

**PG&E Vegetation Management
Work Quality and Verification
Enhancements**

As of November 15, 2020



Together, Building
a Better California

Vegetation Management Program

1/20/2014



Seven Areas of Focused Improvement

Enhanced Work Verification
Quality verification performed near real-time of work completion

Defined Scope Contract for Routine Veg & Unit Cost Pricing for EVM and Tree Removal

Process and Technology Improvements
Development, administration, integration and strategy of VM databases, records and tools

Ground Based LIDAR (GBL)

Vegetation Management Federal Monitor Liaison
Conduct real-time reviews from federal Monitor and State Regulator observations

Vegetations Management Inspectors (VMI)
Establish internal resource expertise and capability

Pace of Enhanced Vegetation Management (EVM)
Compress to 10-year pace (2021-2030) at 2,100 miles per year



Current and Proposed Scope Enhancements

	Current Scope	Proposed Scope Enhancements
Enhanced Work Verifications	<ul style="list-style-type: none"> Work verification is performed on 30% of only the EVM program each year, typically within an average of 14 days following completed work Current workforce encompasses a 1:1 ratio of QV inspector to tree crews with 100 QV contract inspectors staffed at peak 	<ul style="list-style-type: none"> Verification to include all vegetation management work (T&D) in HFTD areas on a 100% basis and a 25% random sample of non-HFTD work. Shift towards near real-time quality assessment Proposed workforce will be ~180 FTE, steady state, targeting a 1:2 ratio of QV inspector to tree crews
Implementation of Defined Scope & UC for EVM & Tree Work	<ul style="list-style-type: none"> Distribution Routine work was performed on a unit price basis and tree removal was performed on a T&E basis PG&E responsible for contracting and coordinating both pre-inspection and tree crew work 	<ul style="list-style-type: none"> Contractors are assigned responsibility for the compliance of circuit bundles (CBs) based on "defined scope". 32 iterations encompass the entire system Contract structure incentivizes contractors to "trim beyond compliance" and own accountability for completed work Transition EVM & tree removal towards unit price basis
Process and Technology Improvements	<ul style="list-style-type: none"> The VM technology and data/performance management team currently supports the development, administration, integration and strategy of VM databases and tools on an ad hoc basis 	<ul style="list-style-type: none"> Build a dedicated team to include members from VM, IT and LO Process Improvement focused on both near term tactical and long term strategic process and technology fixes to close data collection and data and records management gaps
Ground Based LIDAR (GBL)	<ul style="list-style-type: none"> PG&E has conducted ground-based LIDAR pilots using vehicle, ATV and backpack mounted LIDAR technology in 2020 	<ul style="list-style-type: none"> Use ground-based LIDAR using vehicle in a post inspection radial clearance review of completed circuits. Can address ~70% of HFTD circuits due to accessibility Provide digital time-stamped traceable, verifiable, accurate and complete (TVAC) record for work verification
Vegetation Management Federal Monitor Liaison	<ul style="list-style-type: none"> Local operations teams are dispatched to review findings as PG&E becomes aware of federal monitor or state legislator observations 	<ul style="list-style-type: none"> Dedicated centralized team of arborists/professional foresters to conduct reviews of all federal monitor and state legislator findings and ensure timely follow-up and closure of each finding
Vegetations Management Inspectors (VMI)	<ul style="list-style-type: none"> Primarily rely on contractor expertise for directly observing contract tree crews performing work 	<ul style="list-style-type: none"> Staff the VMI team with PG&E employees to ensure internal expertise on all aspects of vegetation work, targeting a 1:20 ratio of VMI to tree crew
Enhanced Vegetation Management Pace	<ul style="list-style-type: none"> Enhanced Vegetation Management pace of 1,800 miles per year results in a 12-year window of completion for the baseline program 	<ul style="list-style-type: none"> Adjust the pace of the baseline program to 2,100 miles per year and shorten the window of completion to 10 years (2023-2030)



Timeline for improvements

	Nov 2020 - Q1 2021	Q2 2021	Q3 2021	Q4 2021
Enhanced Work Verifications	<ul style="list-style-type: none"> 3 Managers 22 Internal Inspectors 150 Contract Inspectors 	<ul style="list-style-type: none"> Additional 55 Internal Inspectors 125 Contract Inspectors 		
Implementation of Defined Scope for Routine & UC Pricing for EVMI	<ul style="list-style-type: none"> All 32 Zones (Circuit bundles) implemented for routine VM program UC Pricing implemented for EVMI and Tree Removal 			
Process and Technology Improvements	<ul style="list-style-type: none"> Stand up dedicated cross functional teams to identify process improvements that are high risk and performed manually 	<ul style="list-style-type: none"> Build out process and tools including revised data capture and TWC records across all VM programs 	<ul style="list-style-type: none"> Integrate tool and application into field and office across all VM programs 	<ul style="list-style-type: none"> Integrate and leverage VM data across other asset management processes
Ground Based LIDAR (GBL)	<ul style="list-style-type: none"> Develop the operational procedure and execution process for Ground Based LIDAR using vehicle 	<ul style="list-style-type: none"> Begin implementing GBL as a pilot inspection radial clearance review of completed circuits in HPTCs 	<ul style="list-style-type: none"> Continue implementation of GBL as a pilot inspection radial clearance review of completed circuits in HPTCs 	<ul style="list-style-type: none"> Implement integration of Ground Based LIDAR data into other asset management processes
Vegetation Management Federal Monitor Liaison	<ul style="list-style-type: none"> Stand up dedicated VM Federal Monitor Liaison team Develop an all-hazards and associated action items 			
Vegetations Management Inspectors (VMI)	<ul style="list-style-type: none"> Complete hiring of all Vegetation Management Inspectors 			
Enhanced Vegetation Management	<ul style="list-style-type: none"> Start execution of the 2,100 miles in line with the approved risk model to achieve 10-year standard 			

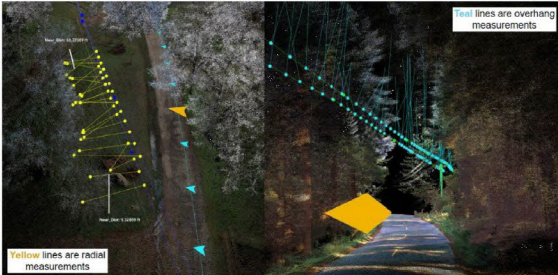


Costing

- Enhanced Work Verifications
- Implementation of Defined Scope for Routine & UC Pricing for EVM
- Process and Technology Improvements
- Ground Based LIDAR (GBL)
- Vegetation Management Federal Monitor Liaison
- Vegetations Management Inspectors (VMI)
- Enhanced Vegetation Management



Ground Based LiDAR for Vegetation Management Inspection



Multiple radial and overhang encroachments extracted from the vehicle LiDAR point cloud



**Back Up Slides
Need to Be Updated**

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Enhanced Work Verifications



Current Scope

- Work verification is performed on 100% of the Enhanced Vegetation Management (EVM) program each year, typically within an average of 14 days following completed work.
- Current workforce encompasses a **1.5 ratio of inspector to tree crews** and typically follow on average two weeks after the work is performed.
- In 2019, work verification was staffed at it's peak with **100** inspectors.
- Work verification data is sent to the local operations team daily with a comprehensive feedback report sent on a weekly basis.



Proposed Enhancement and Scope

- **Expanding work verification to include all vegetation management work (TRD) in HFTD areas and a 25% random sample of non-HFTD work.**
- New workforce will be approx. **360 FTE** with a roughly 70/30 split of external and internal contractors (see org chart), targeting a **1.3 ratio of inspector to tree crews**. This includes management and back office support. Verification will follow one week after the work is performed. EVM work is performed on unit basis and there are no mobilization costs/fees. For Routine work, all costs associated with missed work are borne by the contractor.
- EVM work verification will perform the same scope as the pre-inspector (performing TAI assessment of every strike tree, validating prescriptions of PI, verifying clearances).
- All other work will be verified according to the relevant standards and will follow shortly behind after PG&E is notified of tree work completions.
- This work will **improve and shorten the feedback loop** so near real-time corrections can be made.
- QA and OC are performed on both Transmission and Distribution Routine Compliance Programs (through a statistically valid sample) and will remain unchanged.






Timing / Updates

- By 1/31/21, hire 3 work verification managers and 100 contract inspectors.
- By 01 2021, hire all supervisors, and an additional 22 internal and 60 contract inspectors.
- By 02 2021, hire an additional 50 internal inspectors and 52 contract inspectors.
- By 03 2021, hire an additional 29 internal inspectors.



Continued Implementation of Defined Scope

 Prior Scope	<ul style="list-style-type: none">• Prior to the transition to Defined Scope, Distribution Routine work was performed on a unit price basis with PG&E responsible for contracting and coordinating both pre-inspection and tree crew work.
 Current Enhancement	<ul style="list-style-type: none">• With Defined Scope, <u>contractors are assigned responsibility for the compliance of circuit bundles</u>. This includes both pre inspection and tree work.• Defined Scope is currently being implemented, creating contractor ownership of the vegetation risk on assigned circuits.• This contract structure incentivizes contractors to "go beyond compliance" in order to maintain required clearances for compliance and achieve operational efficiencies.• Defined scope also bundles PI and Tree Work for a single line of accountability and improves the feedback loop.
 Timing / Updates	<ul style="list-style-type: none">• Contracts have been executed for 29 of the 32 total bundles.• Of the 32 bundles, 23 have been implemented and we are continuing to work with contractors to ensure successful implementation of the remaining 9 bundles.

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Ground Based LiDAR (GBL)

Current Scope

- PG&E has been working with various LiDAR based companies for almost 10 years and the technology has come a long way. In 2020, PG&E has conducted a number of ground based LiDAR pilots using vehicle, A/V and backpack mounted systems.
- However, the ability to implement on a large scale still requires development.

Proposed Enhancement and Scope

- Using ground-based LiDAR as a post inspection radial clearance review of completed circuits.
- This review will focus on ground based LiDAR for high voltage circuits.
- The program will be implemented in a pilot program and will be used as a QC check for defined scope radial clearance.
- Some of the HFTDs are accessible to ground based LiDAR.
- Other HFTDs that will still require a supplemental patrol to check the remaining routine scope.




Timing / Updates

- We will begin implementing GBL in Q1 2021 as a post inspection radial clearance review of completed circuits.
- Full implementation will likely take several years but it should be possible to start limited patrols by the end of 2021.

Project Team and Roadmap






Federal Monitor Team

 Current Scope	<ul style="list-style-type: none">As we become aware of federal or state monitor observations, the local operations teams are dispatched to review findings. This is in addition to their daily responsibilities.
 Proposed Enhancement and Scope	<p>Integrate a small team of dedicated arbiters to review all observations, including from the federal and state monitor in real time.</p> <ul style="list-style-type: none">The team will evaluate all observations and provide feedback to the monitor team with the intent to maximize learning for both teams.Findings that are consistent with the current process will be conducted to address any process gaps to improve controls on the VM work.This team will need to be trained on the current system wide dispatching and will report directly to the Senior Director.
 Timing / Updates	<ul style="list-style-type: none">A partial contract team can be onboarded almost immediately with a full contractor team in place by year-end.Throughout 2021, the team will evaluate converting these contractors to full time PG&E employees.

Project Team



Vegetations Management Inspectors (VMI)

 Current Scope	<ul style="list-style-type: none">• The VMI team is comprised of experienced tree workers/arborists directly observing contract tree crews performing work.• Responsibilities include verifying the quality of the work performed and ensuring processes and procedures are followed.• VMIs will provide real-time feedback and conduct observations that will be used to trend performance and provide feedback to our contractors.• VMIs will be observing work and overseeing quality across the service area at a 1:20 VMI to tree crew ratio
 Proposed Enhancement and Scope	<ul style="list-style-type: none">• N/A; the VMI is a new organization that is currently being stood up.
 Timing / Updates	<ul style="list-style-type: none">• Currently hired an Internal VMI Manager and ten VMI Supervisors, currently recruiting to fill the Internal VMI positions (see attached org chart).• We are on track to meet Judge Aboup commitment to extend ten VMI offers by 11/30/20 and an additional 10 offers by 1/31/21.

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