CFVM

Executive Summary

California Forestry and Vegetation Management, Inc. (CFVM) Quality Assurance review for Liberty Utilities Vegetation Management. The following report documents CFVM sampling and assessment findings of spans included in the Fulcrum *2023 Liberty QA App* from 07/2023.

The Quality Assurance audit determined the rate of compliance to be 99.48%.

	Non-Compliant	Population in Sample	Percent of Sample in Compliance
Compliance by Trees	15	2896	99.48%
Compliance by Spans	13	1149	98.87%

Sample Methodology:

The total population was based on a data set of all 19,845 spans in Liberties service territory. Mileage information within the data shows a total of 707.3 miles for an average of 0.0357 miles per span. Using 95% level of confidence, 99% estimated compliance, and a margin of error of 3% a sample size was determined to be 41 miles.

To audit the sample size of 41 miles it was determined that approximately 1150 spans would need to be audited. For efficiency purposes random sample spans were "grown" to form groups of five. The first 230 random sample spans were audited in addition to the two spans on either side.

The population was not stratified in any way. The random breakdown of SRA, LRA and Fire Areas was deemed acceptable.

Field Assessment Questions:

The following questions were answered at each span audited.

1. Population- Count of trees that have ever been pruned and/or that may need to be pruned in the next 3 years (will be within the RCD). This becomes the sample population**.**
2. Priority 1 Growth Tree- Tree in contact or with evidence of prior contact.
3. Priority 2 Growth Tree- Tree within RCD and not a P1.
4. Priority 1 Threat Tree- An entire tree or part of a tree that is already failing.
5. Priority 2 Threat Tree- Tree or part of tree with probable failure within 6 months and affecting the electrical facilities.

6. Tree will not hold- Tree that will not hold regulatory distance for 90 days.
7. Root Cause of a Priority Tree finding- Investigation as to why the tree is now a priority tree finding.
    a. N/A
    b. Scheduling
    c. Missed by Inspection
    d. No-worked by Inspection
    e. No-worked by Liberty
    f. No-worked by Tree Crew
    g. No-worked by QC
    h. Clearance not achieved by Tree Crew
    i. Tree not worked by Tree Crew
    j. MWS not documented
    k. MWS documented and does not qualify

Sample Population:

The population count at the 1149 span audited was 2896, an average of 2.52 trees per span. With 19,845 spans in the system, the sample may be extrapolated to represent a total of 50,009 trees that have ever been pruned and/or may need to be pruned in the next three years.

Population Extrapolation

Avg. Tree Count per Span	Spans Reviewed	Spans in System	Extrapolated Tree Count for System
2.52	1,149	19,845	50,009

Summary of Findings:

Sample Population (Tree Count)	P1 Growth	P2 Growth	P1 Threat	P2 Threat	Will Not Hold
2896	0	16	0	3	10

Priority 1 Growth Tree- There were no Priority 1 growth trees present in the sample.

Priority 2 Growth Tree- There were a total of 16 Priority 2 Growth trees present in the sample. Of the 16 trees: 8 were Priority 2 because of being Undocumented MWS trees and 8 were Priority 2 because of having Growth Within 4 Feet. 15 of the Priority 2 trees were found to be Non-Compliant with regulatory requirements. One of the Priority 2 trees was found in non-HFTD LRA with growth at 3 feet so this tree is Non-Conformant with Liberty standards.

Priority 2 Breakdown *(Compliance and Conformance)*

Priority 2	Undocumented MWS	Growth Within 4 Feet
16	8	8

Priority 1 Threat Tree- There were no Priority 1 Threat trees present in the sample.

Priority 2 Threat Tree- There were a total of 3 Priority 2 Threat trees present in the sample.

Trees Will Not Hold- There were a total of 10 Will Not Hold trees present in the sample.

Root Cause- There were multiple root causes found among the sample. In multiple incidents the growth, being found within 4 feet, was missed by inspection. There were also Priority 2 threat trees missed by inspection. In at least one incident, although possibly two, there was new construction of a pole being moved that could have moved the growth to within 4 feet. A total of 8 MWS trees were found to be undocumented. Finally, there were scheduling issues for some Priority 2 growth trees that have broken compliance because they are fast growers (cycle busters).

Breakdown of Area and Line Type:

	Sample Population	Non-Compliant Tree Total	Compliance %
Distribution LRA- HFTD	616	2	99.68%
Distribution SRA- HFTD	1946	11	99.43%
Distribution FRA- HFTD	156	2	98.72%
Distribution HFTD Combined	2718	15	99.45%
Distribution LRA- non HFTD	57	0	100%
Distribution SRA- non HFTD	7	0	100%
Distribution FRA- non HFTD	0	0	100%
Distribution non HFTD Combined	64	0	100.0%
Transmission	104	0	100.0%

Examples

<u>Priority 2 Growth- Scheduling</u>
Growth of honey locust was found to be within 3 feet under the conductors. This could be considered a cycle buster because it was clear at the time of LiDAR flight, and is a species of significant growth. Muller 1296 is not on the 2023 Inspection Plan.

<u>Priority 2 Growth- Missed by Inspection</u>
Growth of Aspen was found to be within 3.8 feet below the lines. Inspection of the Meyers 3400 Section 2 was completed in Q1 of 2023.

![CFVM logo]

Priority 2 Growth-Missed by Tree Crew on LiDAR

Growth of Aspen was found to be within 3 feet below the lines. The Tree Crew performing LiDAR work had worked this span, and missed observing this tree with growth within 6 feet of the conductors. This tree was technically compliant because it is in non-HFTD LRA.

Priority 2 Growth- N/A

Growth of pine was offset below lines at 3.7 feet. The one LiDAR hit at this location indicated a tree at 6.3 feet clear, and pines are not known to put on over 2 feet of growth, so likely something was missed by LiDAR at this location.
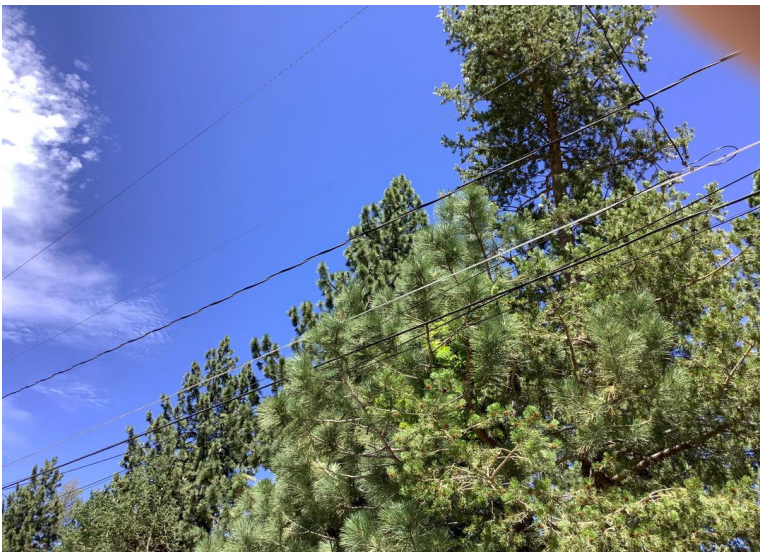
Priority 2 Growth-N/A

Growth of pine was found to be within 2 feet of the lines to the side and 3.5 feet above. There is evidence that a new pole was recently installed at the site and construction did some moving around of the lines. This is an LRA area in HTFD zone 2.

Priority 2 Growth- Undocumented MWS

This span has two undocumented MWS pines in it. One is 19 inch dbh, 85 feet high, with wood at 3.7 feet to conductors. The other is 34 inch DBH, 105 feet high and has wood at 2.1 feet to the conductors. Liberty provided data to CFVM for MWS trees that was uploaded as a layer in Fulcrum. After the project was complete we also checked FieldNote and the LiDAR data to see if any of the undocumented MWS trees were documented elsewhere.

Discussion of Results

With a score of 99.48%, it's reasonable to look at the results and discuss possibilities, within the vegetation management program, to achieve an improved compliance score for the following year. A goal of greater than 99.5% for the following year (July 2024), would certainly be achievable.

With the sample size of 5.8%, the results could be extrapolated to a total of 258.6 possible trees that are not in compliance throughout the entire system. As well, with an average of 2.52 trees found per span to have been pruned in the past or will need to be pruned for compliance in the next 3 years, we can extrapolate at total of 50,009 trees that have ever been pruned and may need to be pruned in the next three years.

Will Not Hold- We could extrapolate from this review, if it was performed later in fire season(3 months later), that with the additional 10 trees, there could have been a conformance rate of 99.14%.

When 'Scheduling' was the root cause behind a finding, we have discussed possible solutions to improve the scheduling issues. When LiDAR is flown during fire season and there are fast growing species, not everything that would be within 4ft, had previously been identified as within 6ft. Examples of fast growers, although they are outlier species, would be: silver maples, locusts, siberian elms, box elder, mulberry, and others. Possible solutions to adapt to the scheduling issues include: targeting of fast growing incompatible species for removal; identifying fast growing species and tracking them in a way that they may be inspected annually before fire season (if they are outside of a recent inspection period); applying growth regulators on the fast growers.

When 'Undocumented MWS' was the root cause we can consider how the MWS trees are identified and documented within the vegetation program. Because trees that have been previously documented as a MWS are the only trees that get checked and re-documented every year, it would be beneficial to consider ways to catch and add additional trees that need to be documented as MWS by both the inspection technicians and quality control technicians that may be reviewing these spans. In addition, to consider the accuracy of LiDAR data to distinguish between major wood and growth to identify MWS trees.

When 'Missed by Inspection' was the root cause we can consider how the inspection technicians could have missed growth that was within or close to 4ft at the time of inspection. There is the possibility of human error when inspecting at such a detailed level. It puts emphasis on the importance and benefits of the Quality Control program and the corrective actions that may come from there being another set of eyes reviewing the inspection work. There is also an added emphasis on training of inspection technicians to be regularly calibrating their visual distance estimates. We also may consider that some of these trees and their growth was likely within the 6ft when LiDAR was flown, so they were also missed by LiDAR and the technology should not be assumed to be 100% accurate when inspectors are following LiDAR flights and its data.

When "Missed by Tree Crew(on LiDAR)" was the root cause we can consider how the tree crew could have missed growth within 6 ft in a span that they are working in. There is the possibility of human error. Again, it puts emphasis on the importance and benefits of the Quality Control program and the corrective actions that may come from there being another set of eyes reviewing the LiDAR Tree Work complete work. There is also an added emphasis on training tree crew members to be regularly calibrating their visual distance estimates.

When "N/A" was the root cause, in some cases, we identified there may have been new poles that changed the distance of both growth and major wood in relation to the conductors . There is a possibility of human error when so many poles are being installed throughout the system and growth may be missed. An idea of added checks would be in having the QC program reviews some of the new construction.

There were also "N/A" root causes for trees that have less growth, like Jeffrey pine, and their LiDAR polygon data was indicating the tree was further than 6ft out. There is potential that the LiDAR data could be inaccurate in some cases and we recognize the limits of the technology. Potentials to mitigate this as an issue would be to continue to check for LiDAR duplicates, as well as continuing the QC program in a way that could potentially add trees that were missed by LiDAR when identified by field techs as will not hold trees.

There is also the idea that LiDAR being flown later this year could be after the trees have finished growing for the year. The last two years that LiDAR was flown, it was at a time that trees may have still being actively growing, so adding that growth that occurs after LiDAR was flown, continuing into the end of fire season, and then conjoining that growth from the previous year would be active spring growth that is occuring, that when combined, in rare instances, could bring about more than 2 ft of accumulated growth.

With a main theme of fast growers being outside of being caught by LiDAR, in the year that they are flown, and aspects of the LiDAR data not catching everything accurately, it may be beneficial to turn to additional technologies for solutions. CFVM has been working with and investing in additional technologies for vegetation management that may be used to complement and supplement the yearly LiDAR flights that we can discuss further.