

# Department of Natural Resources and Environmental Control

## Division of Air and Waste Management

### Air Quality Management Section

CO<sub>2</sub> Budget Trading Program

Offset Project: Afforestation

M & V Report Instructions



JUNE 2009



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## **1. Overview**

To demonstrate the achievement of CO<sub>2</sub>-equivalent emissions reductions from an offset project that has received a consistency determination from the Department, a Project Sponsor must submit to the Department in accordance with these instructions a fully completed *Offset Project Monitoring and Verification Report (M&V Report)*.

The Project Sponsor should review the CO<sub>2</sub> Budget Trading Program regulations of 7 DE Reg. 1147, addressing offset projects and the award of CO<sub>2</sub> offset allowances. All offset project submittal materials and documents are available at:

<http://www.awm.delaware.gov/AQM/Pages/Offsets.aspx>

## **2. Submission Instructions**

Submit one (1) complete paper hardcopy original and one (1) electronic copy of the *M&V Report* in the form of a CD disk. Submit hardcopies of sections requiring signatures as originally-signed copies and scan such signed forms for electronic submission. Facsimiles of the *M&V Report* are not acceptable under any circumstances.

***CO<sub>2</sub> Budget Trading Program  
DNREC Air Quality Management  
156 South State Street  
Dover, Delaware 19901***

The *M&V Report* includes three parts, as described below. Each part comprises specified forms and required documentation. The *M&V Report* has been created as a Microsoft Word document with editable fields. Enter information directly in the fields provided or submit information or documentation as an attachment, as instructed.

The Project Sponsor should save an electronic copy for his or her file to serve as a reference for any necessary remediation.

## **3. M&V Report PARTS and Sections:**

### **COVERSHEET**

#### **PART 1. Preliminary Information Sections**

- Section 1.1 – General Information
- Section 1.2 – Project Sponsor Attestations
- Section 1.3 – Project Sponsor Agreement
- Section 1.4 – Disclosure of Greenhouse Gas Emissions Data Reporting



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**PART 2. Category-Specific Information and Documentation Sections**

- Section 2.1 – Demonstration of Conformance with M&V Plan
- Section 2.2 – Determination of Reporting Period Sequestration

**PART 3. Independent Verification Section**

- Section 3.1 – Independent Verifier General Information
- Section 3.2 – Independent Verifier Certification Statement and Report



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## COVERSHEET

Check the boxes to indicate sections are being submitted.

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### PART 1. Preliminary Information Sections

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#### Section 1.1 General Information

Enter the requested information in the editable text fields in the section. If a text field is not applicable or is unanswerable, enter “NA.” Note the following:

Project Sponsor: The Project Sponsor is the person who is the Authorized Account Representative for the RGGI COATS general account identified in the *Consistency Application*.

RGGI COATS General Account Name and Number: The RGGI COATS general account identified in the *Consistency Application* is the RGGI COATS account into which any awarded CO<sub>2</sub> offset allowances related to the offset project will be transferred.

Offset Project ID Code: The offset project ID code is the alphanumeric code generated when the Project Sponsor creates a record of the offset project in RGGI COATS. The project location entered should be the primary location of the project if the project consists of actions at multiple locations. The brief description of the offset project should indicate all locations where project actions occur or will occur. See the RGGI COATS User’s Guide for more information about creating an offset project record in RGGI COATS, available at: <https://rggi-coats.org/eats/rggi/>

Project Sponsor Organization: Provide the full legal name of the organization the Project Sponsor represents, including any alternative names under which the organization also may be doing business (e.g., John Doe Enterprises, Inc., d/b/a JDE). If the Project Sponsor is representing himself or herself as an individual, enter “NA”.

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**Section 1.2 Project Sponsor Attestations**

Submit the originally signed section as part of the paper hardcopy *M & V Report*. Scan the signed and dated section for submission as part of the electronic version of the *M & V Report*.

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**Section 1.3 Project Sponsor Agreement**

Submit the originally signed section as part of the paper hardcopy *M & V Report*. Scan the signed and dated section for submission as part of the electronic version of the *M & V Report*.

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**Section 1.4 Disclosure of Greenhouse Gas Emissions Data Reporting**

Check the appropriate box in the section to indicate whether greenhouse gas emissions data related to the offset project have been or will be reported to any voluntary or mandatory programs, other than the Delaware CO<sub>2</sub> Budget Trading Program. For each program for which data have been or will be reported, provide the program name, the program type (voluntary or mandatory), program contact information (website or street address), the categories of emissions data reported, the frequency of reporting, when the reporting began or will begin, and reporting status (prior, current, future). The Project Sponsor must disclose future reporting related to current commitments made to voluntary programs as well as future reporting mandated by current statutes, regulations, or judicial or administrative orders.

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## PART 2. Category-Specific Information and Documentation Forms

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### Section 2.1 Demonstration of Conformance with M&V Plan

Provide documentation that procedures and protocols specified in the M&V Plan were performed and records specified in the M&V Plan were generated and retained. Check the boxes where indicated in Section 2.1 to indicate that the referenced documentation is provided as an attachment to Section 2.1. Documentation must include the following:

1. Identification of Sub-populations. Attach a map to scale identifying how the area within the project boundary is divided into sub-populations for determining project carbon sequestration.
  2. Identification of Sampling Plots. Attachment a list of the number, sizes, and locations of all sampling plots used for calculating carbon sequestration during the reporting period for each sub-population. The attachment must include recent photos of sampling plots and distinct sampling plot identifiers to provide for verification of reported sequestered carbon by an independent verifier or the Department.
  3. Documentation of Direct Measurement Procedures Conducted for Each Carbon Pool in Each Sampling Plot. Attach a list for each carbon pool that documents all measurement procedures that were used to calculate carbon sequestered during the reporting period, and cross reference all procedures with those specified in the M&V Plan.
  4. Assessment of Forest Management Practices if Commercial Timber Harvest Activities Have Occurred or Will Occur. If commercial timber harvest activities occurred during the reporting period or will occur during the offset project allocation period, attach the assessment or certification issued by the American Tree Farm System (ATFS), Forest Stewardship Council (FSC), Sustainable Forestry Institute (SFI), or other similar organizations as approved by the Department ensuring that the land within the offset project boundary is being managed in accordance with environmentally sustainable forestry practices. If no commercial timber harvests have occurred or will occur, do not check box number 4 in Form 2.1.
  5. Documentation of Quality Assurance Procedures Conducted. Document the quality assurance procedures that were conducted during the reporting period to ensure accuracy in data collection, data analysis, and data storage, and cross reference all procedures with those specified in the M&V Plan.
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## Section 2.2 Determination of Reporting Period Sequestration

Provide documentation of the carbon sequestered during the reporting period where indicated in Section 2.2 or as an attachment as directed below. Multiple attachments may be integrated into a single document, as long as each element is clearly identified. For submission of the electronic version of the *M&V Report*, spreadsheets must be provided as a distinct electronic file or files (distinct spreadsheets may be incorporated into a single spreadsheet file, as long as each element is clearly identified). Check the boxes in Section 2.2 to indicate that required documentation is attached and includes the required components.

The following documentation must be provided:

1. **Identify Reporting Period.** Enter the dates of the reporting period (start and end dates) and the dates when the reporting period measurements were made (may include a range), where requested in Form 2.2.
2. **Net Carbon Sequestered.** Enter the values (in short tons of CO<sub>2</sub>-equivalent) for the following, where requested in Section 2.2: reporting period carbon stock; baseline carbon stock or carbon stock as of previous reporting period; net carbon sequestered in reporting period. Enter the potential carbon losses discount factor (either 0.9 or not applicable if long-term insurance is retained) and the adjusted net carbon sequestration in reporting period (if applicable), where requested in Section 2.2.
3. **Reporting Period Carbon Pools.** Enter calculated carbon content in short tons of CO<sub>2</sub>-equivalent for the carbon pools included in the reporting period, where requested in Section 2.2:
  - Live above-ground tree biomass (required)
  - Live below-ground tree biomass (required)
  - Soil carbon (required)
  - Dead organic matter and coarse woody debris (required, unless the baseline measurement for this carbon pool is at or near zero, in which case measurement of this carbon pool is optional)
  - Live above-ground non-tree biomass (optional)
  - Dead organic matter, forest floor (optional)

Values for all required carbon pools must be entered. Note that optional carbon pools included in the baseline must also be included in subsequent reporting periods. Optional carbon pools not included in the baseline are not allowed to be included in carbon calculations for subsequent reporting periods.

4. **Reporting Period Description.** Attach a map to scale that provides a description of the practices/management (e.g., regular mowing, intensive grazing, chaining, recreation, etc.) and land cover currently in place within the offset project boundary. Identify on the map the following land covers as applicable:
  - Cropland (specify the crop)
  - Grassland (specify use)
  - Urban (specify urban land use)
  - Pasture (specify animals)
  - Residential areas
  - Public parks
  - Roads and rights of way



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- Power line clearings
- Non-census water

5. Field Measurement Data. Attach a spreadsheet that contains the field measurement data collected from each sampling plot for determining biomass and carbon for each carbon pool. Data that should be included in field measurement datasheets and must be entered in the spreadsheet include:

- Sampling plot names
- Sampling plot dimensions
- Sampling plot slopes
- Tree diameters
- Tree heights
- Standing dead wood diameters, heights, and decomposition classes
- Dead wood transect lengths
- Dead wood diameters and decomposition classes
- Non-tree vegetation and forest floor quadrat sizes
- Non-tree vegetation and forest floor field sample weights
- Non-tree vegetation and forest floor laboratory sample dry weights
- File names for plot photographs

6. Documentation of Carbon Calculations. Attach a spreadsheet that documents all carbon calculations. The spreadsheet must include the following:

- a. Document use of the sampling plot data to estimate area-based carbon for each carbon pool in each sub-population. Document that the sampling plot data for each carbon pool in each sub-population were averaged to obtain the mean carbon stock and standard deviation of area-based carbon in the sub-population. Document the calculation of the 95% confidence interval of the area-based carbon for each carbon pool for the sub-population area based on the number of sampling plots, the standard deviation, and the corresponding standard error.
- b. Document that the estimate of area-based carbon for each carbon pool in each sub-population was converted into CO<sub>2</sub>-equivalent short tons for each carbon pool in each sub-population as follows:

$$TC_j = \sum_{i=1}^n (C_{i,j} * A_i) * 44 / 12 / 0.9072$$

where:

TC <sub>j</sub>	Total carbon in each sub-population in each carbon pool <i>j</i> in short tons of CO <sub>2</sub> -e
C <sub>i,j</sub>	Total carbon in each carbon pool in metric tons per acre or hectare in sub-population <i>i</i>
A <sub>i</sub>	Area of sub-population <i>i</i>
<i>i</i>	1, 2, 3 ... <i>n</i> sub-populations
<i>j</i>	1, 2, 3 ... <i>m</i> carbon pools (the carbon pools are: “latb” – live above-ground tree biomass; “lbtb” – live below-ground tree biomass; “s” – soil carbon; “lantb” –



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live above-ground non-tree biomass; “doff” – dead organic matter, forest floor;  
“docwd” – dead organic matter, coarse woody debris)

- 44/12 The ratio of molecular weights of carbon dioxide to carbon
- 0.9072 Factor for conversion between metric tons and short tons

- c. Document that the estimates of carbon in each carbon pool were summed across all of the sub-populations to determine the total carbon content of each carbon pool for all land within the offset project boundary, represented in short tons of CO<sub>2</sub>-equivalent.
- d. Document that the grand total carbon stock for all land within the offset project boundary, represented in short tons of CO<sub>2</sub>-equivalent, was calculated by summing across all carbon pools:

$$TC_{pb} = TC_{latb} + TC_{lbtb} + TC_s + TC_{lantb} + TC_{doff} + TC_{docwd}$$

where:

- TC<sub>pb</sub> Total carbon content in short tons of CO<sub>2</sub>-e within the offset project boundary (sum of carbon content of all carbon pools in all sub-populations)
- TC<sub>latb</sub> Sum of carbon content in short tons of CO<sub>2</sub>-e of live above-ground tree biomass in all sub-populations
- TC<sub>lbtb</sub> Sum of carbon content in short tons of CO<sub>2</sub>-e of live below-ground tree biomass in all sub-populations
- TC<sub>s</sub> Sum of carbon content in short tons of CO<sub>2</sub>-e of soil carbon in all sub-populations
- TC<sub>lantb</sub> (Optional) Sum of carbon content in short tons of CO<sub>2</sub>-e of live above-ground non-tree biomass in all sub-populations
- TC<sub>doff</sub> (Optional) Sum of carbon content in short tons of CO<sub>2</sub>-e of dead organic matter, forest floor in all sub-populations
- TC<sub>docwd</sub> (Mandatory/optional, as applicable pursuant to Regulation 1147. Sum of carbon content in short tons of CO<sub>2</sub>-e of dead organic matter, coarse woody debris in all sub-populations

7. Demonstration of Quantified Accuracy. Attach a spreadsheet that documents quantified accuracy for the combined carbon pool measurement such that there is 95% confidence that the reported value is within 10% of the true value. The spreadsheet must document that the quantified accuracy was calculated as follows:

- a. Document that the percentage uncertainty in the combined carbon stocks in short tons of CO<sub>2</sub>-equivalent was calculated as follows:

$$U_p = \sqrt{\left( \sum_{i=1}^n U_{sp,i}^2 \right)}$$

where:



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- $U_p$  Total percentage uncertainty in the combined carbon pools below:
- $U_{latb}$  Percentage uncertainty (expressed as a percentage of the mean at the 95% confidence interval) for carbon stock in live above-ground tree biomass
- $U_{lbtb}$  Percentage uncertainty (expressed as a percentage of the mean at the 95% confidence interval) for carbon stock in live below-ground tree biomass
- $U_s$  Percentage uncertainty (expressed as a percentage of the mean at the 95% confidence interval) for soil carbon stock
- $U_{lantb}$  (Optional) Percentage uncertainty (expressed as a percentage of the mean at the 95% confidence interval) for carbon stock in live above-ground non-tree biomass
- $U_{doff}$  (Optional) Percentage uncertainty (expressed as a percentage of the mean at the 95% confidence interval) for carbon stock in dead organic matter, forest floor
- $U_{docwd}$  (Mandatory/optional, as applicable pursuant to Regulation 1147. Percentage uncertainty (expressed as a percentage of the mean at the 95% confidence interval) for carbon stock in dead organic matter, coarse woody debris
- $U_{sp, i}$  Percentage uncertainty (expressed as a percentage of the mean at the 95% confidence interval) for carbon stock in all carbon pools in sub-population  $i$
- $i$  1, 2, 3, ... $n$  sub-populations

- b. Document that the uncertainty in the carbon stock in each carbon pool was summed across sub-populations as follows:

$$U_j = \sqrt{\left( \sum_{i=1}^n U_{j,i}^2 \right)}$$

where:

- $U_j$  Percentage uncertainty (expressed as a percentage of the mean at the 95% confidence interval) for carbon stock in carbon pool  $j$
- $U_{j,i}$  Percentage uncertainty (expressed as a percentage of the mean at the 95% confidence interval) for carbon stock in carbon pool  $j$  in sub-population  $i$
- $j$  1, 2, 3... $m$  carbon pools (the carbon pools are: “latb” – live above-ground tree biomass; “lbtb” – live below-ground tree biomass; “s” – soil carbon; “lantb” – live above-ground non-tree biomass; “doff” – dead organic matter, forest floor; “docwd” – dead organic matter, coarse woody debris)
- $i$  1, 2, 3 ... $n$  sub-populations



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## **PART 3. Independent Verification Section**

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### **Section 3.1 General Information**

Enter the requested information in the editable text fields in the section. If a text field is not applicable or is unanswerable, enter “NA.”

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### **Section 3.2 Independent Verifier Certification Statement and Report**

An accredited independent verifier must sign and date the form. Submit the originally signed form as part of the paper hardcopy of the *M&V Report*. Scan the signed and dated form for submission as part of the electronic version of the *M&V Report*.

The verifier report must document the following:

1. The verifier has reviewed the entire *M&V Report* and evaluated the contents of the report in relation to the applicable requirements of 7 DE Reg. 1147.
2. The verifier has evaluated the adequacy and validity of information supplied by the Project Sponsor to determine CO<sub>2</sub>-equivalent sequestration in accordance with the applicable requirements of 7 DE Reg. 1147 and the documentation required in the *M&V Report*.
3. The verifier has evaluated the adequacy and consistency of methods used by the Project Sponsor to quantify, monitor, and verify CO<sub>2</sub>-equivalent sequestration in accordance with the applicable requirements of 7 DE Reg. 1147 and the Monitoring and Verification Plan submitted as part of the *Consistency Application*.

Provide the independent verifier report as an attachment to Section 3.2 which includes the following contents, in the order listed below:

- Cover page with report title and date
- Table of contents
- List of acronyms and abbreviations
- Executive summary
- Description of objective of report
- Identification of the client, including name, address, and other contact information
- Identification of the offset project
- Description of evaluation criteria (applicable regulatory provisions and documentation requirements specified in the *M&V Report*)
- Description of the review and evaluation process, including any site visits and interviews
- Identification of individuals performing the verification work, including the verification team leader and key personnel, and contact information for the team leader
- Description of the materials provided to the verifier by the Project Sponsor
- Evaluation conclusions and findings, including level of assurance provided