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DATA REQUEST RESPONSE
LIBERTY UTILITIES (LIBERTY)

Data Request No.:	OEIS-P-WMP_2025-Liberty-004
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Subject:
Q01. Regarding Judgmental Sampling for Vegetation Management Quality Control Audits
Q02. Regarding Quality Control Sample Units
Q03. Regarding Annual Substation Defensible Space Inspections
Q04. Regarding Annual LiDAR Inspections of Overhead Distribution and Transmission System

Q01. Regarding Judgmental Sampling for Vegetation Management Quality Control Audits:

On page 2 of its Post Work Verification Procedure, Liberty indicates that "QC inspections for VM are based on judgmental sampling and not 100% inspection. Judgment is used to prioritize QC resource allocation based on risk."

a. When performing judgmental sampling, what factors make it more or less likely that a specific tree, circuit mile, or pole will be selected to audit for QC? Provide a detailed description of the process of Liberty's judgmental sampling for each of the following activities Liberty audits:
   i. Completed Tree Work
   ii. Detailed Inspections
   iii. Hazard Tree Work
   iv. Pole Clearing

b. Stratified random sampling ensures that a sample is representative even if it comes from a non-uniform population (e.g., when there are unequal miles within each HFTD Tier, or if one tree crew performs more work than another). Explain why Liberty uses judgmental sampling as opposed to stratified random sampling.

Response:

a. QC inspections are assigned to the QC contractor by Liberty Vegetation Management upon work completion or completion of a reasonable work sample size prior to the planned QC inspection. Liberty considers various factors when QC work packages are assigned including project schedule and timing of work, region, circuit, population (number of trees, poles, or work orders), local known conditions, vegetation characteristics, HFTD, vendor trends and performance, circuit and section mileage, type of review, and other factors.
   i. Completed Tree Work – Liberty assigns QC of Completed Tree Work of work packages that are completed by the tree contractor through the project schedule, typically January through June. Liberty assigns entire circuits, or sections of circuits, for QC based on the criteria described above. Every completed work order for the Clearance initiative is evaluated for the QC assignment.
   ii. Detailed Inspections – Liberty assigns QC of Detailed Inspections of circuits, sections of circuits, or a reasonable work sample size that are completed by vegetation management inspections. QC of Detailed Inspections occur through the calendar year. QC of Detailed Inspections are assigned based on the criteria described above. All spans and work orders created by VM inspectors in the QC sample are evaluated.
   iii. Hazard Tree Work – Liberty assigns QC of Hazard Tree Work of completed Fall-In Mitigation work. Liberty assigns entire circuits, or sections of circuits, for QC

based on the criteria described above. Completed work orders for trees removed for the Fall-In Mitigation initiative are evaluated.

iv. Pole Clearing – Liberty assigns QC of Pole Clearing throughout the service territory based on the criteria described above. Liberty has conducted random sampling of completed pole clearing work as needed.

b. Liberty utilizes judgement sampling to enhance effectiveness of its quality control processes. By leveraging the knowledge of subject matter experts, QC inspections are proactively directed towards the VM programs current priorities, areas of improvement, and regions of interest. This approach allows for real-time adaptation of QC inspections based on operational insights, historical trends, and on-going program development. Judgement sampling provides a flexible and targeted method that leverages expert knowledge.

Q02. Regarding Quality Control Sample Units:

On page 201 of its 2026-2028 Base WMP, Liberty indicates that the "Population/Sample Unit" for "Completed Tree Work" and "Detailed Inspections" is "Annual Circuit Miles." On page 204, Liberty indicates the "Sample Unit" for "Completed Tree Work" and "Detailed Inspections" is a "Single Tree." On page 204 Liberty lists "Completed Tree Work Criteria," and on pages 204 and 205 Liberty lists "VM Detailed Inspections Criteria." It is unclear how "criteria," "Single Tree[s]," and "Annual Circuit Miles" generate pass rates that Liberty will compare to the "Target Pass Rate[s]" it includes in "Table 9-21: Vegetation Management QA and QC Activity Targets."

a. Provide an example calculation showing all steps of how Liberty calculates audit pass rates using criteria, single trees, and annual circuit miles. Provide separate example calculations for each of the following activities being audited:

i. Completed Tree Work

ii. VM Detailed Inspections

Response:

a. Liberty uses the criteria in Table 9-25, Table 9-26, Table 9-27, and Table 9-28 when evaluating pass rates for each Work Type. The pass rates are averaged for all conditions evaluated.

i. Completed Tree Work

Completed Tree Work – Averaged Pass Rate of all Categories Evaluated 97.7%			
Categories Evaluated	**Total Number of Trees Assessed**	**Trees Passed per Work Type**	**Pass Rate %**
Work Performed	1271	1235	97.17%
MCD Not Achieved	1271	1202	94.57%

Will Not Hold	1271	1228	96.62%
Potential Hazard Remains	1271	1263	99.37%
Site Clean	1271	1244	97.88%
ANSI	1271	1218	95.83%
Other Trees Affected	1271	1271	100.00%
Site Condition	1271	1270	99.92%

Unit Quantity Assessed	Total Assessments (questions) made	Assessments Failed	Assessments Passed	**Total Assessment Pass Rate**
1271	10168	237	9931	**97.7%**

ii. Detailed Inspections

Detailed Inspections – Averaged Pass Rate of all Categories Evaluated 97.2%			
Categories Evaluated	**Total Number of Trees Assessed**	**Trees Passed per Work Type**	**Pass Rate %**
Location Information Correct	692	652	94.22%
Species Correct	692	690	99.71%
Quantity Correct	692	682	98.55%
Work Type Noted	692	678	97.98%
Tree Health Noted	692	690	99.71%
Priority Noted	692	691	99.86%
Project Type Noted	692	691	99.86%
Clean Up Method Noted	692	654	94.51%
Quantity of Non-Listed Trees	692	623	90.03%

Unit Quantity Assessed	Total Assessments (questions) made	Assessments Failed	Assessments Passed	**Total Assessment Pass Rate**
692	6228	177	6051	**97.2%**

Q03. Regarding Annual Substation Defensible Space Inspections:

On page 234 of its 2023–2025 Base WMP, Liberty states that "a minimum of two site visits will occur per facility, per year." On page 186 of its 2026–2028 Base WMP, Liberty states that "generally, two site visits will occur per facility, per year."

a. Explain why Liberty changes its commitment to inspect substations for defensible space from "a minimum of two site visits" per year to "generally, two site visits" per year.

b. Describe factors that would contribute to substation inspections occurring:

i. Less often than two times per year.

ii. More often or equal to two times per year

Response:

a. Liberty conducts defensible space inspections on each substation annually, with the goal of two site visits per year. While this is the intended schedule, Liberty determined it is necessary to account for factors outside of its control that can impact its ability to inspect and perform the substation treatment.
b. Contributing factors.
    i. Factors such as weather, access issues, and operational constraints can contribute to substation inspections being conducted less than twice per year.
    ii. Liberty does not plan to perform substation defensible space inspections more frequently than twice a year.

Q04. Regarding Annual LiDAR Inspections of Overhead Distribution and Transmission System:

In its response to OEIS-P-WMP_2025-Liberty-001, question 01, Liberty states that it "intends to complete LiDAR inspections of the total overhead primary distribution and transmission system annually."

a. What type of raw and processed data are provided to Liberty by this process? (ex. Point cloud data, orthoimagery, geospatial vector data, inspection reports)
b. What type of analysis outputs are provided to Liberty by this process? (ex. Vegetation encroachment distance, clearance violation counts per span, growth rate projections, risk scoring layers integrating vegetation, asset condition, and terrain)
c. How is LiDAR data integrated with Liberty's GIS system?
d. Does Liberty's vegetation management and/or inspection systems ingest LiDAR data directly?
e. How is LiDAR data incorporated into Liberty's Probability of Ignition (POI) or Probability of Consequence (POC) models?
f. Does Liberty use LiDAR derived growth models to project future encroachments or work needs?
g. What department owns and governs the LiDAR data internally within Liberty? (e.g., Vegetation, IT, Asset Management, a cross-functional group)
h. How long is LiDAR data retained, and what is Liberty's plan for historical comparison or trend analysis?
i. Are third-party vendors involved in LiDAR data analysis, and if so, how is data integrity validated?

Response:

a. LiDAR data provided:

- LiDAR point cloud in .las format
- ESRI database
  - Conductor vectors with locations displayed with cartographic properties representing conductor position relative to tower/poles
  - Rectified structure and span locations
  - Vegetation segmentation attributed with clearance detections (fall-in, grow-in analysis)
- Satellite Imagery Tree Health Monitoring
- Point Cloud data
- Software

b. Locations of poles, structures and conductor vectors are identified and used to analyze adjacent vegetation. Wire vectors are created from the LiDAR point cloud, stringing a curved vector from points on the structure or pole.

Vegetation at six feet and above ground level is segmented to represent tree crowns, with each tree assigned a unique Tree ID. Deliverables include tree-top points for all trees and vegetation polygons for detection trees.

Vegetation clearance analysis identifies vegetation that may grow into or fall onto transmission or distribution conductors. It uses tree height data, catenary models, and voltage-specific clearance thresholds to categorize the encroachments and fall-ins. Proprietary software calculates radial clearance distances from each point in the feature-coded point cloud. Reporting includes fall-ins within a 300-foot corridor and grow-ins/overhangs within a 100-foot ROW.

Table 9-10: Vegetation Grow-In Zones, LiDAR Grow-In Analysis

Category	12kV - 25kV	60kV	120kV
Grow-In Zone 1	0 - 1.5 feet	0 - 1.5 feet	0 - 4 feet
Grow-In Zone 2	1.5 – 4 feet	1.5 – 4 feet	4 - 10 feet
Grow-In Zone 3	4 – 6 feet	4 – 6 feet	10 - 15 feet
Grow-In Zone 4	6 – 12 feet	6 – 12 feet	15 - 30 feet

Table 9-11: Vegetation Fall-In Zone Categories, LiDAR Fall-In Analysis

Zone Category	Criteria
Fall-In Zone 1	Overstrike over 6 feet
Fall-In Zone 2	Strike/overstrike less than 6 feet
Fall-In Zone 3	Fall within 6 feet of wire

Liberty uses satellite imagery to monitor tree health along power lines. Through analysis of satellite imagery over time, changes in vegetation health are detected through annual measurements of chlorophyll content. These measurements are compared to a baseline from the initial analysis to identify deviations, which are then aggregated by span and classified into high, medium, or low vegetation stress levels. The results are processed into heat maps that visually highlight areas of concern. Updates are provided semi-annually or on a circuit-by-circuit basis as needed.

c. LiDAR data is used to conflate Liberty's GIS data to update spatial locations of assets as needed.
d. LiDAR data is not ingested directly into Liberty databases or work management systems. LiDAR data is imported into FieldNote (VM work management software) annually. Work orders created in FieldNote from LiDAR data are ingested into Liberty's database.
e. LiDAR derived vegetation data is used to assess tree density, vegetation proximity to conductors and poles, and fall-in and grow-in risk zones. These inputs feed into condition modifiers in the DIREXYON model, which adjust the Probability of Failure (APF) and Probability of Ignition (POI). LiDAR data is also used to forecast vegetation-related failures at the segment level. The LiDAR data is not directly used in calculating POC, which is derived from Technosylva FireSight.
f. Liberty does not use growth models to project future encroachments or work needs.
g. Liberty's Vegetation Program owns the LiDAR data.
h. Historical LiDAR data is retained indefinitely. Liberty has been using LiDAR data to analyze change detection and encroachment reduction aggregated at circuit, voltage, or regional levels.
i. Liberty works with NV5 Geospatial for LiDAR data analysis. NV5 performs comprehensive data validation to verify deliverables meet project specifications. This includes validation of point and pulse densities, data coverage, and calibration using optimal GNSS configurations for sensor, IMU, and base station calculations. Logs and SBET trajectories are reviewed for positional accuracy, and both relative and absolute accuracy are verified alongside raster quality. A project-specific QA checklist is developed by the technical lead, with final data undergoing QC by both datatype and project leads. Scripted tests are implemented to ensure logical consistency and complete attribution, with non-compliant data flagged for resolution.