



September 6, 2018

Mr. Mike Edwards
GIS Manager
Department of Public Utilities
City of Columbus
910 Dublin Road, 3rd Floor
Columbus, Ohio 43215

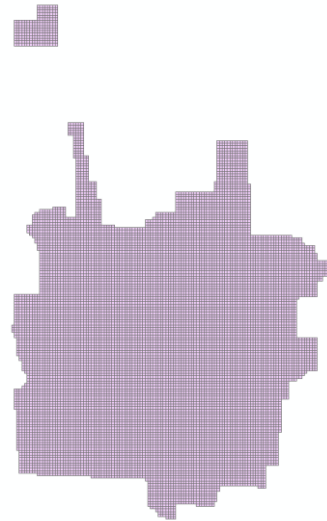
RE: 2019 City of Columbus Orthoimagery/LiDAR Program

Dear Mr. Edwards:

Woolpert is pleased to submit our scope and fee proposal for the 2018-2019 City of Columbus Ortho/LiDAR Project.

Project Boundary

The image to the right depicts the 2019 City of Columbus Project Area, which also includes the Upground Reservoir located in northwestern Delaware County. The 2019 Project Area includes all of Franklin County and portions of Delaware, Union, Licking, Fairfield, Pickaway and Madison Counties. In total, the Project Area is comprised of approximately 680 square miles (614 square miles – City of Columbus Service Area; 53 square miles – Reservoir Priority Areas; 13 square miles – contiguous tiles to “square up” the Project Area).



Project Services

Aerial Imagery Acquisition - 2019

Woolpert will acquire new 3-inch, 4-band, 8-bit aerial imagery covering the Columbus Project Area. Aerial imagery will be acquired during the months of March-April 2019 (leaf-off conditions, during the absence of snow, zero cloud cover, when rivers and streams are within their normal banks, unless otherwise negotiated with the City) with an average sidelap of 60%. The aerial imagery will support the generation of project area wide 1"=50' scale ortho-imagery with a pixel resolution of 3-inches. The imagery will be acquired when the sun angle is 25-degrees or greater. Supplemental flight lines will be acquired over the Downtown Area bounded by SR 315 on the west, I-670 on the north, I-71 on the east, and I-70 on the south. Additional supplemental flight lines covering High Street from SR 104 north to I-270 near Worthington, and along 4th Street from I-670 north to 5th

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Avenue will be acquired. These supplemental flight lines will be acquired when the sun angle is at or near the highest (solar noon) to minimize building shadows.

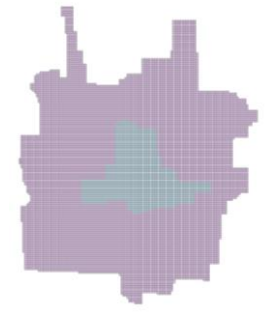
Aerial LiDAR Acquisition/Processing - 2019

Woolpert will acquire new Columbus Project Area LiDAR data during the winter/spring of 2019. The LiDAR data will have a point density average of 0.29-meters NPS (12 PPSM). Vertical accuracy of the LiDAR data will conform to the USGS QLO Standard (5.0cm RMSE) and 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). This implies control data of a higher accuracy and independent of the LiDAR processing will be used to assess the NVA (Non-vegetated Vertical Accuracy) of the Bare Earth Terrain as well as the VVA (Vegetated Vertical Accuracy) in predetermined land-cover types (i.e. brush lands, forested canopy, tall weeds). The LiDAR data will be "hydro-flattened" per the USGS specification. At a minimum, the final products will consist of LAS1.4 Unclassified Swath data not to exceed 2gb in size, LAS1.4 Classified Tiles (classes 1-non-ground, 2-bare earth, 7-outlier, 9-water, 10-breakline proximity, 17-overlap non-bare-earth, and 18-overlap bare earth), 0.5-meter DEM in ERDAS IMG format, Hydrologically Flattened Breaklines in ESRI Shapefile format, Survey Control data in ESRI Shapefile format, Tile Index in ESRI Shapefile format, Per Product FGDC Metadata in XML format, and a

project report detailing acquisition, survey, and processing.

Ground Control

Woolpert will utilize existing ground control established for the Columbus 2011, 2013, 2015, 2017 Ortho and 2012 Contour Projects, along with approximately 90 new ground control points (split evenly between pervious and impervious surfaces) in the Blueprint and Combined Runoff Priority Areas, to support the 1"=50' scale ortho base mapping. The map to the right depicts the Blueprint/Combined Runoff Area (within the larger Columbus Service Area Coverage).



If any additional ground control is needed (i.e. due to an existing point being destroyed or obscured), Woolpert will perform the survey and supply a control diagram to the City of Columbus depicting the proposed location(s) of the new horizontal and vertical GPS control points. Each new control point (if necessary) will consist of a photo identifiable point (i.e. north edge of sidewalk at east edge of paved driveway).

Mapping Standard

The mapping standard, datums, coordinate system and units to be used for the project are as follows:

Ortho Mapping Accuracy Standard

American Society of Photogrammetry and Remote Sensing (ASPRS) Standards for Digital Geospatial Data (edition 1, version 1.0-November 2014) guidelines.

The 7.5cm (3-inch) orthoimagery will meet the ASPRS 7.5cm Horizontal Accuracy Class of 18.4cm @ 95% confidence level

Note: The above is equivalent to the 1990 ASPRS, Class 1 Accuracy Standard

Datums

Horizontal: North American Datum 1983 (2011)

Vertical: North American Vertical Datum 1988

Coordinate System/Geoid/Units

Ohio State Plane, South Zone; Geoid12b; US Survey Feet

Aerial Triangulation

Woolpert will perform aerial triangulation on the newly acquired aerial imagery acquired during the spring of 2019. Triangulation extends and densifies the ground control and will subsequently support the 1"=50' scale ortho base mapping.

Ortho Base Mapping

In 2019, Woolpert will produce project-wide (680 square miles) 1"=50' scale ortho-imagery, with a pixel resolution of 3-inches. The new Columbus LiDAR DEM (2019) will be used to rectify the new 3-inch aerial imagery. The final ortho tiles will be delivered as 4-band (RGBN), 8-bit geoTIFF imagery. Utilizing the existing tiling system (1,250' x 1,250' tiles), the ortho tiles will be approximately 100 megabytes in size.

For the City's review, the new ortho-imagery will be cached to Woolpert's SmartView Connect Redline Server. Woolpert will provide user accounts and instructions on the use of the web server.

After the City has reviewed and accepted the orthoimagery, the imagery will be processed and delivered in geoTIFF format (with the appropriate TIFF World files and metadata) and MrSID Image Format (based upon the MrSIDs previously delivered as part of the 2017 ortho project). An ESRI Image Cache (based upon the Web Mercator projection) will also be produced after the City has reviewed and accepted the ortho-imagery. The same parameters that were used for the image cache produced for the 2017 3-inch orthoimagery will be reused.

Schedule

Project Tasks

- Woolpert will acquire new aerial imagery on or before April 15, 2019.
- Woolpert will acquire new aerial LiDAR on or before April 15, 2019.
- Woolpert will produce and cache the 3-inch ortho-imagery (for Columbus' Review) to Woolpert's SmartView Connect Server on or before July 31, 2019.
- Woolpert will process and deliver the QLO LiDAR on or before August 31, 2019.
- Upon acceptance (by Columbus) of the base ortho-imagery, Woolpert will process the citywide MrSIDs (separate natural color and color infrared MrSIDs) and deliver all ortho data (MrSIDs and geoTIFFs) on an external hard drive. Woolpert will also provide an image cache referenced to the Web Mercator projection, including documentation describing the projection method and transformation applied. This process will require approximately 30 days from the date of acceptance by Columbus.

Deliverables

- One set of 4-band, 8-bit color geoTIFF imagery, with corresponding World files (for each ortho tile)
- One set of MrSID Images (9 – 50x (natural color) and 9 – 50x (color infrared))
- One set of the image cache dataset
- All ortho data will be delivered on an external hard drive
- All LiDAR data (LAS and IMG formats) will be delivered on an external hard drive

Estimated Fees

4-Band, 8-Bit Orthoimagery QL0 Aerial LiDAR	
<i>Service</i>	<i>Fee</i>
2019 – Citywide QL0 3DEP LiDAR	\$247,756.00
2019 – Citywide 1"=50' Scale 3-Inch Ortho-Imagery (4-band, 8-bit)	\$219,155.00
2019 – Contingency Area	\$9,485.00

Invoicing will be based upon project milestones (completion of imagery acquisition; processing of orthoimagery (placed on SmartView Connect), LiDAR; delivery of orthoimagery, LiDAR).

Note: The LiDAR Fee will decrease if Ohio receives a 3DEP Grant covering the entire state (or at least covering the Columbus Metro Area). However, the state will not know the status of the grant until early 2019 and although the state is looking at QL2/QL1 LiDAR which has a vertical accuracy of 4-inches, we'll provide a discount to Columbus as the state/USGS can utilize QL0 in place of QL2/QL1. The exact amount of the discount will be calculated upon the state receiving the grant.

We appreciate the opportunity to present this price proposal and look forward to working with you and your team again.

Sincerely,

Woolpert, Inc.



Brian Stevens, CP, GISP
Program Director