TASK ORDER DETAIL

USGS CONTRACT: G10PC00025

CONTRACTOR: AEROMETRIC

TASK ORDER NUMBER: G13PD00753

TASK NAME: Illinois Twelve Counties LiDAR Processing and Hydro-Flattened DEMs

The Contractor shall furnish all facilities, labor, materials, and equipment, unless specifically identified otherwise, to provide the mapping services and products in accordance with the specifications, terms, and conditions contained in Contract No. **G10PC00025**, and the following requirements specific to this Task Order, and in accordance with Contractor's proposal dated July 25, 2013 and revised proposal dated August 2, 2013 and in the amount of:

Task Order Fixed Price	**$ 117,183.44**

SECTION C: DESCRIPTION/SPECIFICATIONS/WORK STATEMENT.

The following **Section C** additional requirements are applicable to this Task Order:

C.1. **Statement of Work (SOW):** Reference C.1 of the Contract. This task order is for processing, and derivative products of LiDAR data previously collected for twelve counties in Illinois. The LiDAR was collected under two separate contracts, IDOT PTB146-041 & PTB 151 and IDNR 1-080208. *Additional control or vertical accuracy testing are NOT required.* This task order will process the identified LiDAR data and derivative products to the specifications listed below and are based on the ***"U.S. Geological Survey National Geospatial Program Lidar Base Specification, Version 1.0",*** incorporated by reference to this task order. This specification may be viewed at *http://pubs.usgs.gov/tm/11b4/TM11-B4.pdf*. These LiDAR specifications are required baseline specifications. In addition to the requirements listed below, variations from the specifications will be shown and noted below. For any item which is not specifically addressed, the referenced Version 1.0 specifications will be the required specification authority.

This task is for the processing of approximately 7567 square miles of high resolution LiDAR data for twelve complete counties in Illinois which include *Carroll, Jo Daviess, Stephenson, Whiteside, Lee, Ogle, Henry, Rock Island, Champaign, Grundy, Kane and McHenry, to obtain Classified LAS Point Cloud data, existing breakline data collected under contracts PTB146-041 & PTB 151 and IDNR 1-080208, and new breakline collection for Stephenson, Carroll, and Jo Daviess which shall be sufficient to support hydro-flattening of bare-earth DEMs.*

Contractor shall submit a tile index for each county in ESRI Polygon v10.0 or v10.1 File Geodatabase format for review and approval with the technical and cost proposals.

The Government requests a separate proposal that may be exercised as an option to produce hydro-flattened bare-earth DEMs and Mosaics from the processed LiDAR and Breakline data. This proposal shall be structured to include unit pricing. It is the intent of the Government, pending successful negotiations, to exercise this option to the extent funds are available.

C.1.a. **KICK-OFF MEETING:** A kick-off meeting shall be held to outline the communication procedures to be followed for this task order. This meeting may be used as a forum to clarify and resolve remaining technical issues. The kick-off meeting shall be held no later than **two (2) weeks** after contract award.

C.1.b. **DATA PROCESSING AND HANDLING:** The contractor shall be responsible for post processing of LiDAR data of sufficient density and quality to meet the requirements specified in **the referenced Version 1.0 specification**. All processing should be carried out with the understanding that all point deliverables are required to be in fully compliant LAS format, v1.2 or v1.3. Data producers are encouraged to review the LAS specification in detail. Specifications of the LAS data sets will be verified.

C.1.b.(i) **ACCURACY REPORTING**

C.1.b.(i)(a) **Data Accuracy:** Data processed under this Task Order should meet the National Standard for Spatial Database Accuracy (NSSDA) accuracy standards and shall be reported in the metadata. Lidar derivatives produced by the Contractor shall maintain the data accuracies of the source data.

C.1.b.(ii) **Hydro Flattening Requirements:**

C.1.b.(ii)(a) **Inland Ponds and Lakes**:

1. ~2-acre or greater surface area (~350’ diameter for a round pond)
2. Flat and level water bodies (single elevation for every bank vertex defining a given water body).
3. The entire water surface edge must be at or just below the immediately surrounding terrain.
4. Long impoundments such as reservoirs, inlets, and fjords, whose water surface elevations drop when moving downstream, should be treated as rivers.

C.1.b.(ii)(b) **Inland Streams and Rivers**:

1. 100’ **nominal** width: This should not unnecessarily break a stream or river into multiple segments. At times it may squeeze slightly

below 100’ for short segments. Data producers should use their best professional judgment.

2. Flat and level bank-to-bank (perpendicular to the apparent flow centerline); gradient to follow the immediately surrounding terrain.
3. The entire water surface edge must be at or just below the immediately surrounding terrain.
4. Streams should break at road crossings (culvert locations). These road fills should not be removed from DEM. However, streams and rivers should **not** break at bridges. Bridges should be removed from DEM. When the identification of a feature as a bridge or culvert cannot be made reliably, the feature should be regarded as a culvert.

C.1.b.(ii)(c) **Non-Tidal Boundary Waters**:

1. Represented only as an edge or edges within the project area; collection does not include the opposing shore.
2. The entire water surface edge must be at or below the immediately surrounding terrain.
3. The elevation along the edge or edges should behave consistently throughout the project. May be a single elevation (i.e., lake) or gradient (i.e., river), as appropriate.

C.1.b.(ii)(d) **Tidal Waters**:

1. Water bodies such as oceans, seas, gulfs, bays, inlets, salt marshes, very large lakes, etc. Includes any significant water body that is affected by tidal variations.
2. Tidal variations over the course of a collection, and between different collections, will result in discontinuities along shorelines. This is considered normal and these “anomalies” should be retained. The final DEM should represent as much ground as the collected data permits.
3. Variations in water surface elevation resulting in tidal variations during a collection should NOT be removed or adjusted, as this requires either the removal of ground points or the introduction of unmeasured ground into the DEM. The USGS NGP priority is on the ground surface, and accepts the unavoidable irregularities in water surface.

C.1.b.(ii)(e) Scientific research projects in coastal areas often have very specific requirements with regard to how tidal land-water boundaries are to be handled. For such projects, the requirements of the research will take precedence.

C.1.c. **DELIVERABLE PRODUCTS:** The following deliverable products shall be produced from the LiDAR provided.

C.1.c.(i) **Raw Point Cloud Data:** Existing raw strip information

C.1.c.(i)(a) Shall be converted to LAS v1.2 **to the extent original lidar data exists**.

C.1.c.(i)(b) Point Record Format 1, 3, 4, or 5 shall be produced **to the extent lidar information is available**.

C.1.c.(i)(c) Georeference information shall be included in all LAS file headers

C.1.c.(i)(d) GPS times are to be recorded as Adjusted GPS Time, at a precision sufficient to allow unique timestamps for each return.

C.1.c.(i)(e) Intensity values

C.1.c.(i)(f) Full swaths, all collected points to be delivered, **to the extent original lidar data was not trimmed**.

C.1.c.(i)(g) 1 file per swath, 1 swath per file, file size not to exceed 2GB, as described in Section II, Paragraph 5.

C.1.c.(ii) **Classified Point Cloud**:

C.1.c.(ii)(a) Fully compliant LAS v1.2 or v1.3, Point Record Format 1, 3, 4, or 5, including "File Source ID" shall be produced **to include a 1-tile buffer beyond the county boundary for each of the twelve counties, to the extent the original lidar data was not trimmed.**

C.1.c.(ii)(b) Georeference information included in LAS header

C.1.c.(ii)(c) GPS times are to be recorded as Adjusted GPS Time, at a precision sufficient to allow unique timestamps for each return.

C.1.c.(ii)(d) Intensity values

C.1.c.(ii)(e) Tiled delivery, without overlap

C.1.c.(ii)(f) Classification Scheme (minimum):

1. Code 1 – Processed, but unclassified
2. Code 2 – Bare-earth ground
3. Code 7 – Noise (low or high, manually identified, if needed
4. Code 8 – Model Key-point (mass point)
5. Code 9 – Water
6. Code 10 – Ignored Ground (Breakline Proximity)

C.1.c.(ii)(g) *Note: Class 7, Noise, is included as a convenience for the data producer. It is not required that all "noise" be assigned to Class 7.*

C.1.c.(ii)(h) *Note: Class 10, Ignored Ground, is for points previously classified as bare-earth but whose proximity to a subsequently added breakline requires that it be excluded during Digital Elevation Model (DEM) generation.*

C.1.c.(ii)(i) *Use of the ASPRS/LAS Overlap classification (Class=12) is prohibited. Refer to the Lidar Base Specification V1.0 for proper point classification.*

C.1.c.(ii)(j) ***Note: Overlap Points that were trimmed shall be described in the appropriate metadata file(s).***

C.1.c.(iii) **Bare Earth Surface (Raster DEM):**

C.1.c.(iii)(a) Cell Size no greater than **3.2 feet**, and no less than the design Nominal Pulse Spacing (NPS).

C.1.c.(iii)(b) **Model Keypoints (Class = 8)** shall be included in the bare earth DEM.

C.1.c.(iii)(c) Delivery in an industry-standard, GIS-compatible, 32-bit floating point raster in two formats:

1. ERDAS .IMG
2. ESRI ArcGrid (ArcGIS v10.0 or v10.1 is preferred)

C.1.c.(iii)(d) Georeference information shall be included in raster file

C.1.c.(iii)(e) Tiled delivery, without overlap

C.1.c.(iii)(f) DEM tiles will show no edge artifacts or mismatch

C.1.c.(iii)(g) Void areas (i.e., areas outside the project boundary but within the tiling scheme) shall be coded using a unique "NODATA" value. This value shall be identified in the appropriate location within the file header.

C.1.c.(iii)(h) Lidar Base Spec V1.0 states "Vertical accuracy of the lidar data will be assessed and reported in accordance with the guidelines developed by the National Digital Elevation Program (NDEP) and subsequently adopted by the American Society for Photogrammetry and Remote Sensing (ASPRS). Complete definitions for vertical accuracy assessments are in Section 1.5 of the NDEP Elevation Guidelines (NDEP, 2004)." All QA/QC analysis materials and results are to be delivered to the USGS.

C.1.c.(iii)(i) Depressions (sinks), natural or man-made, are not to be filled (as in hydro-conditioning and hydro-enforcement).

C.1.c.(iii)(j) Water Bodies (ponds and lakes), wide streams and rivers ("double-line"), and other non-tidal water bodies as defined in Section III are to be hydro-flattened within the DEM. Hydro-flattening shall be applied to all water impoundments, natural or man-made, that are larger than ~2 acre in area (equivalent to a round pond ~350' in diameter), to all streams that are nominally wider than 100', and to all non-tidal boundary waters bordering

the project area regardless of size. The methodology used for hydro-flattening is at the discretion of the data producer.

C.1.c.(iv) **Breaklines:**

C.1.c.(iv)(a) Breaklines collected under contracts, IDOT PTB146-041 & PTB 151 and IDNR 1-080208**, shall be delivered for** the Illinois Counties of McHenry, Kane, Henry, Grundy, Champaign, Whiteside, Lee, Ogle, and Rock Island.

C.1.c.(iv)(b) Hydro-flattened breaklines **shall be collected for** the Illinois Counties of Stephenson, Carroll, and Jo Daviess.

C.1.c.(iv)(c) Breaklines shall be delivered as:

1. PolylineZ or PolygonZ File Geodatabase (Arc GIS v10.0 or v10.1) is preferred.
2. Polygon and polyline in shapefile format (Arc GIS v10.0 or v10.1) is preferred.

C.1.c.(v) **Bare-earth DEM Mosaic:** A county-wide **3.2 feet pixel**, bare-earth DEM mosaic shall be created for each of the counties identified in Section C.2. Each mosaic shall include a 1-tile buffer beyond the county boundary as data is available. The mosaic format shall be ESRI ArcGRID (ArcGIS v10.0 or v10.1 is preferred).

C.1.c.(vi) **Metadata:** Metadata shall comply with the USGS National Geospatial Program Lidar Base Specification, Version 1.0. Contractor should review the Metadata section (specifically Appendix 4 and Appendix 5) and seek guidance as appropriate. The following Metadata requirements shall be met:

C.1.c.(vi)(a) Processing Report detailing classification and product generation procedures including methodology used for breakline collection.

C.1.c.(vi)(b) QA/QC Reports (detailing the analysis, accuracy assessment and validation of:

1. The bare-earth surface (absolute)
2. **The classified LAS point cloud**
3. Other optional deliverables as appropriate

C.1.c.(vi)(c) Geo-referenced, digital spatial representation of the precise extents of each delivered dataset. This should reflect the extents of the actual LiDAR source or derived product data, exclusive of Triangular Irregular Network (TIN) artifacts or raster NODATA areas. A union of tile boundaries or minimum bounding rectangle is not acceptable. ESRI Polygon **v10.0 or v10.1 File Geodatabase** is preferred.

C.1.c.(vi)(d) Product metadata (FGDC compliant, XML format metadata). One file for each:

1. Project

2. Lift *(note: this is one per lift – not one per project)* or raw strip as pertaining to converted format
3. Tiled deliverable product group (classified LAS point data, breaklines, etc.). Metadata files for individual tiles are not required.

C.1.c.(vii) **Project Report:** The contractor shall deliver a production report which details:

C.1.c.(vii)(a) Quality control procedures and results.

C.1.c.(vii)(b) Production report shall be Microsoft Word, Adobe PDF format or other compatible digital format.

C.1.c.(viii) **Project Pilot:** Contractor shall deliver a Project Pilot Delivery consisting of the Classified LAS Point Cloud and associated Breaklines, Hydro-flattened bare-earth DEMs and metadata to include approximately **twenty-five (25) percent** of JoDaviess and Kane Counties in Illinois.

C.2. TILING SCHEME AND DATA FORMAT:

C.2.a.(i) **Tile Coverage:** Tiles shall be complete to the tile edges. Tiles shall not be clipped to the county boundary, but shall be delivered with one-full tile buffer beyond the county extent, as data exist. Each county shall be identified and placed inside individual folders.

C.2.a.(i)(a) **Tile Size:**

1. Tiles shall be 2000 feet x 2000 feet
2. Tiled deliverables shall conform to the tiling scheme, without added overlap.
3. Tiling scheme will be used for all tiled deliverables.
4. Tiled deliverables shall edge-match seamlessly in both the horizontal and vertical.
5. Tile Index in ESRI Polygon v10.0 or v10.1 File Geodatabase is preferred.

C.2.a.(i)(b) **Tile Naming:** Tiles shall be named according to the approved IL Tile Index shapefile to be delivered with proposal.

C.2.a.(i)(c) **Spatial Reference System**: Data shall be delivered in the original spatial reference system.

C.2.a.(i)(d) **Horizontal Datum**: shall be NAD83 (HARN)

C.2.a.(i)(e) **Coordinates:**

1. Illinois State Plane West shall be used, for Carroll, Henry, Jo Daviess, Lee, Ogle, Rock Island, Stephenson and Whiteside counties.

2. Illinois State Plane East shall be used, for Champaign, Grundy, Kane, McHenry counties.

C.2.a.(i)(f) **Vertical Datum:** shall be NAVD88

C.2.a.(i)(g) **Units:** shall be US Survey Feet

C.3. **PERMITS:** Not applicable.

C.4. **USE AND DISTRIBUTION RIGHTS:** All deliverable data and documentation shall be free from restrictions regarding use and distribution. Data and documentation provided under this Task Order shall be freely distributable by government agencies.

C.5. **NOTE:** ***"Base Lidar Specifications, Version 1.0",*** **Deliverables** section regarding data providers' rights to resell data or derivative products as they see fit are specifically exempted from this task order.

C.6. **CERTIFICATIONS:** The contractor shall certify as part of its proposal that the work performed on this task order complies with Section 52.225-05 of the Federal Acquisition Regulations relating to Trade Agreements.

C.7. **THE GOVERNMENT POINT-OF-CONTACT (POC)** for this Task Order is: Gail Dunn.

Address: USGS/NGTOC

ATTN: Gail Dunn, MS 663
1400 Independence Road
Rolla, MO 6540

Telephone: (573) 308-3756
FAX: (573)-308-3810
e-mail: gdunn@usgs.gov

C.8. **Digital Deliverables**: Reference C.1 of the Contract.

C.8.a. **The Contractor shall deliver one copy** of the LiDAR data products and documentation as specified in Section C.1 of this Task Order.

C.8.b. **Format:** Data shall be delivered in the formats specified in C.1.c above.

C.8.c. **Delivery Medium:** The digital data shall be delivered on external hard drive, i.e. (firewire, or USB2 – Less than USB2 is not acceptable). Files shall be stored into appropriate directories on the drive.

C.8.d. **Deliverable Validation:** Reference C.1 - 3.12 of the Contract. The Government may choose to contract with a separate contractor for validation on all submitted deliverables.

SECTION D: - PACKAGING AND MARKING

D.1. No additional Section D requirements are applicable to this Task Order.

SECTION E: - INSPECTION AND ACCEPTANCE - The following Section E additional requirements are applicable to this Task Order:

E.1. **Inspection Period:** Reference GS0720 of the Contract. The inspection period begins the day after the data has been delivered. All deliverables will be validated within a Sixty (60) calendar-day inspection period, with the exception of the Pilot Data which will be reviewed within seven (7) calendar days.

E.2. **Inspection and Acceptance Procedures:** ReferenceE780 of the Contract. The Government will perform a full inspection of all deliverables in accordance with E780 (b) of the Contract.

E.3. **Nonconforming deliverables:** Nonconforming deliverables returned to contractor for rework shall be delivered in accordance with Contract clause E784 (b).

SECTION F: - DELIVERIES OR PERFORMANCE - The following Section F additional requirements are applicable to this Task Order:

F.1. **Place of Delivery:** Reference GS0904 of the Contract. Contractor shall submit all requested deliverables to the address of the POC, as shown in Section C of this Task Order.

F.2. **Negotiated Delivery Schedule:** Reference F981 of the Contract. The Government requires the following delivery schedule:

F.2.a. **Lot One (1) Kick-off Meeting:** A kick-off meeting shall be held to outline communication procedures that shall be followed for this task order. The kick-off meeting shall be held no later than two (2) weeks after contract award, but no later than **August 9, 2013.**

F.2.b. **Lot Two (2) Pilot Data:** Consisting of the Classified LAS Point Cloud, Breaklines, Metadata and Hydro-flattened Bare-Earth DEMs to include approximately twenty-five (25) percent each of JoDaviess and Kane Counties in Illinois. This pilot data shall be delivered no later than **45** calendar days following the Kick-off meeting, but in no case later than **September 10, 2013.**

F.2.c. **Lot Three (3) LiDAR and Derivatives:** Consisting of all required deliverables (including metadata) of the LiDAR data and its derived products as specified in the task order, shall be delivered no later than **120** calendar days following Government response to Pilot Data, but in no case later than **January 31, 2014**.

F.2.d. **Lot Four (4) DEM Mosaics:** One copy of a 3.2 feet pixel, bare-earth surface, raster DEM Mosaic (including metadata) as specified in the task order, shall be delivered for each county not later than **30 calendar days** following acceptance of Lot Three (3) by the Government, but in no case later than **March 1, 2014**.

F.3. **Progress Reports:** Contractor shall submit a monthly progress report for this task order in accordance with Contract clause GS0921 and GS0931.

SECTION G: - CONTRACT ADMINISTRATION DATA

G.1. No additional Section G requirements are applicable to this Task Order

SECTION H: - SPECIAL CONTRACT REQUIREMENTS -The following Section H additional requirements are applicable to this Task Order:

H.1. **Applicable Regulations And Permits -- Aircraft Operations**: Not Applicable to this task order

H.2. **Government Furnished Property:** Reference H1480 (Conditions Regarding Use Of GFP) of the contract. No Government furnished property is being supplied with this Task Order.

SECTION I: - CONTRACT CLAUSES

I.1. No additional detail is required for this Task Order.

SECTION J: - LIST OF ATTACHMENTS TO THIS TASK ORDER

J.1.	Attachment A -	Project Area Description	1 Page
J.2.	Attachment B -	Tile Index Geospatial File	1 Page

TASK ORDER Attachment A -
Illinois Twelve Counties LiDAR Processing and Hydro-Flattened DEMs – Project Description and Diagram

Detailed Project Area Diagram

END "ATTACHMENT A"

TASK ORDER Attachment B -
Illinois Twelve Counties LiDAR Processing and Hydro-Flattened DEMs - Project Tile Index Geodatabase File

THIS SECTION CONSISTS OF THE FOLLOWING DATA SET(S)

IL_Tiles_State_Plane_Harn.gdb.zip

END "ATTACHMENT B"