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Discipline Code	Discipline	Description of Work	Key Personnel Required	Employee Registration Required	Minimum Years of Experience	Firm Registration Required	Additional Requirements
2	Aerial Image & LIDAR Collection/Processing - Manned Aircraft	The work consists of acquiring large format, frame metric camera aerial imagery and airborne topographic LIDAR data using a manned platform at various altitudes above mean ground level. The aerial camera and topographic LIDAR systems must be integrated with on board Global Navigation Satellite System/Inertial Measurement Unit (GNSS/IMU) equipment to collect data for high accuracy sensor position and orientation determination. The work also includes flight and control plan preparation, image and LIDAR post processing, and certifying Reports for acquisition, position and orientation data, and LIDAR derived elevation products.	Land Surveyor	P.L.S.		P.L.S.	All work must be performed under the responsible charge of a North Carolina (NC) registered Professional Land Surveyor (PLS). All Reports for acquisition, position and orientation data, and LIDAR derived elevation products must be certified by an NC PLS. The large format, frame metric camera shall be capable of acquiring frame imagery with the exposure station's nadir Ground Sample Distance (GSD) generally between 0.10 foot and 0.45 foot with 60% forward overlap. Deviations from this GSD range should be noted in firm's prequalification materials. The topographic LIDAR system must be capable of acquiring and producing elevation data that meets Quality Level 1 specifications as defined in the USGS LIDAR Base Specification version 2.1. Submitted prequalification materials must include the following: proposed sub consultants; equipment list (planes, cameras, LIDAR systems, GNSS/IMU equipment, etc.) with technical data sheets for all proposed equipment; base of operation for manned aircraft operations that includes airport code, airport name, city, and state; and proposed software list (flight planning, post processing, LIDAR derived elevation product formats, etc.).
157	Large Format, Metric Camera Photogrammetric Services	The work consists of performing 3-D stereo image measurements for computing position and orientation of large format, frame metric camera aerial imagery and photogrammetrically stereo compiling planimetric, topographic, and DTM data; merging the compiled photogrammetric data with field data such as planimetric classification, cadastral data, and utility data; field classifying planimetric features; collecting and mapping cadastral data from existing county tax bases; producing planimetric maps, topographic maps, base plan sheets, digital orthophotography, DTM data and Aerotriangulation and Airborne Survey Reports as specified in the NCDOT Photogrammetry Unit manuals; and delivering the planimetric maps, topographic maps, base plan sheets, digital orthophotography, DTM data and Reports in digital formats. All mapping and base plan sheet digital data and DTM data shall be delivered in 3-D design files that conform to the NCDOT Photogrammetry level structure and symbology specifications; meet the global origin and working units found in the NCDOT Workspace Standards; and be compatible with the most current and future versions of Bentley Connect/ORD. Digital orthophotography shall be delivered in MrSID or TIF format with associated world files with specified compression.	Land Surveyor	P.L.S.		P.L.S.	All work must be performed under the responsible charge of a North Carolina (NC) registered Professional Land Surveyor (PLS). All Aerotriangulation and Airborne Survey Reports must be certified by an NC PLS. The firm must be capable of providing full photogrammetric services with large format, frame metric camera imagery, including aerotriangulation, DTMs, digital data delivery, cadastral mapping and field classification. Submitted prequalification materials must include the following: proposed sub consultants; example planimetric mapping file & DTM file in Microstation V8 DGN format, and example orthophoto files in TIF and SID formats with associated world files; list of proposed hardware and software in use at the office that will perform these services; and the location address of the office being prequalified.
158	Aerial Image Collection & Mapping Products W/UAS	The work consists of using small format, frame non-metric camera imagery for generation of geospatial products to include image position and orientation determination, orthophotos, and elevation data. The work includes acquiring small format, frame aerial imagery with a mechanical shutter, non-metric camera on board an unmanned aerial system (UAS) platform at various altitudes above mean ground level. Primary focus is for Vertical Take Off/Landing (VTOL) UAS but fixed wing platforms are not precluded. For UAS operation, either a FAA Remote Pilot Certificate with an UAS rating under 14 CFR Part 107 (small UAS rule), section 44807 exemption of the FAA Reauthorization Act of 2018, or a Special Airworthiness Certificate (SAC) will be required. The firm must adhere to all current and future FAA and NC regulations regarding UAS operations including obtaining a NC Commercial UAS Operator Permit. The work also includes flight and control plan preparation, delivering geospatial products, and certifying Reports for acquisition, position and orientation data, orthophotos, and elevation data products.	Land Surveyor	P.L.S.		P.L.S.	All work must be performed under the responsible charge of a North Carolina (NC) registered Professional Land Surveyor (PLS). All Reports for acquisition, position and orientation data, orthophotos, and elevation data products must be certified by an NC PLS. The small format, frame non-metric camera must have a mechanical shutter and be capable of acquiring frame imagery with the exposure station's nadir Ground Sample Distance (GSD) generally between 0.05 foot and 0.15 foot with 80% forward overlap at altitudes between 100 to 400 feet above mean ground level. Deviations from this GSD range should be noted in firm's prequalification materials. Submitted prequalification materials must include the following: proposed sub consultants; equipment list (UAS, cameras, GNSS/IMU equipment if applicable, etc.) with technical data sheets for all proposed equipment; proposed software list (flight planning, structure from motion photogrammetry, elevation data product formats, etc.) in use at the office that will perform these services; name, FAA license information, NCDOT Aviation Division UAS Operator Permit information, and amount of UAS operator experience for all proposed UAS pilots; general liability insurance information for UAS operations; and the location addresses for the base of operation for unmanned aircraft operations and the post-acquisition data processing of the offices being prequalified.
159	Aerial LIDAR Collection/Processing & Elevation Data W/UAS	The work consists of using a lightweight, small format, topographic LIDAR system for generation of LIDAR derived elevation data products. The work includes acquiring small format, topographic LIDAR data on board an unmanned aerial system (UAS) platform at various altitudes above mean ground level. Primary focus is for Vertical Take Off/Landing (VTOL) UAS but fixed wing platforms are not precluded. For UAS operation, either a FAA Remote Pilot Certificate with an UAS rating under 14 CFR Part 107 (small UAS rule), section 44807 exemption of the FAA Reauthorization Act of 2018, or a Special Airworthiness Certificate (SAC) will be required. The firm must adhere to all current and future FAA and NC regulations regarding UAS operations including obtaining a NC Commercial UAS Operator Permit. The work also includes flight and control plan preparation, delivering elevation data products, and certifying Reports for acquisition, position and orientation data, and elevation data products.	Land Surveyor	P.L.S.		P.L.S.	All work must be performed under the responsible charge of a North Carolina (NC) registered Professional Land Surveyor (PLS). All Reports for acquisition, position and orientation data, orthophotos, and elevation data products must be certified by an NC PLS. The small format, topographic LIDAR system must be a survey grade system that provides deeper vegetation penetration, power line extraction capabilities, and ground classified elevation data with a minimum density of 7 points per meter squared with an Root Mean Square Error accuracy of 0.10 foot or less with systematic elevation bias removed. Submitted prequalification materials must include the following: proposed sub consultants; equipment list (UAS, LIDAR sensor, cameras, GNSS/IMU equipment, etc.) with technical data sheets for all proposed equipment; proposed software list (flight planning, LIDAR post processing, LIDAR derived elevation product formats, etc.); name, FAA license information, NCDOT Aviation Division UAS Operator Permit information, and amount of UAS operator experience for all proposed UAS pilots; FAA UAS Registration information; general liability insurance information for UAS operations; accuracy test results, including horizontal accuracy results if available, for the proposed LIDAR system; and the location addresses for the base of operation for unmanned aircraft operations and the post-acquisition LIDAR data processing of the offices being prequalified.
160	Aerial Mapping Control	This work consists of establishing ground control for aerial mapping using Global Positioning System (GPS) and/or conventional surveying techniques. It involves placing and surveying well distributed photo-identifiable panels at control point locations throughout the project and submitting a Control Surveys Report. The Control Report must include both localized and State Plane Coordinates for each control point and shall be signed and sealed by the North Carolina Professional Land Surveyor (PLS).	Land Surveyor	P.L.S.		P.L.S.	Submit a list of GPS surveying equipment and a list of conventional surveying equipment. Submit an example of a GPS site calibration or site localization (this needs to show that you can GPS existing control points on a project and rotate, translate and scale your GPS data so that your GPS data agrees with the project control).