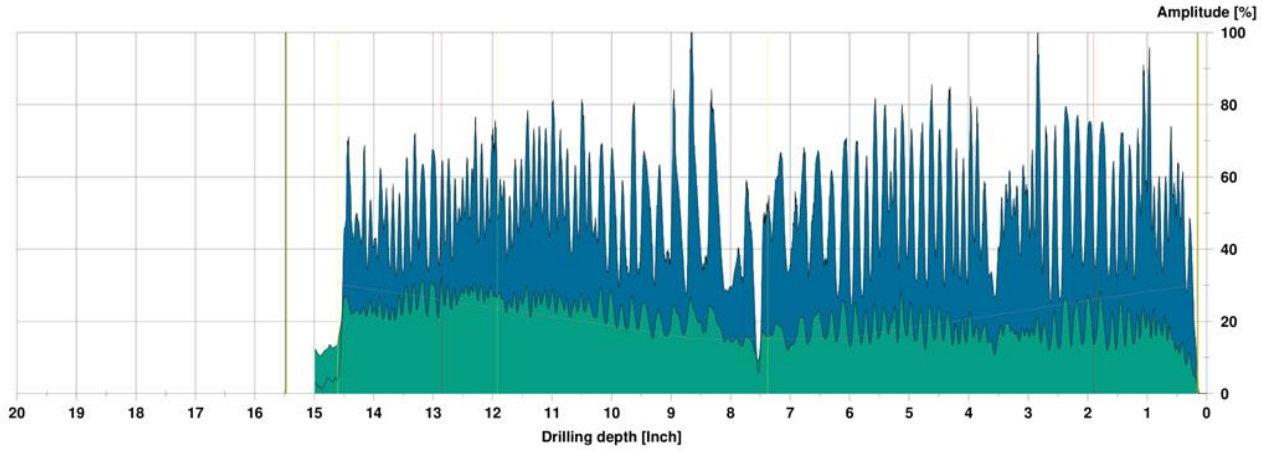
Resistograph Plot - Wood Pole in good condition

Measuring / object data

Measurement no.:	47	Speed	: 3000 r/min	Diameter:	13,25 in
ID number	: 20694	Needle state:	---	Level	:
Drilling depth	: 14,99 in	Tilt	: -30°	Direction:	
Date	: 01/15/2019	Offset	: 56 / 289	Species	:
Time	: 11:33:03	Avg. curve	: off / off	Location	:
Feed	: 10 in/min			Name	:

WoodInspector

Program	: Pole - EMERA 1.00	Sum decay	:	0,0% |	0,0% |	0,0%
Pole type	:	Heart rot	:	0,0% |	0,0% |	0,0%
Measurement	: Below soil level	Shell rot	:	No |	No	
Defect pattern:	No decay	Remaining wall:		50,0% |	50,0% |	50,0%
Result (auto)	: PASS	Strength	:	100,0% |	100,0% |	100,0%



Assessment

Comment

20694M047 (PASS).rgp

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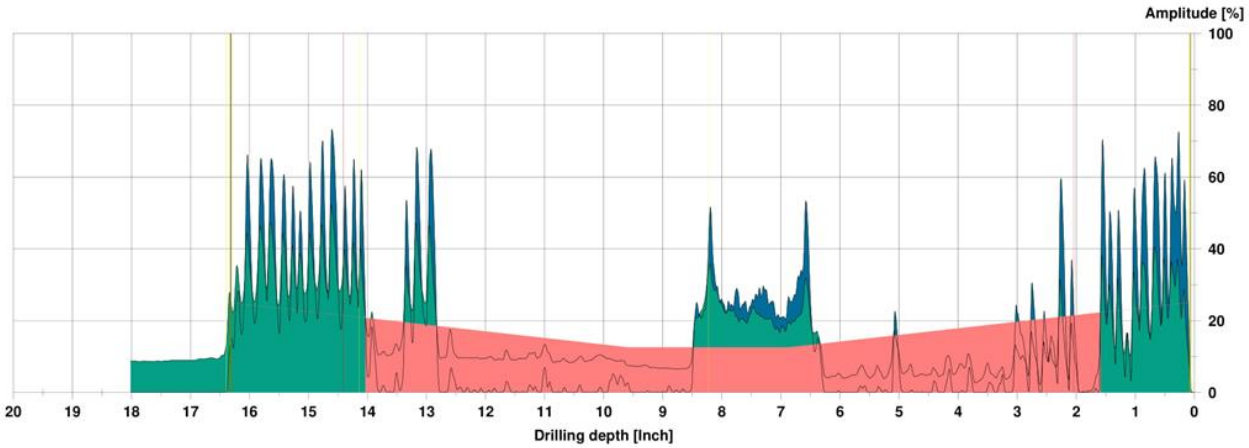
Rejected Wood Pole – Heart Rot

Measuring / object data

Measurement no.	: 13	Speed	: 3000 r/min	Diameter	: 16,25 in
ID number	: 20781	Needle state	: ---	Level	:
Drilling depth	: 18,01 in	Tilt	: -1°	Direction	:
Date	: 10/23/2018	Offset	: 93 / 388	Species	:
Time	: 09:24:24	Avg. curve	: off / off	Location	:
Feed	: 40 in/min			Name	:

WoodInspector

Program	: Pole - EMERA 1.00	Sum decay	: 40,7% | 35,6% | 76,3%
Pole type	:	Heart rot	: 40,7% | 35,6% | 76,3%
Measurement	: Auto diameter	Shell rot	: No | No
Defect pattern	: Heart rot	Remaining wall	: 9,3% | 14,4% | 11,8%
Result (auto)	: REJECT	Strength	: 56,1% | 74,3% | 65,2%



Assessment

Comment

20781M013 (REJECT).rgp

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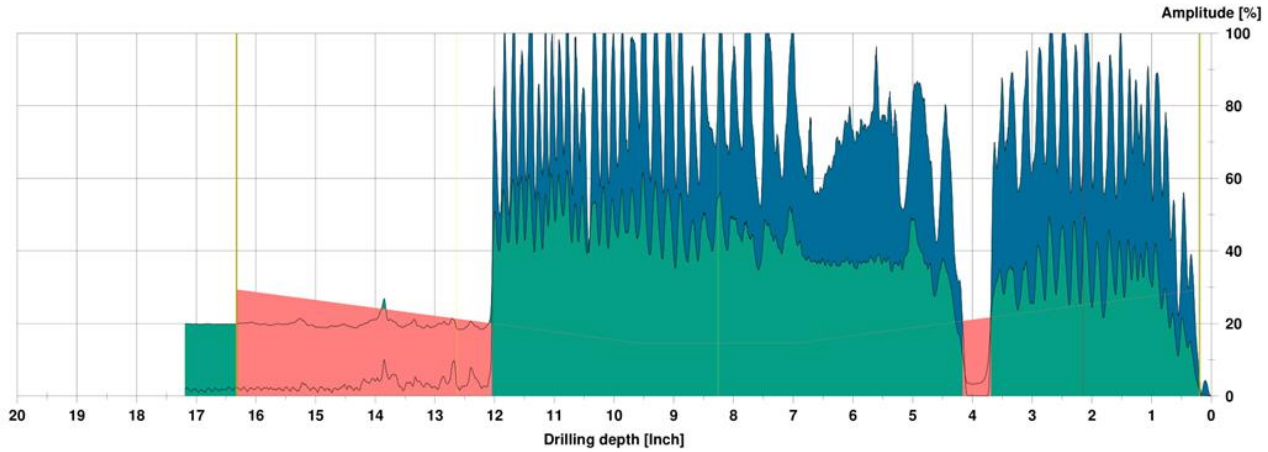
Rejected Wood Pole – Heart Rot & Shell Rot

Measuring / object data

Measurement no.	: 46	Speed	: 3000 r/min	Diameter	: 14,00 in
ID number	: 20705	Needle state	: ---	Level	:
Drilling depth	: 17,19 in	Tilt	: -30°	Direction	:
Date	: 01/17/2019	Offset	: 111 / 415	Species	:
Time	: 10:57:14	Avg. curve	: off / off	Location	:
Feed	: 40 in/min			Name	:

WoodInspector

Program	: Pole - EMERA 1.00	Sum decay	: 2,9% | 0,0% | 2,9%
Pole type	:	Heart rot	: 2,9% | 0,0% | 2,9%
Measurement	: Below soil level	Shell rot	: No | Yes
Defect pattern	: Heart+shell rot	Remaining wall	: 21,7% | ---
Result (auto)	: REJECT	Strength	: 89,7% | ---



Assessment

Comment

20705M046 (REJECT).rgp

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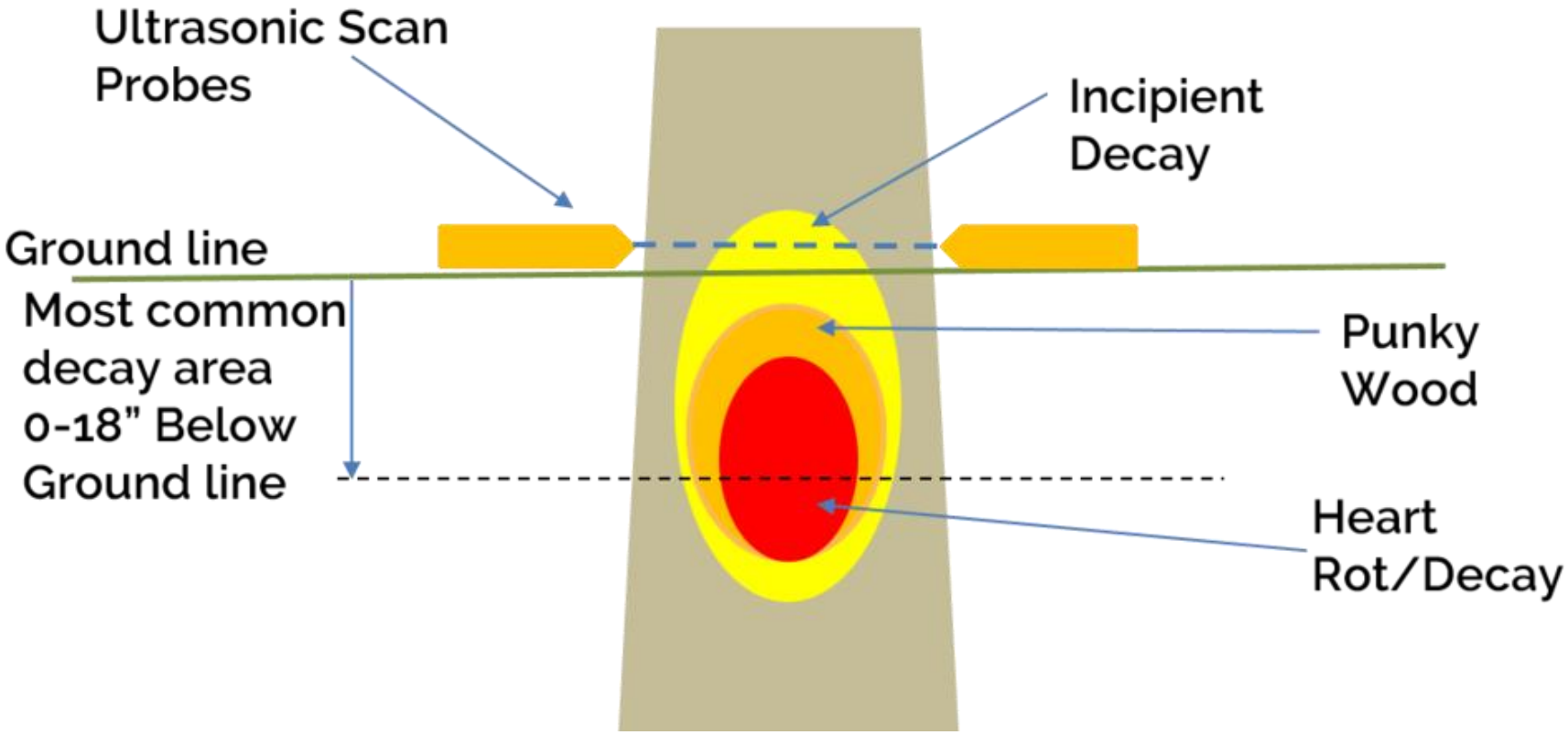
Wood Pole Ultrasonic Pilot Program



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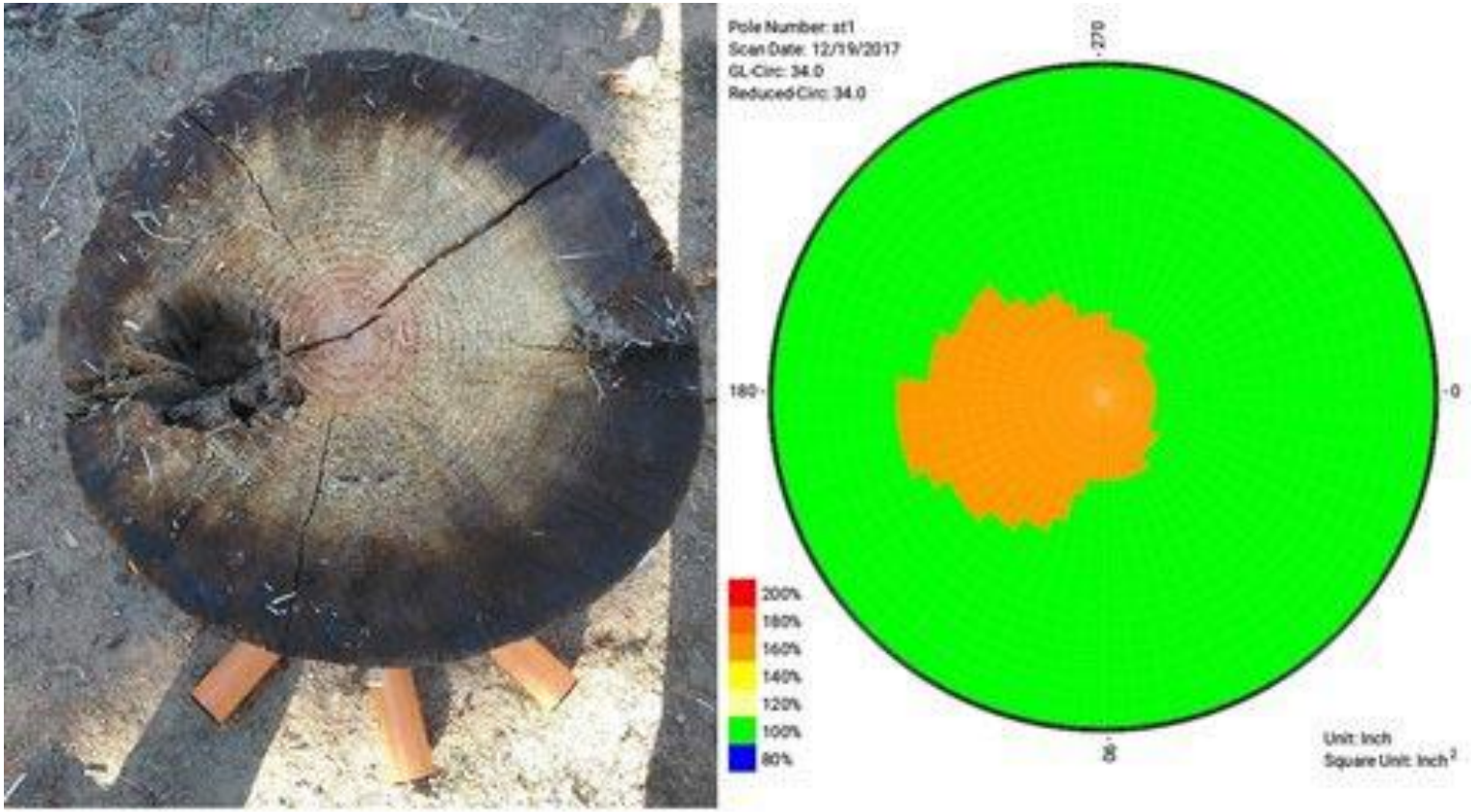
Wood Pole Ultrasonic Pilot Program



Ultrasonic testing image provided by Utility Asset Management.

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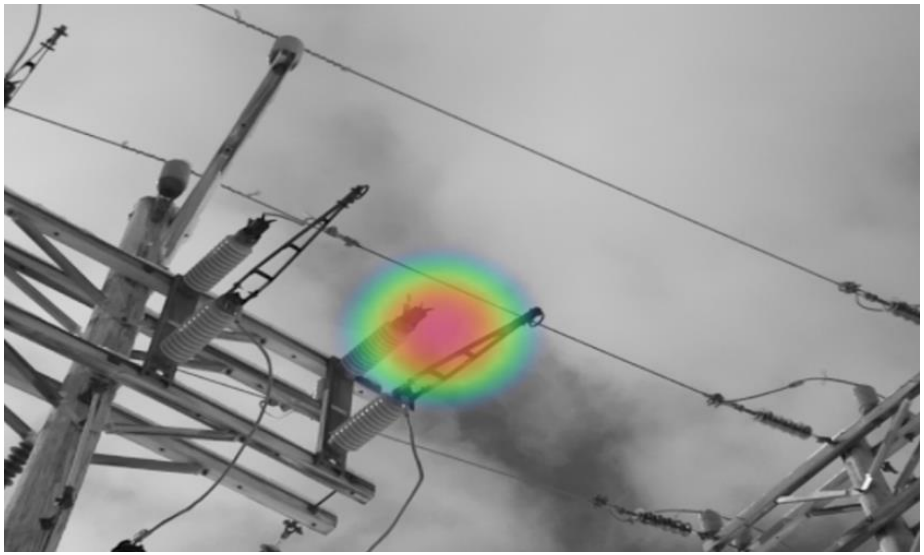
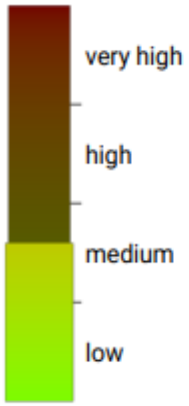
Handheld Acoustic Condition Assessment



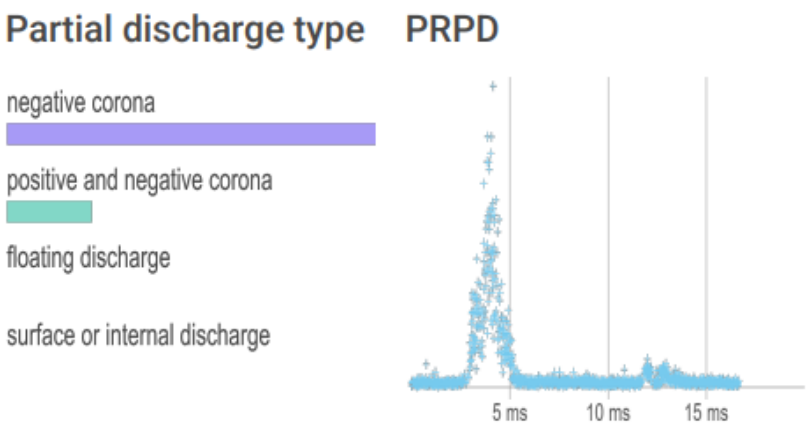


Description

This is classified as corona, i.e., partial discharge into air. In most cases, corona is harmless.

Recommendation

Typically no action required unless power loss, audible noise, electromagnetic interference, or deterioration of nearby polymer insulators is a problem.



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Handheld Acoustic Condition Assessment

Severity

very high

high

medium

low

Description

This is classified as a surface or internal discharge. The discharge appears to be strong and might rapidly escalate to complete insulation breakdown.

Recommendation

Immediate action. Visual inspection. Cleaning of polluted surfaces. Repair or replacement of the components.

Partial discharge type

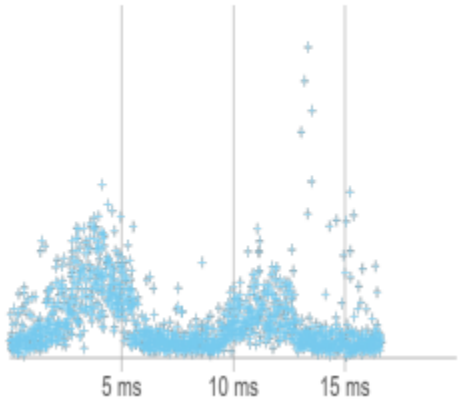
negative corona

positive and negative corona

floating discharge

surface or internal discharge

PRPD



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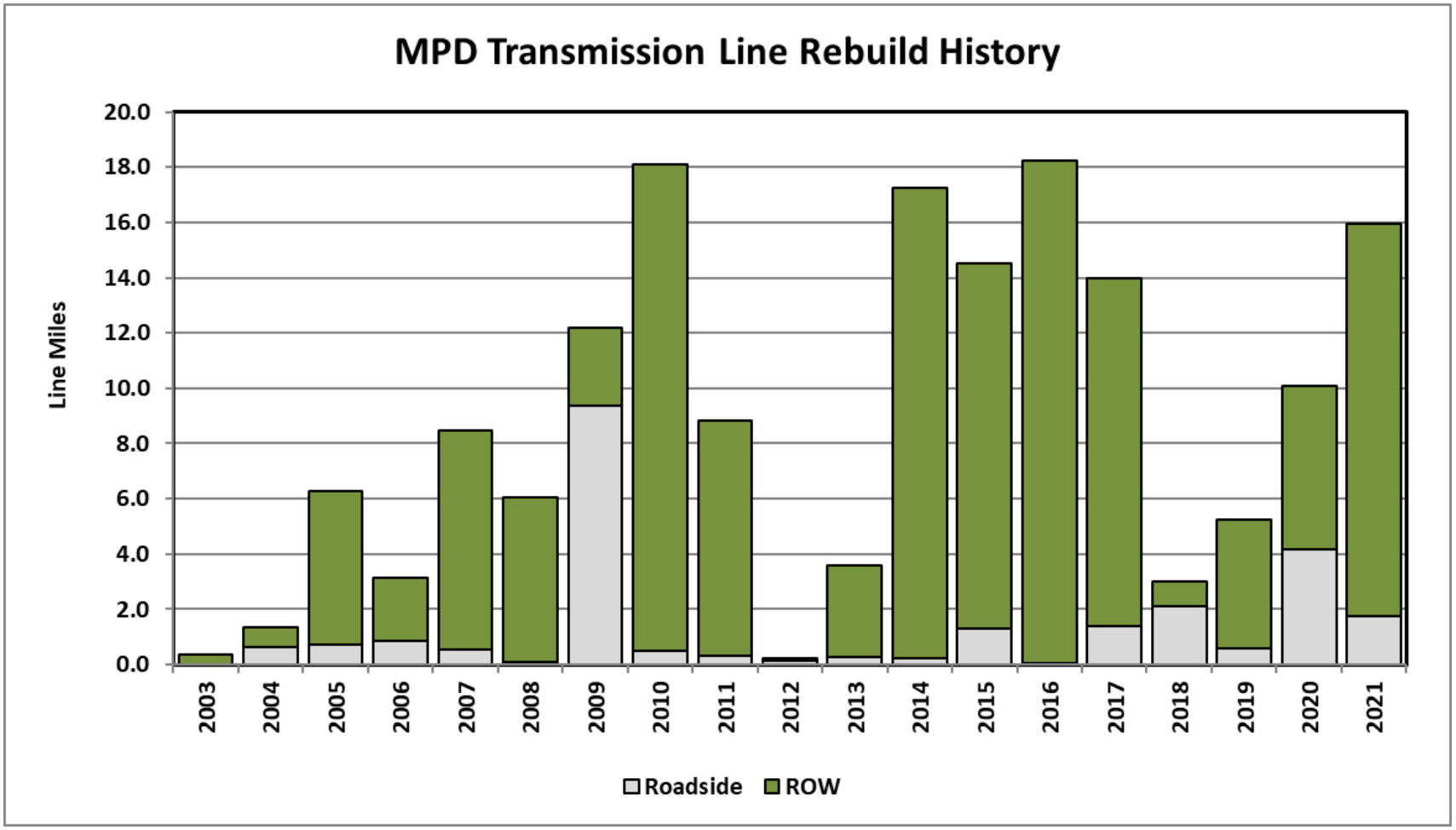
20-Year MPS Transmission Line Rebuild History



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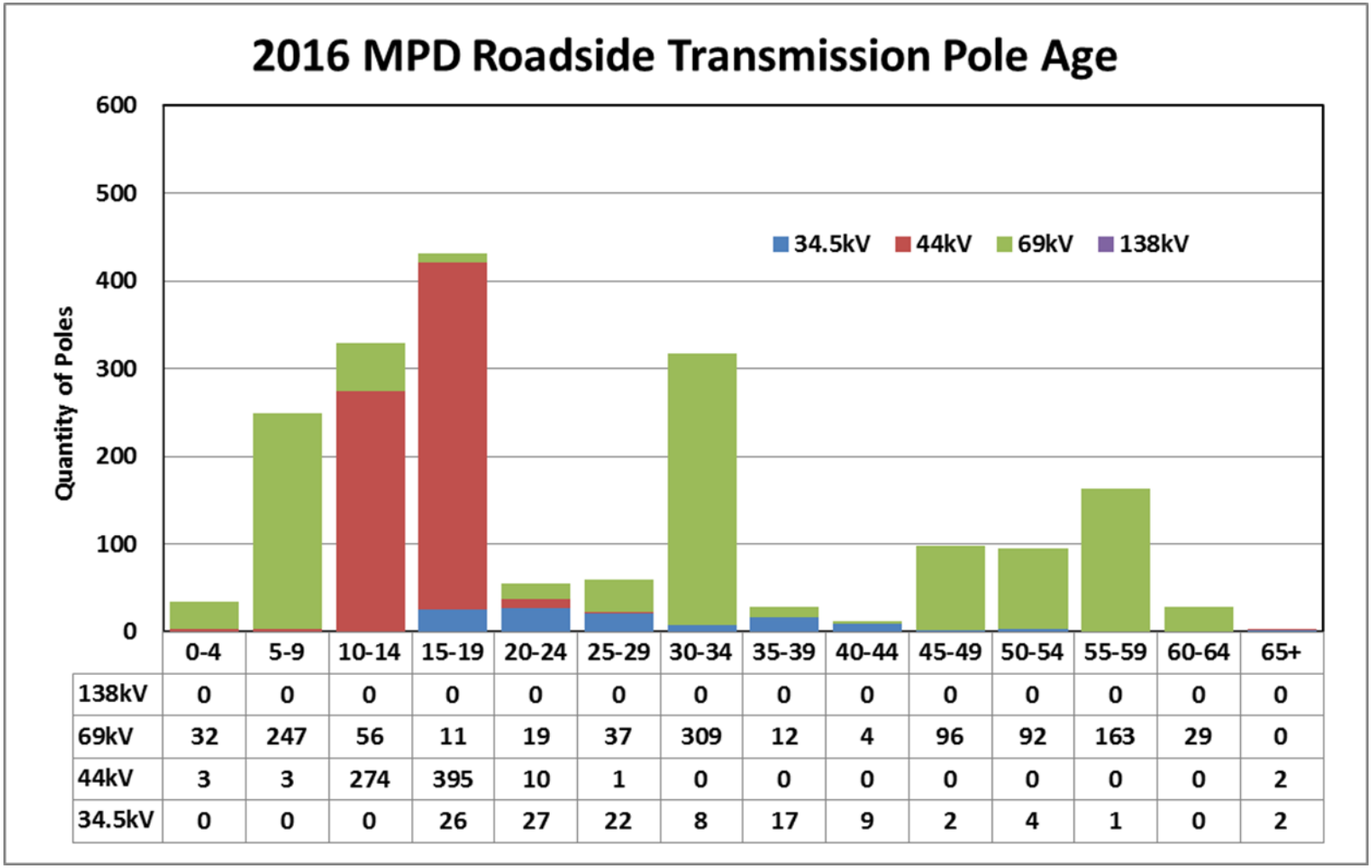
MPD Roadside Transmission Line Pole Age - 2016



	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
138kV	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69kV	32	247	56	11	19	37	309	12	4	96	92	163	29	0
44kV	3	3	274	395	10	1	0	0	0	0	0	0	0	2
34.5kV	0	0	0	26	27	22	8	17	9	2	4	1	0	2

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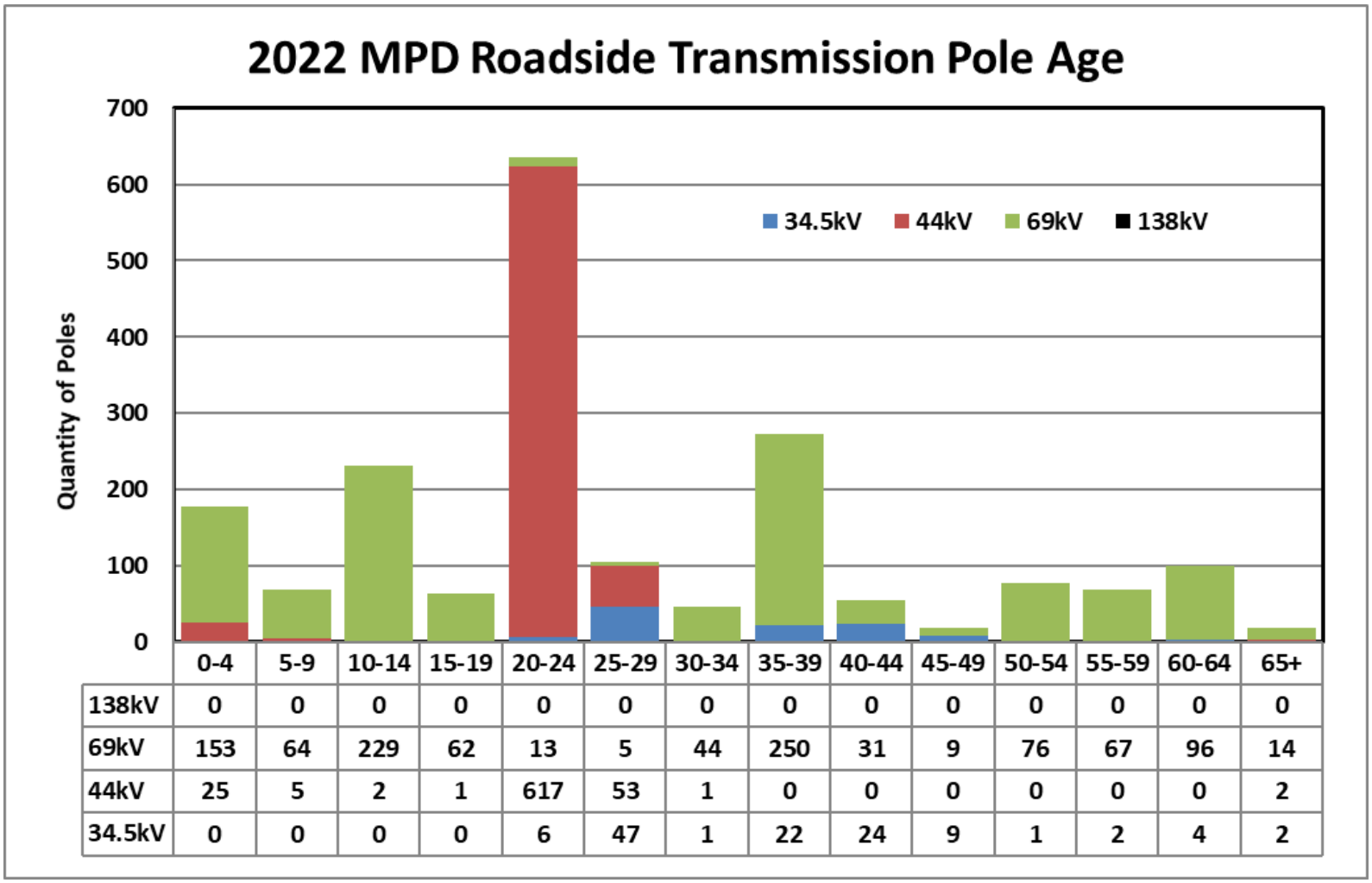
MPD Roadside Transmission Line Pole Age – 2021



	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
138kV	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69kV	153	64	229	62	13	5	44	250	31	9	76	67	96	14
44kV	25	5	2	1	617	53	1	0	0	0	0	0	0	2
34.5kV	0	0	0	0	6	47	1	22	24	9	1	2	4	2

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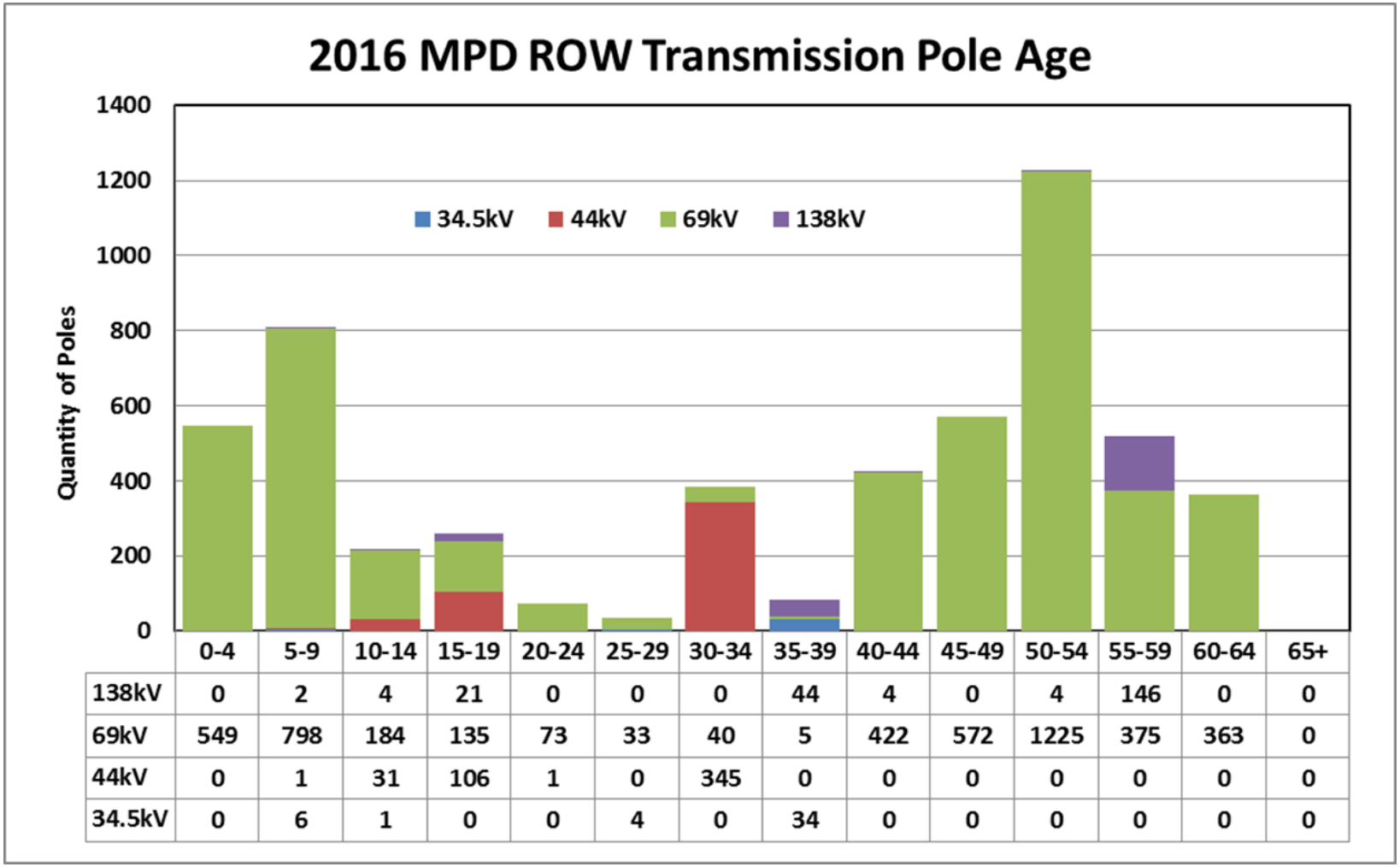
MPD ROW Transmission Line Pole Age - 2016



	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
138kV	0	2	4	21	0	0	0	44	4	0	4	146	0	0
69kV	549	798	184	135	73	33	40	5	422	572	1225	375	363	0
44kV	0	1	31	106	1	0	345	0	0	0	0	0	0	0
34.5kV	0	6	1	0	0	4	0	34	0	0	0	0	0	0

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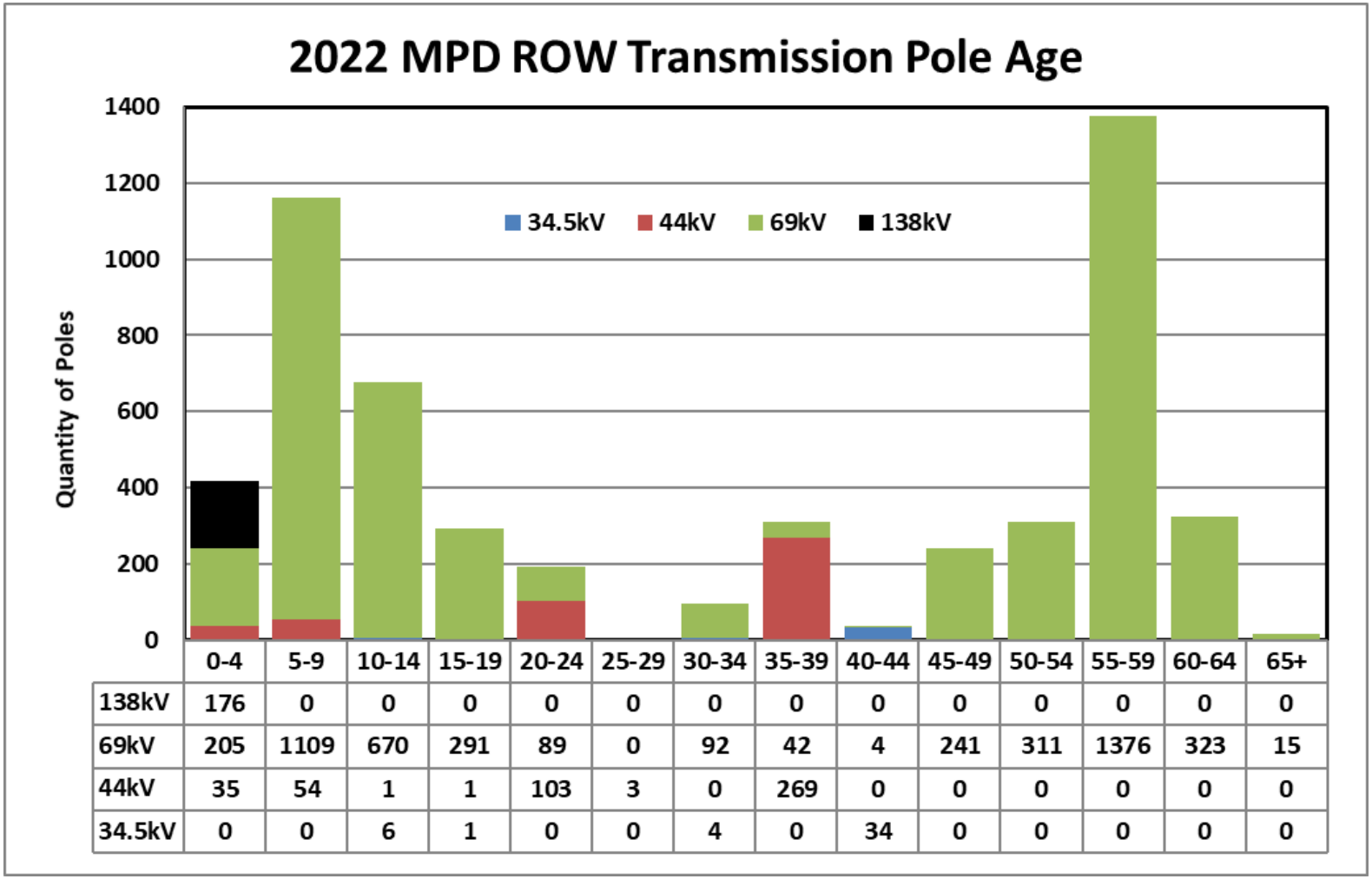
MPD ROW Transmission Line Pole Age - 2021



	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
138kV	176	0	0	0	0	0	0	0	0	0	0	0	0	0
69kV	205	1109	670	291	89	0	92	42	4	241	311	1376	323	15
44kV	35	54	1	1	103	3	0	269	0	0	0	0	0	0
34.5kV	0	0	6	1	0	0	4	0	34	0	0	0	0	0

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Chapter 330 Summary

	2019	2020	2021	2022
Plan miles	30	33	29	17
Average Miles per year	6.1	6.7	5.9	3.3
Average Cost per year ($ M)	$4.2	$5.3	$4.6	$2.6

Reasons for reduction:

- Large project, Line 1176, is complete
- Currently, no large projects in the 5 year plan – drives averages down (miles & cost)
- Smaller projects: Line sections from 1.2 to 4 miles ($1.0 - $3.5 M)
- Tap Line 69053 removed from plan

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Reliability Performance

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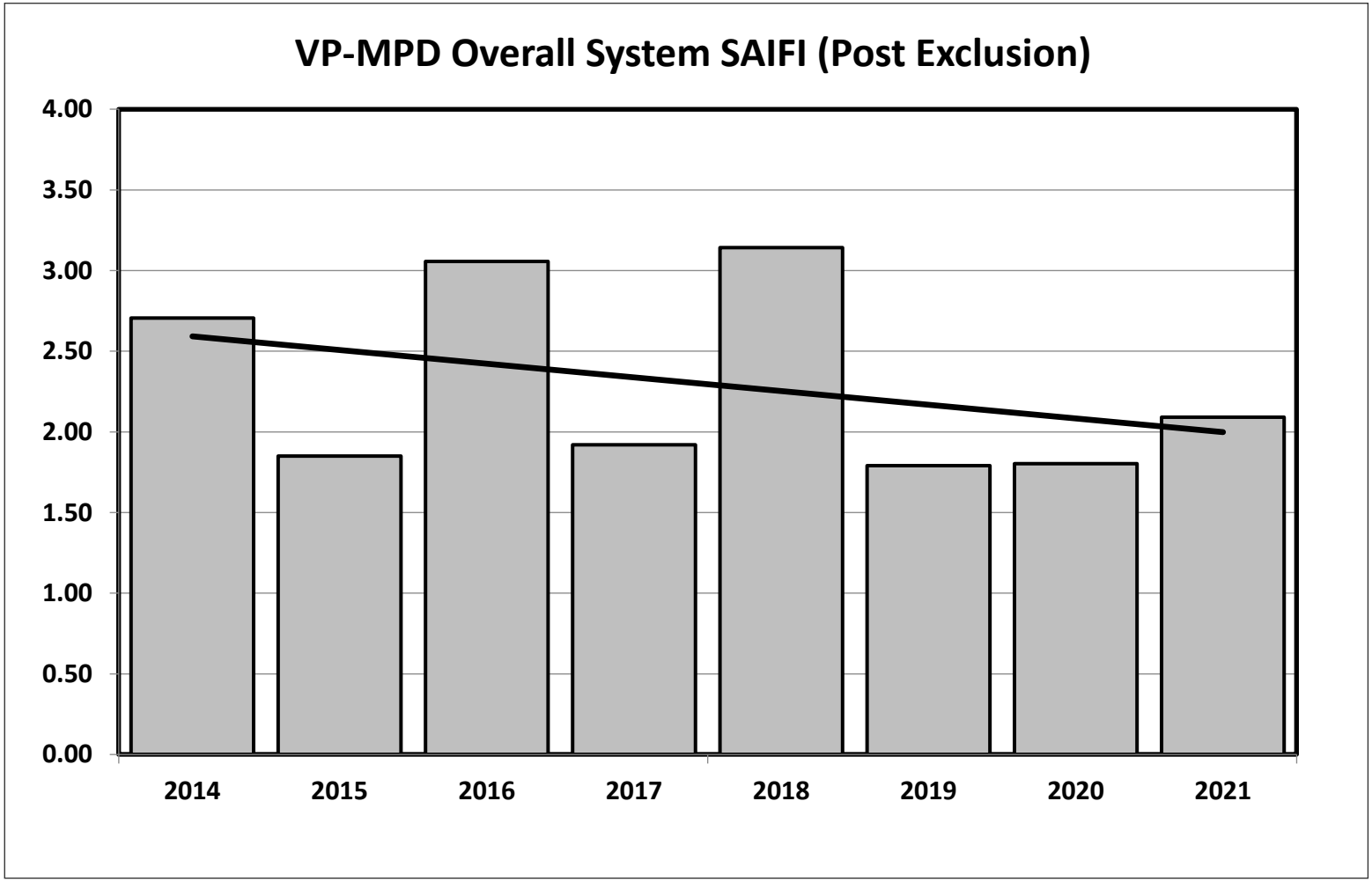
MPD Reliability Performance - Frequency



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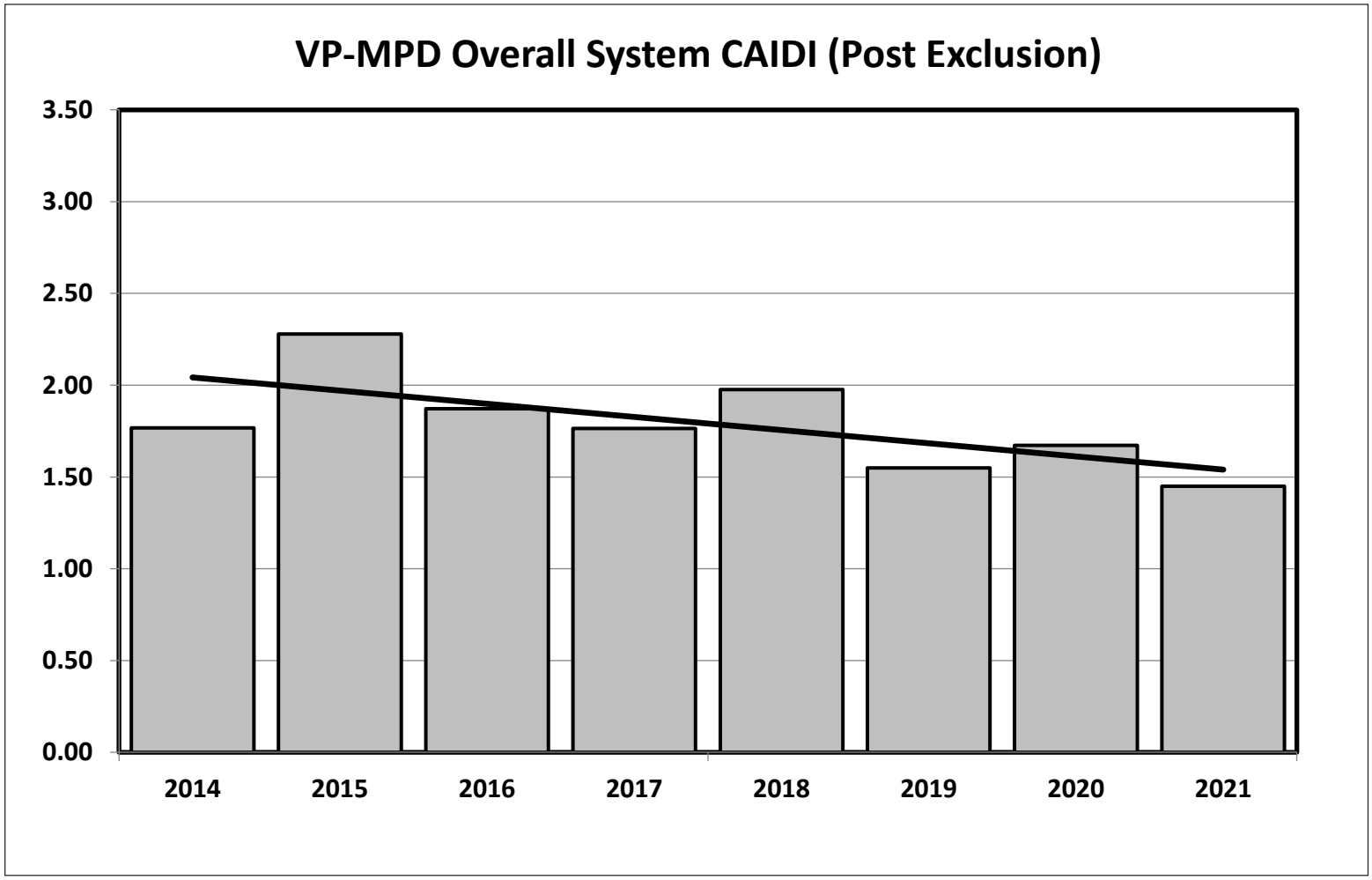
MPD Reliability Performance - Duration



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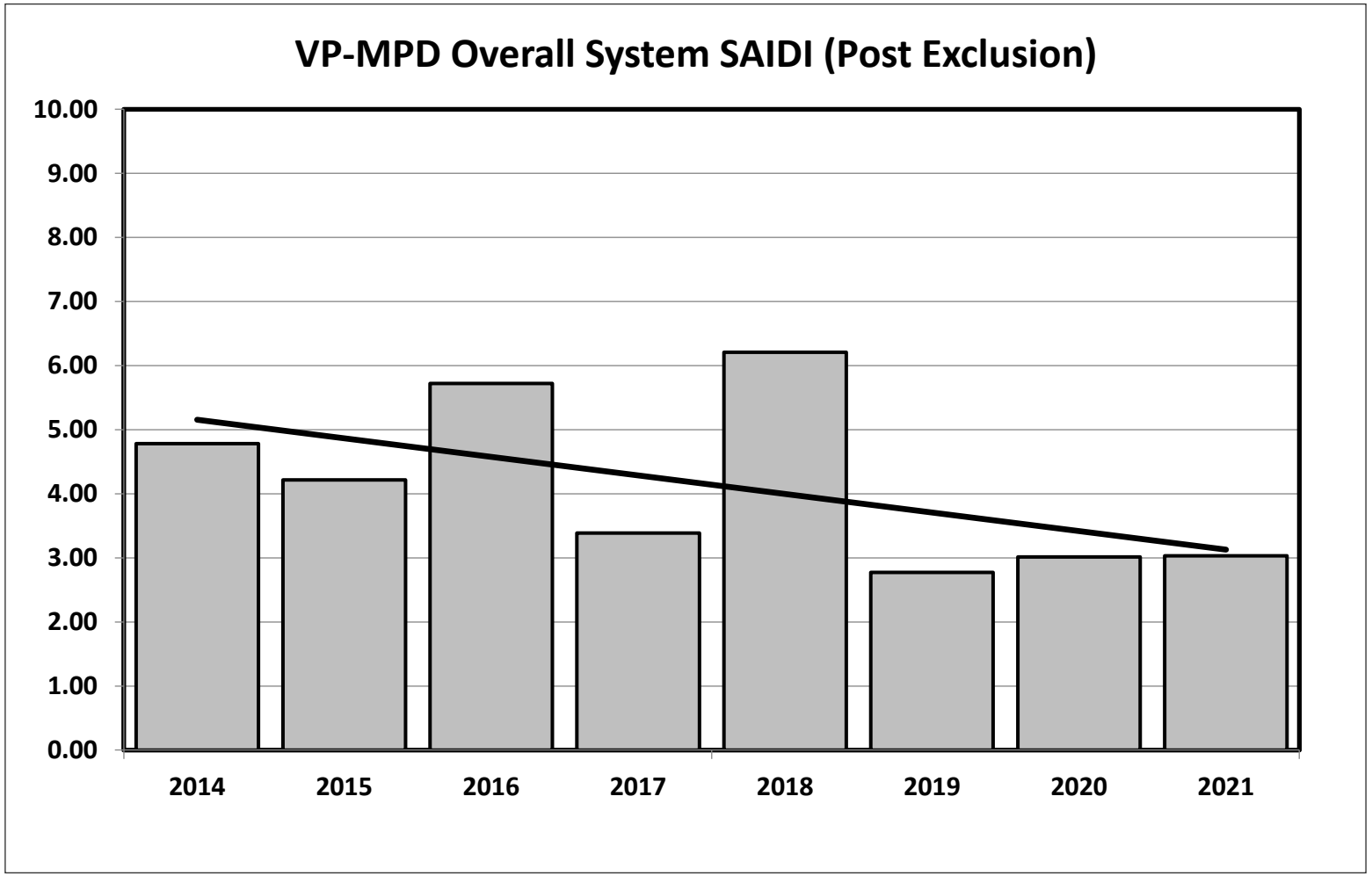
MPD Overall Reliability Performance



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Grid Planning

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Integrated Planning Announcement

Integrating high penetrations of inverter based renewable generation into the grid creates challenges.

Here in the MPD, between existing units and today's interconnection queue, we have more than 200 MW of such units – and we currently peak at about 100 MW.

Solar capacity alone would be more than 160% of the peak.

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Versant Integrated Grid Planning

- Versant is initiating an Integrated Grid Planning (IGP) effort
- Will use the PAG process to conduct that process, to get stakeholder feedback

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GEO Report on Northern Maine

- Versant Obligations: actively participate in policy making and facility state policy goals
- Engage with and educate legislature and policy makers as part of the planning process
- Versant's intentions – the Northern Maine planning process via the PAG – were:
  - Shared with the GEO
  - Included in the N. Maine report…
  - Which was accepted by the EUT (March 10th)

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Planning Advisory Group – Integrated Plan

FERC approved Tariff specifies the process by which the Transmission Provider does system planning – an Advisory Group (PAG) is specified within that process.

Versant has held a PAG meeting annually given that Chapter 330 is required every year – more often than the Tariff requirement - Biennial meetings.

Versant has also invited a wide group of stakeholders to these meetings: the Tariff described PAG process however, is open to a defined group of 7 entities to assist.

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PAG Entities

- Transmission Owners – Liberty
- Customers – TBD
- Generators – TBD
- Suppliers – TBD
- Neighboring Trans. Providers & Control Areas - NBP
- Regulatory Agencies – MPUC
- Public Advocates – OPA

- Governor's Energy Office – GEO
  - LD 1959

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Tariff Language

5.3 Discussion of Assumptions. Members of the Planning Advisory Group shall have the opportunity to question and discuss principal assumptions used in the planning process. The process shall be through meetings of the Planning Advisory Group. Such meetings, if appropriate, may be held via email or other solicitation of written comments.

Biggest controversies generally stem from assumptions used to conduct the study

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Assumptions: Hourly/Seasonal Impacts

- Load/growth forecasts
- Generation/energy/DER forecasts
  - June 21st is very different than December 21st
- "8760" Analysis
- Impact of droughts?
- Days without sun?
- Days without wind?

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PAG Feedback

- Transmission enhancements and expansions
- Distribution requirements
- Storage requirements
- Voltage controls/Reactive Power support
- Demand Response
- Public Policy Requirements
- Cost/rate impacts

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Study/Modeling

- Thermal analyses
- Voltage analyses
- Stability analyses
- Time Series analysis
- These system performance models will be run with and without potential reinforcement options to determine impact on system reliability
- Expect hundreds of scenarios will be run
- Expect to build a combined Transmission & Distribution system model

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Inertia and Grid Forming vs. Grid Following

Fig. 2. Bears on bicycles showing conceptually that with high levels of grid-following PECs, the system becomes unstable simply because sufficient levels of grid-forming assets are not present [13]. Here, the full bicycle is any grid-forming asset, either SGs or grid-forming PECs, whereas the tagalong bicycle is a grid-following asset, with or without grid-supporting functionality.

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