



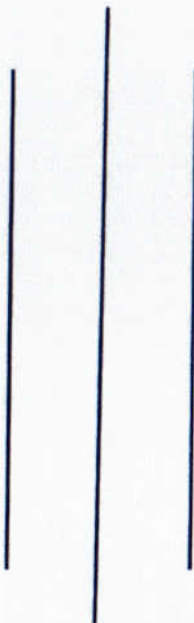
Terms of Reference

For

Procurement of Consultancy Firm for the Field Data Collection for the Development of Allometric Equations (Volume and Biomass) of Major Nine Tree Species of Nepal

(Koshi, Lumbini, Karnali and Sudurpaschim Province)

Ref: NP-REDD-513851-CS-QCBS



Government of Nepal
Ministry of Forests and Environment
Forest Research and Training Centre
Babarmahal, Kathmandu

September 2025

सहानिर्देशक
DIRECTOR GENERAL

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Procurement of Consultancy Firm for the Field Data Collection for the Development of Allometric Equations (Volume and Biomass) of Major Nine Tree Species of Nepal (Koshi, Lumbini, Karnali and Sudurpaschim Province)

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1. Background

Robust and reliable information of volume, biomass and forest carbon for the improvement of national forest monitoring system is one of the focused areas of the globe. In addition to the National Forest Inventory System, tree level allometric equations is one of the major areas to be strengthened to make it compatible with the needs of the REDD+ process, and establishing a reliable and effective monitoring, reporting and verification (MRV) system. One of the critical actions suggested for the second phase of the REDD+ readiness project, which includes MRV, is the development of precise and country-representative allometric equations for major tree species. The FRTC had conducted such kinds of field works for seven tree species in the past and now in the final stage of developing equations. Similar kinds of field work have been completed for the proposed nine tree species in Bagmati and Gandaki provinces. However, this action has not been completed for other provinces yet.

Allometric equations are statistical models used for estimating the volume and biomass of plant individuals (trees, poles, saplings, etc.), using the relationships against their different variables such as diameter, height, volume, and so on. Although input variables may vary between allometric equations, tree diameter at breast height (DBH), wood density and height are the most used input variables. Even though direct measurements of volume and biomass give higher accuracy; they are less practicable in the field due to resource limitations and the need for destructive procedures. Alternatively, allometric volume/biomass/carbon/nutrient stock equations as a function of easily measurable tree-level variables (such as diameter at breast height (dbh), total tree height, crown dimension) and stand-level variables that describe stand site quality (e.g., site index, site productivity index, etc.), stand density (e.g., stand basal area and number of stems per unit area etc.) and stand development stages are developed.

Estimating biomass is an essential aspect of carbon study, where the effects of deforestation, forest degradation, and carbon sequestration significantly affect the global carbon balance. Quantifying carbon stocks differences for various forest types is also necessary for the quantifying emission/removal factors, which are the key requirements for carbon credit market. As a result, many ecosystem services offered by forests can be evaluated using allometric equations, including the estimation of forest carbon stocks.

The use of an allometric equation has made a significant contribution to carbon accounting. However, general allometric equations not only provide precise estimation due to the variability of the tree architecture and wood density of various species but also has effect on the amount of tree biomass and carbon stocks substantially. Thus, it is preferable to employ species-specific equations for determining the biomass of a forest.

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Currently, there are no updated and precise allometric equations for the various tree species that might be used for forest reference level (FRL) and MRV improvement for the REDD+ process in Nepal. The 1990's allometric models are the ones used for the current version of the FRL. The Forest Resource Assessment (FRA 2010-2014) also used the allometric models developed by Sharma and Pukkala (1990) to estimate the carbon stock. Those models were developed using wood volume tables generated from the non-destructively measured sample data collected in the 1960s, as well as the wood density values used weren't specifically developed for the country. Instead, these values were sourced from other countries for different purposes. This may not be sufficient for current carbon market and forest management requirements. Contemporary allometric equations would support (i) the fulfilment of specific methodological framework requirements of specific standards (ii) the need to have more accurate measurements that will impact, among other elements, a lower uncertainty buffer (increasing the number of emission reduction (ERs) that can be transacted) (iii) the need to have accurate tool for scientific forest management. To upgrade the data tiers for REDD+ processes, other related initiatives and forest management, there is an urgent need to develop species-specific volume and biomass allometric equations for major tree species using the robust scientific approach.

Over the past decade, various attempts have been made to prepare allometric equations (Volume and Biomass) for the key tree species identified in the national forest resource assessment 2015 of Nepal, such as Department of Forest Research and Survey (DFRS) through ICI project, REDD Implementation Centre (REDD-IC), under the REDD+ Readiness project. However, their initiatives were not executed for various administrative and technical reasons. Recognizing its importance, "Forests for Prosperity Project" has also identified the preparation of Allometric Equations as one of the significant activities for carbon accounting which will ultimately help to develop appropriate and precise policies and plans for sustainable forest management. As a result, the Forest Research and Training Centre (FRTC) planned to develop allometric equations for each of the major sixteen tree species in Nepal through "Forests for Prosperity" program with the financial support from the World Bank. Till now FRTC has prepared allometric equations (draft) of seven major tree species and has collected field level data and attributes of remaining nine major tree species from two provinces Gandaki and Bagmati. The FRTC has planned to collect data (including wood, branch and foliage specimens and others) of nine tree species, namely, *Quercus* spp, *Acer* spp, *Rhododendron* spp, *Picea smithiana*, *Pinus wallichiana*, *Tsuga dumosa*, *Betula utilis*, *Lyonia ovalifolia* and *Abies* spp. from remaining four provinces in this fiscal year. Therefore, the assignment for the consultancy firm is intended to collect data of the nine major tree species from four provinces, i.e. Koshi, Lumbini, Karnali and Sudurpaschim.

2. Objectives of the Assignment

The main objective of the program is to prepare the allometric equations of nine major tree species of Nepal, namely: *Quercus* spp, *Acer* spp, *Rhododendron* spp, *Picea smithiana*, *Pinus wallichiana*, *Tsuga dumosa*, *Betula utilis*, *Lyonia ovalifolia* and *Abies* spp. The purpose of this assignment is limited to felling, measurements, recording, and collection of data and samples of the above-mentioned tree species from Koshi, Lumbini, Karnali and Sudurpaschim Provinces. The details of variables and measurement/sampling protocols, to be followed, are documented in a field manual. Specific objectives of the assignment include:

otherwise unsuitable for sample collection during harvesting, the FRTC will replace it with an alternative tree of the same species and size group.

In total 411 (subject to revision until RFP is issued) trees of different sizes of nine species should be felled, sectioned, debarked, measured, and recorded as prescribed in the "Manual" prepared for such assignments. In addition to the felling and measurement of 14 (subject to revision until RFP) trees would be studied by uprooting the trees.

3.4 Preparation of fieldwork

Fieldwork is the most important part of this program, so thorough preparation is key to completing the task efficiently and accurately. The consulting firm is responsible for all fieldwork arrangements, including travel and logistics. Before heading out, field crews will be trained on tools, equipment, measurements, and safety protocols. The consulting firm must coordinate with the Technical Committee and FRTC to develop a fieldwork plan.

3.4.1 Trainings

The consultancy firm should organize and manage the field crew's pre-field training for four days with at least two days' field practical. Field crews should be mobilized only after they are adequately trained for the job. The firm should be responsible for all aspects of training.

3.5 Felling and Measurement of Trees

Felling and measurement are the core part of the assignment in accordance with field protocol/manual, prepared by the FRTC for allometric equations preparation. The following activities are to be performed under this task, but are not limited to:

- i. Navigate to the tree, layout the plot of 10 m radius and measure all the tree diameter (greater than 5 cm) within plots, and measurement of stand and site-specific parameters,
- ii. Document each tree to be felled with detailed information and photographs.
- iii. Fell the sample trees according to all relevant felling rules and safety measures.
- iv. Measure the stem's diameter, both with and without the bark, at various points (as prescribed in the Field Manual) until you reach tip of the tree.
- v. Delimbing, sectioning, and taking measurements of tree stem and large branches (>10cm diameter).
- vi. Measure *in-situ* weights of smaller stems, smaller branches (<10cm diameter) and all foliage immediately after separation.
- vii. From each felled tree, collect representative samples of all its components for laboratory analysis as described in field manual.
- viii. Record weight and volume of each disc from the stem, branches, and roots ensuring proper labelling as per the field manual.
- ix. Transport properly all collected samples—including discs from the stems, branches, and roots, as well as foliage samples—to the FRTC biometry laboratory at Babarmahal, Kathmandu. Upon arrival, handle and manage them in the laboratory to preserve their original conditions ensuring proper safety and easy identifications.

During data collection, the field crews must use the specific data forms provided by the FRTC. The firm must submit the field tally sheet, with each page signed by the team leader

- Collecting tree and stand-level variables/attributes.
- Collecting data on the root, stem, branches, and foliage attributes in standard formats with the highest level of precision.
- Collecting and transporting samples/specimens to the FRTC laboratory for the development of volume and biomass models, ensuring proper labeling, safety, and handling.

3. Scope of the Work

For work convenience, time management and efficient outputs, the project is consolidated into one assignment. The following tasks need to be carried out for the successful completion of this assignment.

3.1 Desk Review

Before beginning this task, it is crucial to review and comprehend the volume and biomass equations already existing for the different trees species. To understand the methods, procedures, and designs employed thus far, a desk review of the FRA process in Nepal, FRA reports, FRL, MRV documents related to REDD+ readiness. Additionally, manual of field work, various allometric equations reports, papers, documents, and guidelines are necessary to review to ensure the accuracy of data collection and grasp the standard data collection process.

3.2 Consultation with the Technical Committee and Other Stakeholders

The consultancy firm shall work in consultations with the Technical Committee formed by the MOFE/FRTC to get appropriate guidance for the successful completion of the task assigned. The committee will also supervise and oversee this assignment for quality assurance and quality control. The technical committee will comprise five members as follows:

1. Coordinator -DDG Forest Technology Development Division, FRTC
2. Member - Representative from REDD-IC
3. Member - Representative from the Department of Forests and Soil Conservation (DoFSC)
4. Member - Representative from the Department of National Park and Wildlife Conservation (DNPWC).
5. Member Secretary – Section Chief, Biometry section, FRTC.

Relevant experts and officials from FRTC, REDD-IC, the Ministry of Forests and Environment (MOFE), DoFSC, DNPWC, and Provincial Forest-related Ministries Division Forest Offices (DFOs), Protected Areas, along with forest authorities, local governments, local communities, and forest user groups need to be consulted as required.

3.3 Sampling Design and Selection of Trees

In order to develop more precise allometric equations, it's essential to have a solid sampling design for selecting, harvesting, and measuring trees. We will use the permanent sample plots from the Forest Resource Assessment (FRA) as a basis for our sampling frame, assuming there are enough trees of various sizes available. Before we started, the FRTC, REDD-IC and other stakeholders identified a list of potential sample trees. The FRTC then randomly selected the final trees to be harvested and measured from this list. If, however, a selected tree is found to be decayed, broken, missing, or

3.5 Management of Felled Trees and their Parts

After measurements of sample trees, remaining parts (stems, branches and small branches) stacked in designated sites with proper records must be handed over to the concerned authorities (DFO/Protected Area Offices, and/or Community Forest User Groups, Buffer Zone Committees, Conservation Committees etc.). Moreover, consultancy firm is responsible for cleaning the felling sites with consultation of concerned authorities.

3.6. Data Entry and Submission

All the data/information collected during the fieldwork shall be verified and confirmed by the consultancy firm and provided with a hard copy and digital copies. Each page of the tally sheets should be reviewed and verified by the team leader and signed before submission to FRTC. The data must be entered into a software as agreed by the FRTC, and its accuracy should be thoroughly checked and confirmed.

4. Work schedule and Reporting

4.1 Inception Report with Detail Action Plan and Timeframe

The consultancy firm shall prepare the inception report with detailed methodology, action plan and present it in the inception workshop. All the feedback, suggestions and input from the workshop participants must be incorporated into the inception report and submitted to the FRTC for approval. The inception report must be submitted a week after signing the contract or as per the agreement in the contract. The consultancy firm shall submit two hard copies and a digital copy of the inception report to the FRTC.

4.2 Progress Report

The consultancy firm shall submit a monthly progress report (both field and office work) during the assignment period as per the agreed format/template of the FRTC. The template should include but not limited to the following information.

- Statistics of data, sample/specimen collected.
- Photographs (movie clips) from the field.
- Manpower (both skilled and unskilled) used during the period.
- Issues and feedback from the field experiences.
- Narrative of progress.
- Others

4.3 Draft Report and Final Report

The consultancy firm shall submit two hard copies and a digital copy of the draft report to FRTC, prepared and signed by the team leader, for review and suggestions after completing the assignment. The comments and suggestions provided by the FRTC shall be incorporated into the final report. Three hard copies, duly checked and signed by the team leader, along with a soft copy of the final report, must be submitted to FRTC. In addition, all relevant photographs, videos, raw data, digital data and samples/specimens must be submitted to FRTC

5. Deliverables

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The consultancy firm is required to submit the following deliverables to FRTC:

- Inception report: within two weeks after the contract.
- Training report: field crews will be trained after approval of the inception report, and the training report will be submitted within one week of completion of the training.
- Monthly Progress reports: first week of following month till the completion of the task.
- The draft report: it will be submitted after completion of the fieldwork and data entry (within 4.5 months of the contract).
- Handover of tally sheet and sample specimens/discs of stem, branches, foliage and bark to FRTC.
- Final report: 15th June, 2026.

Note: Deliverable will be tied up with a payment mechanism elaborated in RFP.

6. Team composition and qualification of the firms

6.1 Qualification of the Firms

The consultancy firm should be legally registered with the authority concerned and registered in the VAT system as provisioned in the prevailing Act. The firm/company should have tax clearance until the last fiscal year. The firm should have a minimum of 5 years of general work experience. The preference will be given to the firms that have conducted the following activities: (a) allometric equation, (b) forest inventory (i.e., covering a large area, at least at the provincial level). Firms having experience in development of allometric equations will have preference. When applying as a joint venture (JV), each company must individually meet the requirement of having a minimum of five years of general working experience with a valid JV agreement or with an intention to form a JV agreement and its purpose. At the shortlisting stage, the firms will be assessed for (a) Experience of firms (general and specific), (b) Qualification and (b) organizational capability (technical and managerial capability).

6.2 Team Composition, Responsibilities, and Qualification of the Team Members

The assignment will be executed by a team of experts led by a Team Leader assisted by two-field managers and 14 field crews. However, additional field crews may be required depending on the contract duration, and to cope up in case of any unavoidable circumstances during the project period. Each field crew comprises one Crew Leader, one Senior Forest Technician, one Forest Technician, one Technical Assistant, one Power Chainsaw Operator with a Helper, and Field laborers (skilled and unskilled) as needed. Furthermore, Local Resource Persons and the representative of the concerned forest authorities and/or forest users are also required to facilitate the fieldwork. Among them, the qualification and experience of only Team Leader, Crew Leader and Senior Forest Technician and Forest Technician will be evaluated. However, other experts such as Forest Technician and Field Manager must be offered with at least minimum qualification and experience mentioned in this TOR.

6.2.1 Team Leader (One person)- 2.5 Months (Intermittent input over the period of 4 months)

Roles and responsibilities: The Team Leader will lead the team in close coordination with and under the guidance of the technical committee and FRTC. The team leader will:

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- Study and analyze FRA documents, FRA system, and other inventory and allometric equations-related literature.
- Develop action plans with a timeline of each activity after discussion with other team members.
- Coordinate team and make sure that all the crew members are well trained and capable of performing their respective jobs for the assignment.
- Prepare the Inception Report for presentation in the inception workshop.
- Incorporate comments and suggestions and finalize methodology for fieldwork in consultation with the FRTC and Technical committee.
- Coordinate consultation meetings and discussions with the Technical Committee, FRTC, REDD-IC, and other relevant forest authorities at the provincial and district/field level as well.
- Make sure that all the field work (felling and measurement of selected trees) are completed following the protocol developed by FRTC and data are recorded and kept appropriately.
- Assure the highest quality of all the field work and preparation of samples.
- Prepare and submit reports in accordance with the deliverables mentioned in section 5.

Required qualifications and experience:

- Minimum qualification of master's degree in forestry/ Natural Resource Management (shall be bachelor in forestry) or equivalent and preference in additional qualifications.
- At least ten years of working experience after minimum qualification in a related field.
- Experience in leading a similar project/team/program etc., is preferable.

The Team leader having specific experience in conducting at least two activities or two years/projects of experience in allometric equations, forest inventory, or biometry work is expected. Preference will be given to experts with experience in allometric equations.

6.2.2 Crew Leaders (14 persons)-Each 3 Months

The crew leaders are responsible for leading the field crews and coordinating concerned forest authorities and other stakeholders at the field level.

Roles and responsibilities: The crew leaders are primarily responsible for the technical aspect of the field work, including precise stand and plot measurements, felling sample trees, sectioning, and recording measurements. Furthermore, they are responsible for collecting sub-samples/specimens, labeling them, and transporting them to the FRTC laboratory in Babarmahal, Kathmandu. S/He is also responsible for precise data recording, quality control and supervision of all field works and data validation in the field as well. The data entry and handover of samples to FRTC is also responsible for crew leaders.

Required qualifications:

- Have minimum qualification of bachelor's degree in forestry and three years of work experience in related fields (or higher degree in forestry/related fields and one year's experience).

Specific experience in allometric equations, tree measurements (related to this task), national forest inventory, or biometry work will be considered. Preference will be given to candidates with experience in allometric equations.

6.2.3 Senior Forest Technician (14 persons)- Each 3 Months

The main role of senior forest technicians is assisting the crew leader in field data collection. They are mainly responsible for measuring tree height and collecting other plot-level and tree-level data, directing to prepare sample discs, proper leveling and packaging, marking and directing to forest technician for other measurements of the tree sections as well as instruct and supervision of labours.

Required qualification:

- Have minimum qualification of Bachelor's in forestry and one year of experience. However, I. Sc. forestry/Diploma in Forestry and seven years of work experience in related assignments is also acceptable.
- Specific experience in allometric equations, tree measurements (related to this task), national forest inventory, or biometry work will be considered. Preference will be given to candidates with experience in preparation for allometric equations.

6.2.4 Forest Technician (14 persons) - Each 3 Months

The main role of forest technicians is assisting the crew leader and senior forest technician. They are mainly responsible for measuring tree-diameters of predetermined position, weighing and labeling samples, assisting the senior forest technician, and measurement of volume of samples as guided by the field protocol and directing the labours.

Required qualification:

- Have minimum qualification of I. Sc. in forestry or diploma in forestry or above.
- Specific experience in allometric equations, tree measurements (related to this task), national forest inventory, or biometry work will be considered. Preference will be given to candidates with experience in preparation for allometric equations.

6.2.5 Technical assistant (14 persons) - Each 3 Months

The forest assistants are responsible for assisting the Crew Leader and entire team. Their primary responsibilities include responsible assisting with labeling and managing samples, measuring sample volumes as per the field protocol and supervising field laborers. They are also responsible for capturing photographs and short videos documenting the entire process for each tree.

Required qualification:

- Have minimum qualification of I. Sc. in forestry or diploma in forestry or above.
- The forest assistant will be expected to have specific experience or trained in photography and taking video in addition to allometric equation preparations.

6.2.6 Field Managers (2 persons)- 5.5 Person Months

The main role of field managers is to assist the team leader in management aspect of field as well as office. One field manager is responsible for eastern part and other is for western part of the country.

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They are mainly responsible for the logistic and field equipment management, organizing training, crews' mobilization to the field, coordination to the Divisional Forest office (DFO), Warden (Protected Areas), Forest User Group and other concern stakeholders. The field managers are responsible for managing the conflict if any adverse conditions arise in the field. Moreover, they are also responsible for handovers of left-over harvested materials such as timber and fuelwood etc. to the relevant authorities.

Required qualification:

- Have minimum qualification of B.Sc. in forestry and three years of general experience in forest related field work or I. Sc. /Diploma in forestry and ten years' experience in forest related field work.
- Preference will be given to the person having specific experience as field manager in relevant work.

6.2.7 Other Support Staff

It includes local resource persons (LRPs), power chain saw operators and their assistants, skilled and unskilled laborers, porters, drivers, foresters for volume measurement etc. LRP should help the field crews at the local level by providing field level support and coordination, whereas the laborers are required for felling, sectioning, measurement, and weighing of tree components. Each field crew should have at least one power chain saw handler and one helper, who is also capable of operating chain saw on close monitoring of main operator. Power chain saw operators should have high skill for felling trees and capable of minor maintenance of chain saw.

If consulting firm could not accomplish the contracted project/work in time, additional manpower can be hired by the firm with the consent of FRTC.



7. Inputs to the Firm

7.1 Information about selected Trees

The client will provide the location, size, and site information of selected trees for felling, measurement, recording, and sample collection to complete the assignment. However, if the selected trees are missing/felled at the time of felling the crews should inform FRTC and/or technical committee and they will select other trees of same class and species from the marked sample tree list.

7.2 Documents and Consultations

FRTC will provide data collection field manual for biomass and volume equations and some background documents to carry out the assignment. FRTC will make the access of library to the consultant as required. FRTC will provide the necessary support for organizing the consultations at all levels.

7.3 Equipment and Tools

It is the responsibility of the firm to manage the required equipment/tools for the assignment. The consulting firm must have the required field equipment for forest plots and tree measurements, tree felling, sectioning, measuring the sections, weighing of the sample and volume measurements. FRTC may provide equipment such as GPS, Vertex, and Diameter Tapes for this task, if available, to the firm. If FRTC provide the instruments, the consulting firm should submit a bank guarantee at least to the contract period of the amount as decided by FRTC to use those instruments. All the equipment taken from the client must be returned in good condition after completing the assignment. In case of loss and damage of equipment, replacement must be done by the consulting firm.

8. Supervision, Monitoring, and Quality Control

Since the method for this assignment is destructive, supervision and monitoring are more important. The FRTC and the Technical Committee will supervise, monitor, and ensure the quality of the data collected by the firm. A separate budget will be allocated for this purpose (The firm will not be responsible for the cost associated with this). Supervision and monitoring of the work will be done simultaneously with the measurement activities conducted by the field crews.

Quality control and quality assurance can be done in the overall process by the client throughout the assignment. The quality assurance and control will be done mainly in tree and site selection, felling, sectioning, measurement of the trees, and collection and measurement of sample specimens. The quality of the sample will be checked, especially by repeated measurement.

9. Safety and Precaution

The firm should ensure all the safety and security measures such as complete safety equipment and accessories (First Aid, field gear, insurance, etc.) for all crew members (including lab technicians). The consulting firm shall be responsible for the safety and security of all personnel involved in the fieldwork. The Client shall not be responsible for the safety or security of any personnel.

10. Intellectual Property Rights



All the data collected in the field such as daily field books, original sets of maps used, processed data, and the database developed during this assignment will be the property of the Government of Nepal. The consulting firm must submit photographs video, primary field data (hard and soft copy) sample specimens and final report to the FRTC. These will be the sole property of the client. The data should not be used for any other purpose or for any third party without the prior written consent of FRTC.

11. Deliverables and tentative Payment Schedule

S.N.	Deliverables/Output	Timeline/Duration after signing the agreement	Instalment of Payment
1	Inception report	2 weeks	-
2	Training report: Field crews will be trained after the approval of the inception report, and the training report will be submitted	Within 1 month	20%
3	Monthly Progress reports: Monthly progress reports will be submitted during the first week of the following month	First week of following month	
4	Completion of 50% works (i.e., Handover of 50% tally sheet and sample specimen)		40%
5	Draft Report and Field Tally Sheet: The draft report along with tally sheet will be submitted after completion of fieldwork and data entry	within 4 months of the contract	-
6	Handover sample specimens/discs of stem, branches, foliage and bark etc. to FRTC		25%
7	Submission and approval of final report	End of June 2026	15%

Note: Payment would be made after submission and acceptance of each report/deliverable.

12. Selection Process and Criteria

The consultancy firm shall be selected based on the Quality and Cost Based Selection (QCBS) set forth in the World Bank's Procurement Regulations for IPF Borrowers, Sixth edition February 2025, consultancy selection method. The selected firms based on EOIs will be requested to submit the full technical and financial proposal following the World Bank's Procurement Regulations.

13. Work Schedule

The assignment is expected to begin in February 2026 and should be completed by 15th June 2026.



