CLARIFICATION TO *VM0042 METHODOLOGY FOR IMPROVED AGRICULTURAL LAND MANAGEMENT, V1.0*

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This document provides a clarification applicable to VCS methodology *VM0042 Methodology for Improved Agricultural Land Management, v1.0,* effective from the date provided in the table below. Project proponents and validation/verification bodies (VVBs) shall apply and interpret *VM0042, v1.0* consistent with the clarification set out in this document.

Clarification	Description	Document and Section Reference	Effective Date
Clarification 1	Independent subject matter expert review required when using emerging technologies to estimate soil organic carbon (SOC) stocks for biogeochemical model inputs	*VM0042, v1.0*, Section 9.2: parameter tables for $fSOC_{bsl,i,t}$ and $SOC_{wp,i,t}$	Effective from 23 January 2026, including all new project requests

1   CLARIFICATION

Clarification 1:

The following clarification is added to the "QA/QC procedures to be applied" row in the parameter tables for $fSOC_{bsl,i,t}$ and $SOC_{wp,i,t}$ in Section 9.2 Data and Parameters Monitored in *VM0042, v1.0*:

Where emerging technologies (e.g., remote sensing) are used to determine SOC stocks at t = 0, an independent subject matter expert must issue a formal technical opinion explicitly validating the approach by confirming the integrity and accuracy of the SOC estimates derived from the emerging technology. The expert's assessment and conclusions must address at least the following:

1) Quality of the calibration dataset (e.g., spatial and temporal coverage, depth range, methodological lab measurement approach)

2) Representativeness and sufficiency of samples used for calibration, recalibration, and model validation, including how the sample size was determined

3) Performance of the technology (i.e., model coverage (%), R^2 (value), and model prediction error)

4) Appropriateness of covariates, data sources, and procedures used for data processing and feature engineering

5) Scientific rigor of technology selection (e.g., model architecture)

6) Appropriateness of variogram selection and fitting

7) Coherence of error propagation and uncertainty quantification procedures

Background:

Until the recent publication of VCS tool *VT0014 Estimating Organic Carbon Stocks Using Digital Soil Mapping, v1.0*, emerging methods for estimating SOC content and stock changes – particularly the use of remote sensing, geospatial data, and statistical methods – lacked standardized guidelines to provide confidence in their accuracy and integrity. This contrasts with well-documented methods, often accompanied by corresponding ISO standards, such as the direct measurement of SOC in soil samples using analytical laboratory techniques (e.g., dry combustion, considered best practice in SOC measurement).[1]

Data-driven estimates of SOC can introduce significant uncertainty and errors due to technological limitations (e.g., associated with remote sensing data), spatial resolution constraints, lack of in situ ground-truth data for calibration and validation, and variability in soil properties that is difficult to capture remotely. Subsequent data processing using machine learning algorithms can introduce additional uncertainties. Biogeochemical models may then propagate these uncertainties, biasing outputs or misrepresenting soil carbon fluxes. Projects that use new methods (as allowed per Tables 6 and 7 of *VM0042, v1.0*) but do not follow the *VT0014* guidance risk under- or over-estimating SOC stocks used as inputs to biogeochemical models. Therefore, independent expert review and approval of new methods for estimating SOC stocks when using remote sensing, geospatial data, or statistical methods, along with associated quality assurance and quality control procedures, are required to ensure conformance to methodological rigor and accuracy standards expected under *VM0042, v1.0*.

VM0042, v2.0 clarified that the use of remote sensing to estimate and monitor SOC stock changes would not be allowed until Verra published a VCS tool with requirements and guidelines to ensure the robustness and reliability of this method. *VT0014, v1.0* was published in August 2025. Shortly after, Verra issued a [correction to *VM0042, v2.1*](#) stating that the use of remote sensing to estimate and monitor SOC stock changes would be allowed on a go-forward basis provided project proponents follow the requirements and procedures in the most recent version of *VT0014*.

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[1] ISO *10694:1995 Soil quality — Determination of organic and total carbon after dry combustion (elementary analysis)* available at: https://www.iso.org/standard/18782.html