



Scope of Work on Master Agreement # AV2406 Acquisition of Aerial Photography & LiDAR Elevation Data Strawberry River

The State of Utah, Department of Technology Services (DTS), Division of Integrated Technology, Automated Geographic Reference Center (AGRC), and partners are contracting with Aero-Graphics, Inc. (Vendor) to acquire, process, and deliver aerial photography, aerial LiDAR, and derivative products that meet the specifications described in this Scope of Work (SOW) and contracted under Master Agreement #AV2406.

This SOW identifies the specific acquisition requirements, production specifications and standards, deliverables, and schedule for LiDAR data collection and deliverable data products that adhere to the US Geological Survey (USGS) Quality Level 1 (QL1) LiDAR specifications. (This SOW identifies the acquisition requirements for QL1 LiDAR specifications for the area defined in this SOW.) The LiDAR data will be acquired in the late summer or early fall of 2019. Pricing will be based on the cost submitted in the bid response to Solicitation # WS16020 / ZC17056 for the Strawberry River project area by Vendor.

1. Aerial Photography & LiDAR Data Products

The light detection and ranging (LiDAR) data products delivered to AGRC must adhere to USGS National Geospatial Program (NGP) *LiDAR Base Specification Version 1.3 (USGS, 2018)* available at <https://pubs.usgs.gov/tm/11b4/pdf/tm11-B4.pdf>. These LiDAR specifications are the required minimum baseline specifications, and project deliverables shall meet or exceed USGS QL1 specifications. For any item that is not specifically addressed, the referenced *LiDAR Base Specification Version 1.3 (USGS, 2018)* will be the required specification authority.

The aerial photography will be 4-band orthorectified 12 cm GSD aerial photography, collected simultaneously with the Lidar.

2. Project Areas, Performance Period, and Acquisition Modifications

The State of Utah 2019 Strawberry River LiDAR Acquisition (Project) covers portions of Utah as shown in Strawberry_River.png, [Figure 1](#), and are delineated in the Strawberry_River shapefile in Attachment 1.

2.1. Project Area

The Project acquisition area totals approximately 88.5 mi² in Utah, as shown in Strawberry_River.png. Further details on the project area are explained in [Section 2.1.1](#). For the contracted area, the delivered data products must cover at least the spatial extent (i.e., footprint) of the area delineated in Attachment 1. Any acquisition footprints that extend beyond the project



area are acceptable, and if data is acquired outside these footprints, at least the raw point cloud data shall be provided.

2.1.1. Strawberry River

The Strawberry River area totals 88.5 mi² and shall be collected and delivered according to a combination of USGS QL1 LiDAR specifications, as delineated in Attachment 1 and shown in Figure 1.

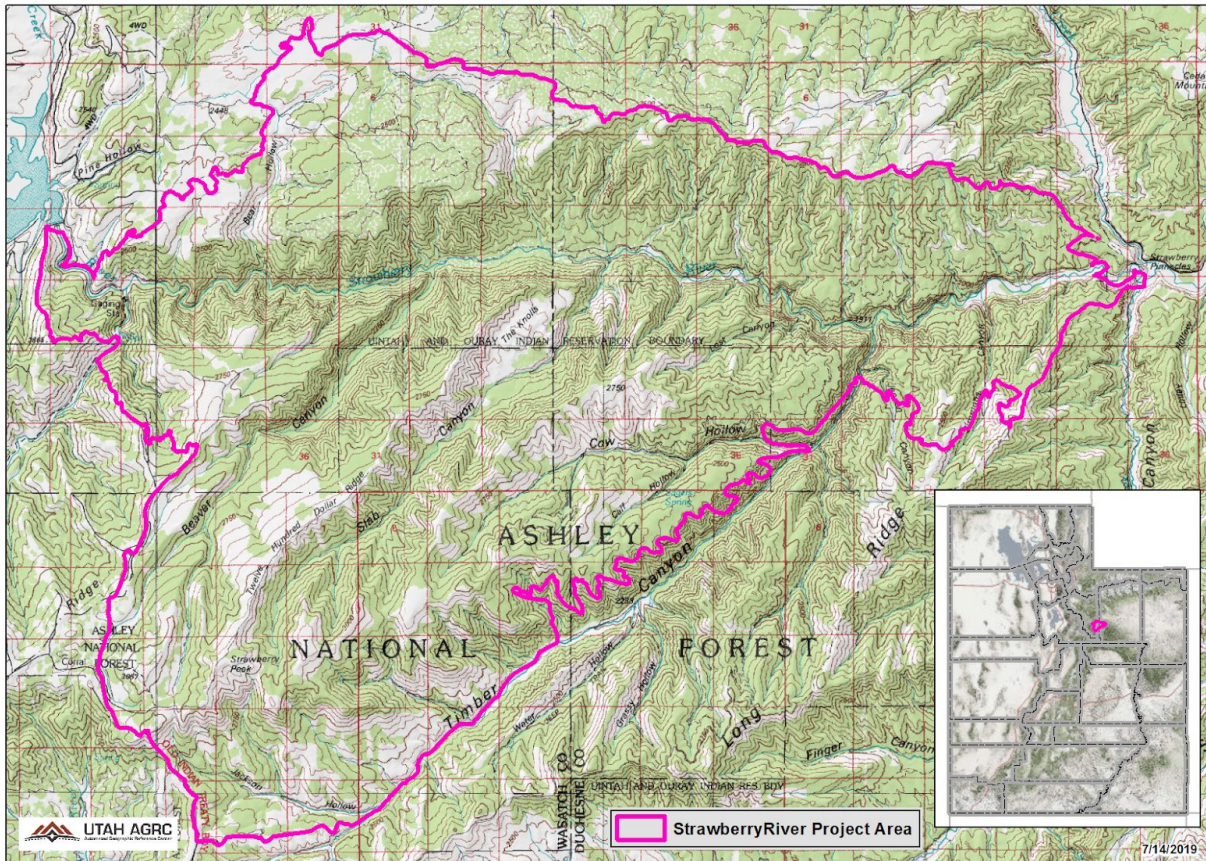
There are no specifications for leaf-off/leaf-on requirements; however, leaf-off conditions are preferred and the LiDAR acquisition shall be timed to ensure that:

- the ground surface is free of snow, ice, and standing water;
- rivers are free of ice and are at a stage of low flow; and
- preferably, lakes and reservoirs are close to the lowest levels of the year.

In addition, LiDAR penetration to the ground must be adequate to produce a bare-earth surface digital elevation model (DEM) that meets or exceeds the requirements for vertical accuracy.

Figure 1: Acquisition Area

Strawberry River - Figure 1



2.2. Performance Period

For the project area described in [Section 2.1](#), the acquisition shall be acquired in the late summer or early fall of 2019. Acquisition may occur when flows on the [Strawberry River at the Pinnacles](#) USGS gauge are less the 90 cfs.

2.3. Acquisition Modifications

Any additions or modifications to the project area, by either AGRC or the other cooperators, will adhere to the data deliverables, standards, specifications, criteria, and inspection process described in this SOW. Any changes requested after the initial contracts have been negotiated will follow the agreed upon contract amendment process between AGRC and the Vendor.



3. Delivery and Quality Assessment and Acceptance Schedule

The LiDAR data acquisition schedule will be agreed upon by AGRC and the Vendor based on actual weather and on-the-ground conditions after the contract has been approved. This schedule may include a small, initial pilot delivery, selected from within the project area, to ensure that the delivered data products meet the specifications and conditions of the contract.

A formal data product delivery schedule will be agreed upon by AGRC and the Vendor after the contract has been approved. However, this schedule may be modified in response to unforeseen circumstances, such as unfavorable weather or other conditions out of the Vendor's control.

The anticipated schedule of delivery and quality assurance is as follows:

- Vendor completes a flight of the contracted area.
 - The length of acquisition time will be determined by the Vendor in collaboration with AGRC.
- Vendor processes and delivers all data products to AGRC for initial inspection and review.
 - AGRC and the USGS have 60 days to review and submit correction requests.
- Vendor addresses initial review comments and redelivers areas to AGRC for final inspection.
 - Vendor has 20 days to redeliver with corrections.
- AGRC completes final inspection and review.
 - AGRC and the USGS have 60 days to review and submit correction requests.
- Vendor addresses final review comments and delivers final and complete data products to AGRC.
 - Vendor has 20 days to redeliver final data product.

If it is not possible to rework the data to correct the error(s), a re-flight of that area may be required.

3.1. Inspection Schedule

An inspection schedule for quality assurance of all products will be developed between the Vendor and AGRC. The Vendor shall document its internal quality assurance work as described in [Section 6](#). A review committee designated by AGRC will quality-check the submitted LiDAR products. In addition, the USGS National Geospatial Technical Operations Center (NGTOC) will review the delivered data products to ensure that they meet the requirements of the USGS NGP *LiDAR Base Specification Version 1.3* (USGS, 2018) and The National Map: 3D Elevation Program (3DEP) requirements set forth in this SOW. **Deliverables will not be accepted by AGRC without acceptance by the USGS NGTOC.** The inspection period for each initial data product delivery will be up to 60 calendar days; these inspection periods may be concurrent. Review of any redelivery of data with corrections will be completed within 20 calendar days of receipt. If collection conditions necessitate the need for a later acquisition, the Vendor can negotiate a time extension with AGRC through a contract amendment. Data deliveries will be made to AGRC at the address specified in the contract.



4. Access to Lands and Airspace

The Vendor is responsible for applying for and obtaining all required permits, clearances, permissions, etc. for access, over-flight, or intrusion to restricted or otherwise limited ground access and/or airspace, which may be included within the requirements of this project. AGRC can assist with expediting these processes where possible.

5. Data Product Deliverables

The products listed in this [Section 5](#) are required project deliverables. All deliverables shall adhere to the USGS NGP *LiDAR Base Specification Version 1.3* (USGS, 2018) “Deliverables” and “Data Processing and Handling,” except for the following:

Exceptions to <i>LiDAR Base Specification Version 1.3</i>	
Deliverable	Adheres to
Albers tiles and projection	not required
EleHydro Breaklines	not required
Bare-Earth Surface (Raster DTM)	vertical accuracy with root mean square error less than or equal to 6 centimeters
Raw point cloud deliverables (discussed in Section 5.2)	LiDAR Base Specification Version 1.2 (USGS, 2014)
First-return surface deliverables	Section 5.5 First-Return Raster (Raster DSM) of this document

Also see [Section 15](#) “Cited Specifications and Standards” in this SOW for all requirements on the processing and handling of the LiDAR data.

All files shall use lowercase extensions. When delivered before the final approval and acceptance:

- raw swath should be in compressed LAZ format
- other point cloud data must be in uncompressed LAS format, and
- DSM and DEM data must be in uncompressed GeoTIFF format

Once AGRC and the USGS NGTOC have approved and accepted data for a specific area, the Vendor shall provide a complete copy of all the final deliverables, with any corrections incorporated, with:

- classified point cloud data delivered as lossless compressed LAZ files using LASzip (<https://www.laszip.org/>) v3.1 or a later release, and
- raster digital surface (DSM) and elevation (DEM) model data delivered as lossless compressed LZ77 or LZW TIFF files



5.1. Metadata

All descriptive information and metadata about the project include text reports, graphics, and supporting shapefiles or geodatabases, and Federal Geographic Data Committee (FGDC) compliant metadata files are required. Product metadata files shall comply with the “Content Standard For Digital Geospatial Metadata” (CSDGM)(FGDC, 1998), which facilitates the development, sharing, and use of geospatial data. See National Spatial Data Infrastructure (NSDI) CSDGM(FGDC, 1998) and *LiDAR Base Specifications Version 1.3* (USGS, 2018) “Metadata” section for metadata requirements for this project.

5.2 Raw Point Cloud

While not required by the USGS, raw point cloud deliverables *are* required by, and shall include or conform to, the procedures and specifications outlined in *LiDAR Base Specifications Version 1.2* (USGS, 2014) “Raw Point Cloud.” Additional requirements below:

- No classifications are required; however, Overage (overlap) and Withheld Flags will be properly set.

5.3 Classified Point Cloud

Classified point cloud deliverables shall include or conform to *LiDAR Base Specifications Version 1.3* (USGS, 2018) “Classified Point Cloud”.

- All project swaths, returns, and collected points shall be fully calibrated, adjusted to ground, classified, and segmented into tiles. Project swaths exclude calibration swaths, cross-ties, and other swaths not used, and not intended to be used, for product generation.
- *LAS Specification Version 1.4 PDRF 6, 7, 8, 9, or 10.*
- Overage (Overlap) and Withheld flags set as appropriate.
- If collected, waveform data in external auxiliary files with the extension .wdp. See *LAS Specification Version 1.4-R13* (ASPRS, 2011) for additional information.
- Correct and properly formatted georeferenced information as WKT (OGC, 2001) included in all LAS file headers.
- GPS times recorded as adjusted GPS times at a level of precision that is sufficient to allow unique timestamps for each pulse.
- Intensity values, normalized to 16-bit. See *LAS Specification Version 1.4* (ASPRS, 2011) for additional information.
- Tiled delivery, without overlap, using the project tiling scheme ([section 7](#)).
- Classification, as defined in the table below, at a minimum.

Classification	
Code/Class	Description
1	Processed, but unclassified



2	Bare earth
7	Low noise
9	Water
17	Bridge decks
18	High noise
20	Ignored ground <i>(typically breakline proximity)</i>
21	Snow <i>(if present and identifiable)</i>
22	Temporal exclusion <i>(Typically nonfavored data in intertidal zones)</i>

5.4 Bare-Earth Surface (Raster DTM), Hydro-Flattening, and Breaklines

Classified point cloud deliverables shall include or conform to *LiDAR Base Specifications Version 1.3* (USGS, 2018) “Bare-Earth Surface (Raster Digital Elevation Model)”.

Bare-earth surface deliverables shall include or conform to the following procedures and specifications:

- Bare-earth DEM, generated to the limits of the BPA.
- Cell size no greater than 0.5 meters (QL1) and 1.0 meters (QL2).
- An industry-standard, GIS-compatible, 32-bit floating raster format (TIFF).
- Georeference information in or accompanying each raster file, as appropriate for the file format. This information shall include both horizontal and vertical systems; the vertical system shall include the geoid model used to convert from ellipsoid heights to orthometric heights.
- Tiled delivery, without overlap, using project tiling scheme ([section 7](#)).
- DEM tiles with no edge artifacts or mismatch. A quilted appearance in the overall DEM surface will be cause for rejection of the entire DEM deliverable, whether the variations are caused by differences in processing quality or character among tiles, swaths, lifts, or other artificial divisions.
- Void areas (e.g., areas outside the BPA but within the project tiling scheme) shall be coded using a unique NODATA value. This value shall be identified in the appropriate location within the raster file header or external support files (e.g., *.aux* or *.xml* metadata).
- Hydro-flattening as outlined in the following [section 5.4.1](#). Depressions (sinks), whether natural or man-made, are not to be filled (as in hydro-conditioning). The methodology used for hydro-flattening is at the discretion of the data producer.
- Bridges removed from the surface.
- Road or other travel ways over culverts shall remain intact in the surface.
- A report on the assessed absolute vertical accuracy of the bare-earth surface in accordance with the guidelines set forth in ASPRS (2014).



- Quality assurance/quality control (QA/QC) analysis materials used in the assessment of absolute accuracy.

5.4.1 Hydro-Flattening

See the “Digital Elevation Model Surface Treatments” section of *LiDAR Base Specification Version 1.3* (USGS, 2018) for all hydro-flattening requirements.

5.4.2 Breaklines

Delivery of all breaklines collected on or used in support of the project is required for USGS-NPG LiDAR products. This includes breaklines used for bridge and saddle treatments and any additional breaklines required by project cooperators. Breaklines representing all hydro-flattened features in a project, regardless of the method used for hydro-flattening, are required for USGS-NGP LiDAR projects.

All breaklines are to be delivered in a shapefile or geodatabase format, or both, as PolylineZ or PolygonZ feature classes. See the “Breaklines” section of *LiDAR Base Specification Version 1.3* (USGS, 2018) for all breakline requirements.

5.5 First-Return Surface (Raster DSM)

While not required by the USGS, first-return surface deliverables are required and shall include the following:

- First-return DEM (e.g., highest hit) generated to the limits of the BPA.
- Cell size no greater than 0.5 meters (QL1) and 1.0 meters (QL2).
- An industry-standard, GIS-compatible, 32-bit floating raster format.
- Georeference information in or accompanying each raster file, as appropriate for the file format. This information shall include both horizontal and vertical systems. The vertical system shall include the geoid model used to convert from ellipsoid heights to orthometric heights.
- Tiled delivery, without overlap, using project tiling scheme ([section 7](#)).
- DEM tiles with no edge artifacts or mismatch. A quilted appearance in the overall DEM surface will be cause for rejection of the entire DEM deliverable, whether the variations are caused by differences in processing quality or character among tiles, swaths, lifts, or other artificial divisions.
- Void areas (e.g., areas outside the BPA but within the project tiling scheme [[section 7](#)]) shall be coded using a unique NODATA value. This value shall be identified in the appropriate location within the raster file header or external support files (e.g., *.aux* or *.xml* metadata).

5.6 4-Band Digital Orthorectified Aerial Photography

Aerial Photography shall be collected simultaneously with the LiDAR, fully orthorectified, and delivered as follows:



- 4-band (RGBI)
- 12 cm GSD
- 8-bit unsigned integer
- Uncompressed GeoTIFF (.tif) format with .tfw worldfiles
- Tile-based and project level metadata in XML format
- Horizontal accuracy must adhere to ASPRS Class 1 specifications

6. Contractor's Project History Report/Folder

Upon conclusion of the LiDAR acquisition, the Vendor will compile and provide a project history report/folder for each project area. This folder will be used by AGRC in the inspection process for the LiDAR data products. The report/folder, will contain, at a minimum, the following:

- Methods
 - A record of field work procedures.
 - Data derivation and adjustments.
 - A processing report detailing calibration, classification, and product generation procedures, including the methodology used for breakline collection and hydro-flattening.
 - Any problems encountered and solutions used in resolving the problems.
- Correspondence and records
 - The SOW between AGRC and the Vendor.
 - All production guidance received from AGRC, including all written guidance from telephone conferences, emails, contractual modifications, and any other source.
 - All LiDAR acquisition methods and equipment used; the results of the LiDAR acquisition; Vendor accuracy assessments, including internal reproducibility and absolute accuracy; the file formats and file-naming conventions of all relevant project files; and the tiling schemes used in the project.
- Flight information
 - The aircraft trajectory log.
 - All smooth, best, estimated trajectory (SBET) files detailing aircraft position (i.e., easting, northing, elevation, etc.); angle; rotation (i.e., heading, pitch, and roll); and GPS time, recorded at regular intervals of ≤ 1 second. May include additional attributes (ASCII text or shapefile and .dbf format).
 - A statistical report summarizing the results of the airborne GPS adjustment and the overall accuracy of the adjusted IMU data.
 - A collection report detailing mission planning and flight logs.
- Control
 - A survey report detailing the collection of control and reference points used for calibration and QA/QC.
 - The documentation for the identity, published position, and measured position of all existing National Geodetic Survey (NGS) marks used for reference stations.
- QA/QC
 - QA/QC reports detailing the analysis, accuracy assessment and validation of:
 - The point data (i.e., absolute, within swath, and between swath),
 - The bare-earth surface (i.e., absolute), and
 - Other optional deliverables as appropriate.
 - Quality control procedures and results.



- o All internal quality control checklists.
- o Internal quality control error calls and the corrective actions taken to correct the error(s).
- o All Vendor QA validation reports/error reports and accuracy reports, generated from internal software QA programs, demonstrating that the data meets requirements as stated in the SOW.

7. Tiling Scheme and Projection

All finalized project deliverables shall be based off the US National Grid (USNG) and delivered according to the UTM USNG Tiling Scheme and UTM Projection and Mapping Units ([section 10.2](#)).

Tiles that lie completely within the project area shall be complete to the tile edges. Tiles that lie partially outside the project area boundary shall be complete to the project area boundary with enough overlap beyond the project area boundary to ensure that no parts of the project are omitted. All tiled deliverables will conform to the project tiling scheme, without added overlap. Tiled deliverables will edge-match seamlessly, without gaps, both horizontally and vertically.

7.1 Albers Tiling Scheme

- ~~• Tiles shall be 1,000 meters x 1,000 meters.~~
- ~~• For ease of searching, the standard file-naming convention is based on the easting and northing locations of the lower-left corner for each tile. An example of a tile name for a 1-km tile is w0002n0612.~~

7.2 UTM USNG Tiling Scheme

- Tiles shall be 2,000 meters x 2,000 meters for raster deliverables with the exception of tiles around the periphery of the project area that are better suited for 1,000 meters x 1,000 meters tiles.
- Tiles shall be 1,000 meters x 1,000 meters for the classified LAS deliverables.
- Tiles shall be named according to the US National Grid System based on the SW corner (e.g., 12TVK060160).

7.3 Void Areas

The extent of LiDAR coverage over the project area shall be sufficient to ensure void areas do not exist within the project area. Void areas within delivered tiles and within the project area are not acceptable.

8. Delivery Medium and Format

Deliverables shall be delivered on USB3-compatible portable hard drives using an uncompressed and unencrypted NTFS file system. Delivery tiles shall be accompanied by an index shapefile, suitable for loading into ArcMap, of the tiles delivered.



All data and products associated with contract deliverables will meet or exceed relevant National Standard for Spatial Data Accuracy (NSSDA) standards. See NSDI Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy (FGDC, 1998).

Upon completion of the project, and after all deliverables have been accepted by AGRC, the Vendor will deliver hard drives containing all the finalized deliverables for the project, as described in [Section 5](#), and the deliverables will become the property of the State of Utah.

9. Data Acquisition Requirements and Collection Conditions

Refer to *LiDAR Base Specification Version 1.3* (USGS, 2018) for acquisition requirements and collection conditions.

9.1. Additional Data Acquisition Requirements

- Instruments shall be calibrated for every mission.
- Flight plans shall be parallel flight lines with a cross-tie at or near the end, or both, of each project flightline.
- Requirements for point density, terrain, positional dilution of position (PDOP) , and Geomagnetic Kp Index (see <https://www.gfz-potsdam.de/en/kp-index/>) shall be considered for flight plans.
- The intensity values (i.e., signal strength) of each return pulse shall be recorded in the LAS, in their file's native radiometric resolution.
- In order to prevent clustering effects and to ensure uniform densities throughout the data set, a regular 1 x 1 meter grid shall be laid over the data, and at least 90 percent of the cells in the grid shall contain the requisite number of points per square meter.

10. Standards, Specifications, and Requirements

Refer to *LiDAR Base Specification Version 1.3* (USGS, 2018) for the following specifications:

- QL1 and QL2 specifications
- Vertical accuracy requirements
- Horizontal accuracy requirements
- Positional accuracy validation
- Relative accuracy requirements
- Completeness of coverage

10.1 Albers Projection and Mapping Units

- ~~Spatial Reference System for delivery of the AOIs shall be: data referenced to NAD83 (2011), Albers Equal Area, Meters; NAVD88 (using the latest Geoid model available from the NGS), Meters.~~
- ~~All data shall be delivered in Orthometric Heights.~~



- ~~****NOTE*****In all cases, the CRS that is used shall be recognized and published by the European Petroleum Survey Group (EPSG) and correctly recognized by industry standard geographic information system (GIS) software applications. For Albers Equal Area, the EPSG code is 6350.*~~

10.2 UTM Projection and Mapping Units

- Spatial Reference System for delivery of the AOIs shall be: data referenced to NAD83 (2011), UTM, Zone 12 (WKID 6341); NAVD88 (using the latest Geoid model available from the NGS), Meters.
- Horizontal and vertical units shall be meters.
- All data shall be delivered in Orthometric Heights.
- ****NOTE*****In all cases, the CRS that is used shall be recognized and published by the European Petroleum Survey Group (EPSG) and correctly recognized by industry standard geographic information system (GIS) software applications. For UTM Area, the EPSG code is 6341.*

10.3 Datums

All data collected must be tied to the datums listed below:

- Horizontal datum:
 - North American Datum of 1983 (NAD83) using the most recent NGS-published adjustment (currently NAD83, epoch 2010.00, realization of 2011)
- Vertical datum:
 - North American Vertical Datum 1988 (NAVD88) for orthometric heights
 - All vertical units will be measured in meters.
- Geoid model:
 - The latest hybrid geoid model of NGS, supporting the latest realization of NAD 83 (currently [2017] Geoid12b model), is required to perform conversion from ellipsoid heights to orthometric heights.

10.4 Usability

- Files shall have consistent internal formats.
- Vendor shall propose all details of file names and file formats that are not specified here. Proposed names and formats must be approved by AGRC.
- All file extensions shall be lowercase.
- Files may be gzip or zip compressed. Use of compression shall be lossless and uniform across a given data layer.
- GIS data (.tif, shapefiles, etc.) shall have complete and correct associated projection, metadata, and sidecar files.
- All files must be readable and free of malicious code.



10.5 GPS Procedures

10.5.1 GPS Measurements

All GPS measurements shall be made with multi-frequency Global Navigation Satellite System (GNSS) receivers with GLONASS. All GPS measurements shall be made during periods with PDOP ≤ 3.0 and with at least six satellites in common view of both a stationary reference receiver and the roving receiver.

10.5.1.1 Stationary Reference Receivers

Stationary reference receivers shall be located at existing NGS marks or at new marks. In the case of an existing mark, its location shall be verified by processing one GPS session of at least two hours' duration and comparing the computed position with the position published by NGS. Each new mark shall be located by tying to one or more NGS Continuously Operating Reference Stations (CORS) by static GPS methods. If the distance to the nearest CORS is less than 80 km, at least two independent GPS sessions, each at least two hours long, shall be used. If the distance to the nearest CORS is greater than 80 km, at least two sessions, each at least four hours long, shall be used.

10.5.1.2 GPS Reference Receivers

At least two GPS reference receivers, with sampling positions at ≥ 1 Hz, shall be in operation during all LiDAR missions. The roving GPS receiver in the aircraft shall sample positions at ≥ 2 Hz. Differential GPS baseline lengths shall be no longer than 30 km. Check Points, Ground Control Points (GCPs), or ground survey points used for both survey calibration and assessment of absolute vertical accuracy shall be established using GPS and/or other techniques that are expected to result in accuracies of 1.5 cm (RMSEz) or better. Strongly clustered GCPs are useful, perhaps even desirable, for calibration. Vertical accuracy shall be assessed by calculating and averaging the distances between a subset of at least 30 GCPs that are not clustered and a surface interpolated from LiDAR first returns. At least 20 percent of flightline swaths shall contain points in this subset, and the maximum distance between these GCPs should be no less than one-half of the maximum distance across the survey area.

10.5.2 Project History Report/Folder

The Vendor Project History Report/Folder ([Section 6](#)) shall document the identity, published position, and measured position of all existing NGS marks used for reference stations. The locations of new marks shall be described, along with their measured positions and the identity and published positions of CORS to which their locations were tied. The report shall describe the technique(s) used to establish GCPs and document the positions and residuals of all GCPs used to evaluate survey accuracy.



10.6 Ground Control

Two types of vertical accuracy GCP (or ground surveyed points) shall be collected by the Vendor for this project: Control Points and Check Points. Ground control shall include and conform to *LiDAR Base Specifications Version 1.3* (USGS, 2018) “Check Points” and shall be delivered in the UTM projection.

10.6.1 Utah Reference Network

AGRC maintains The Utah Reference Network (<http://gis.utah.gov/#gps>) of over 90 GNSS/GPS virtual reference (VRS) RTK stations and will facilitate use of this network upon request of the Vendor.

11. Data Release, Data Use, and Distribution Rights

11.1 Data Release

Prior to AGRC’s final acceptance of data products, the Vendor will not release data produced as part of this project plan to any other party or entity without approval by AGRC,.

11.2 Data Use and Distribution Rights

After AGRC’s final acceptance of data products, all use and distribution of deliverable data and documentation will be free from restrictions (the State of Utah and partners require unrestricted rights to all delivered data and reports that are placed in the public domain). Data and documentation provided under this project plan shall be in the public domain and shall be made freely distributable by federal, state, and local government agencies.

12. Contact List

AGRC Contacts		
Contact Person	Phone Number	Email
ADMINISTRATIVE		
Matt Peters, Director	385-202-3297	mpeters@utah.gov
TECHNICAL		
Rick Kelson, Project Manager	801-538-3237	rkelson@utah.gov



13. Project Communication

13.1 Production Status Reports

The Vendor shall provide AGRC's Project Manager with weekly status reports for all project work. Reports shall include detailed information regarding the work accomplished for each production phase. An online website may be used to provide status information.

13.2 Acquisition Reports

The Vendor shall also provide AGRC's Project Manager with regular progress updates throughout the data acquisition process. Updates shall commence at acquisition onset and shall continue until acquisition is complete. The frequency of these updates shall be based upon the collection period but shall be submitted no less than once a week. The updates shall include maps or shapefiles representing the geographic extent of the acquired data.

13.3 Initial Project Meeting

An initial project meeting between AGRC and the Vendor will be scheduled after each project request. This meeting will ensure that both AGRC and the Vendor 1) understand the requirements necessary to produce the deliverables, 2) review source data, and 3) make any final adjustments to technical guidance.

13.4 Teleconference

The Vendor will teleconference regularly (i.e., weekly or as needed) with AGRC to discuss status, production, and technical issues during a project.

14. Delivery Date and Timely Completion

14.1 Delivery Date

AGRC and the Vendor will agree in writing to a delivery schedule for LiDAR products. Delivery for all final LiDAR products, including any redeliveries because of quality assurance rejection, shall be by no later than April 30, 2020. The Vendor shall not exceed this date without agreement to a new date from AGRC. Any request for modifications of the final delivery date must be received 30 days prior to the expiration of the original date. Requests will only be considered for reasons outside of the Vendor's control, such as unforeseen weather changes.

14.2 Timely Completion

The payment schedule shall include penalties for late delivery of products. The payment schedule will be based on 40 percent of the total project cost after completion of the LiDAR acquisition



flights. After delivery of the final product(s) to AGRC and after the completion of processing and corrections based on the QA review by AGRC and USGS, payment will be made as follows:

- If delivered on time as specified in the contract, another 30 percent of the total project cost will be paid.
- There will be a 30 percent holdback that will be paid after that final delivery of all data and required reports and metadata deliveries are accepted by the USGS NGTOC and are confirmed by AGRC.
- If the final product(s) is not delivered on the schedule specified, there will be a 3 percent (of the total bid) penalty for each week the product delivery is delayed.

15. List of Cited Specifications and Standards

Specifications for the acquisition of LiDAR and deliverables not explicitly outlined above must adhere to the required specifications in the “References Cited” section (p. 22) of *LiDAR Base Specification Version 1.3*, as well as the following:

- “Guidance for Flood Risk Analysis and Mapping: Elevation Guidance” by the Federal Emergency Management Agency (FEMA) (May 2016), https://www.fema.gov/media-library-data/1469794589266-f404b39e73fa7a1c5ffe4447636634d4/Elevation_Guidance_May_2016.pdf.

16. Pricing

16.1 Strawberry River

Pricing is based on the cost of **\$42,622 for the ~88.5 mi² project area** that combines **StrawberryRiver_option1** and **StrawberryRiver_option2** into one QL1 project, submitted in the bid response to solicitation DTS20209076 (see attached).

16.2 Project Area Adjustment

Adjustment to existing project area, including the expansion of project boundaries or changes to USGS Quality Level specification, will not exceed 25 percent of the original bid total.

17. Contract Payments

For purchases and service pursuant to this contract, invoices shall be sent electronically to Matt Peters (mpeters@utah.gov) and Rick Kelson (rkelson@utah.gov) at the Utah Department of Technology Services, Automated Geographic Reference Center:

Invoices approved for payment shall be sent electronically to:

- dtsaccountspayable@utah.gov
- rkelson@utah.gov



Payments will be processed in accordance with the State of Utah Cooperative Contract Standard Terms and Conditions for Services, as included in Master Agreement # AV2406.

18. Post Project Vendor Review

At the conclusion of the project, the Project Manager named in this SOW will complete a performance evaluation, unless waived, of the Vendor's project performance. The Vendor must have a positive evaluation in order to remain eligible for future projects with AGRC. The following criteria will be used for evaluation:

Points | Criteria

- 10 | Vendor was easy to work with
- 10 | Vendor provided all necessary project reporting and/or met all requirements in this SOW
- 10 | Vendor provided products that are well organized and are of the highest industry standards
- 10 | Vendor acquired project area within the estimated acquisition window with the exception of circumstances outside of the Vendor's control
- 10 | Vendor delivered project deliverables on time with the exception of circumstances outside of the Vendor's control
- 10 | Vendor provided necessary corrections resulting from USGS NGTOC QA in the time frame outlined in the SOW

—Total—

60

Vendors receiving a performance evaluation score of less than 45 out of 60 will be required to submit a performance improvement plan on the next project that they wish to participate in. In order for the Vendor to qualify for future solicitations, the evaluation committee must review the improvement plan and determine that the plan adequately addresses the issues outlined in the performance review.



IN WITNESS WHEREOF, the parties sign this Scope of Work on Master Agreement # AV2406

CONTRACTOR

AGRC

**DEPARTMENT OF
TECHNOLOGY SERVICES**

Contractor's signature

Agency's signature

Agency's signature

Name and title

Matt Peters, Director, AGRC

Daniel Frei, Executive, DTS



Aero-Graphics, Inc.	
P1.1 Aerial Lidar for Strawberry River Option 1_USGS Quality Level 1	
Item Total Price	21,045.00
Description	in Northern Utah, located in
Quantity	1
Estimated Delivery Date	12/19/2019
Comment (Optional)	This option can be eliminated. See comment under Option 2.
P1.2 Aerial Lidar for Strawberry River Option 2_USGS Quality Level 2	
Item Total Price	36,990.00
Description	in Northern Utah, located in Wasatch and Duchesne Counties, of the Strawberry
Quantity	1
Estimated Delivery Date	12/19/2019
Comment (Optional)	If the State of Utah prefers to have the entire watershed flown at QL1, we can do so with the Galaxy sensor system and this essentially eliminates the need for Option 1 and adds an additional \$5632 to the cost of option 2. This eliminates the need to exercise options 1 and 2 and saves the State of Utah \$15413. Please contact Casey at (801) 541-0295 should you have any questions. Kindest regards, Casey