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<abstract>TASK NAME: Sandy River ARRA LiDAR - USGS CONTRACT: G10PC00057 TASK ORDER NUMBER: G10PD00843 CONTRACTOR: Woolpert Inc.

LiDAR data is a remotely sensed high resolution elevation data collected by an airborne platform. The LiDAR sensor uses a combination of laser range finding, GPS positioning, and inertial measurment technologies. The LiDAR systems collect data point clouds that are used to produce highly detailed Digital Elevation Models (DEMs) of the earth's terrain, man-made structures, and vegetation. This task order requires the LiDAR data to be collected at a nominal pulse spacing (NPS) of 0.35 meters (8 Pulses Per Square Meter {ppsm}). The final products include first, last, and at least one intermediate return LAS, a bare earth model, and intensity data in separate files.).</abstract>

<purpose>The task order consists of LiDAR data acquisition, processing, and production of derivative products of approximately 25.3 square miles of river corridor along the Sandy River in Oregon. This task order requires the LiDAR data to be collected at a nominal pulse spacing (NPS) of 0.35 meters (8 Pulses Per Square Meter {ppsm}).

Watershed Sciences, Inc. collected the LiDAR and produced this data set for Woolpert, Inc.</purpose>

<supplinf>The reflective surface data represents the DEM created by the laser energy reflected from the first surface encountered by the laser pulse. Some energy may continue beyond this initial surface, to be reflected by a subsequent surface as represented by the last return data. Intensity information is captured from the reflective surface pulse and indicates the relative energy returned to the sensor, as compared to the energy transmitted. The intensity image is not calibrated or normalized but indicates differences in energy absorption due to the the interaction of the surface materials with laser energy, at the wavelength transmitted by the sensor. The bare earth model is created by identifying the returns that fall on the ground surface and by interpolating a surface between these points. In this manner, buildings and vegetation are removed from the bare earth model. This data set does not include bridges and overpasses in the bare earth model as the delineation point for these structures is not reliably discernable in the LiDAR data.

This data is assembled by 0.75 minute quadrangles (1/100 of a USGS 7.5 minute quad) that correspond to the delivery delineation for LiDAR point datasets</supplinf>

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Datasets are defined as NAD83(NSRS2007) in the ESRI software environment, as an approximation of CORS96. (NAD83(CORS96) is not an available horizontal coordinate definition in the standard installation of ArcCatalog v.9.3.)</useconst>

<ptcontac>

<cntinfo>

<cntorgp>

<cntorg>Woolpert, Inc.</cntorg>

</cntorgp>

<cntpos>Geospatial</cntpos>

<cntaddr>

<addrtype>mailing and physical address</addrtype>

<address>125 Fairchild Streeet, Suite 120</address>

<city>Charleston</city>

<state>SC</state>

<postal>29492-7505</postal>

<country>USA</country>

</cntaddr>

<cntvoice>(843) 216-0401</cntvoice>

<cntfax>(843) 216-0405</cntfax>

<hours>8:00 a.m. to 5:00 p.m. Eastern Time</hours>

</cntinfo>

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<attraccr>The LiDAR data for this task order met the National Standard for Spatial Database Accuracy (NSSDA) accuracy standards. The NSSDA standards specify that vertical accuracy be reported at the 95 percent confidence level for data tested by an independent source of higher accuracy.</attraccr>

<qattracc>

<attraccv>0.17'</attraccv>

<attracce>Tested 0.17 feet vertical accuracy at 95 percent confidence level.</attracce>

</qattracc>

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<logic>Compliance with the accuracy standard was validated by the collection of GPS ground control points during the acquisition of LiDAR. The following checks were performed. - The LiDAR DEM data was checked against the project ground control. The technical staff confirmed the accuracy of the points during initial processing. Airborne GPS was also utilized during processing. The LiDAR flight lines have been examined to ensure that there was at least 75% sidelap, there are no gaps between flightlines, and overlapping flightlines have consistent elevation values. Shaded relief images have been visually inspected for data errors such as pits, border artifacts, gaps, and shifting. The data was examined at a 1:3000 scale.</logic>

<complete>The following methods are used to assure LiDAR accuracy. - Use of IMU and ground control network utilizing GPS techniques. - Use of airborne GPS in conjunction with the imagery and LiDAR acquisition. - The following software is used for validation of the surface modeling - LiDAR DEM Data - Terrascan, TerraModeler, Leica - MicroStation - ESRI - ArcInfo - ERDAS Imagine - Woolpert Proprietary software</complete>

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<horizpar>For this task order, horizontal accuracy checks of the individual LiDAR points was not applicable.</horizpar>

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<qvertpa>

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<procdesc>LiDAR Data Acquisition. The LiDAR data was collected in September-October, 2010. The survey utilized a Leica ALS50 Phase II mounted in a Cessna Caravan 208. Near nadir scan angles were used to increase penetration of vegetation to ground surfaces. Ground level GPS and aircraft IMU were collected during the flight.</procdesc>

<procdate>20101223</procdate>

<proccont>

<cntinfo>

<cntorgp>

<cntorg>Woolpert, Inc.</cntorg>

</cntorgp>

<cntpos>Geospatial</cntpos>

<cntaddr>

<addrtype>mailing and physical address</addrtype>

<address>125 Fairchild Street, Suite 120</address>

<city>Charleston</city>

<state>SC</state>

<postal>29492</postal>

</cntaddr>

<cntvoice>(843)-216-0401</cntvoice>

<cntfax>(843)-216-0405</cntfax>

<hours>8:00 a.m. to 5:00 p.m. Eastern Time</hours>

</cntinfo>

</proccont>

</procstep>

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<procdesc>LiDAR Data Processing. 1. Flight lines and data were reviewed to ensure complete coverage of the task order area and positional accuracy of the laser points. 2. Laser point return coordinates were computed using ALS Post Processing software, based on independent data from the LiDAR system, IMU, and aircraft. 3. The raw LiDAR file was assembled into flight lines per return with each point having an associated x, y, and z coordinate. 4. Visual inspection of swath to swath laser point consistencies within the study area were used to perform manual refinements of system alignment. 5. Custom algorithms were designed to evaluate points between adjacent flight lines. Automated system alignment was computed based upon randomly selected swath to swath accuracy measurements that consider elevation, slope, and intensities. Specifically, refinement in the combination of system pitch, roll and yaw offset parameters optimize internal consistency. 6. Noise (e.g., pits and birds) was filtered using ALS postprocessing software, based on known elevation ranges and included the removal of any cycle slips. 7. Using TerraScan and Microstation, ground classifications utilized custom settings appropriate to the study area. 8. The corrected and filtered return points were compared to RTK ground survey points collected to verify the vertical accuracies. 9. Ground classified point density is sampled for each processing tile at 1-foot resolution. Resulting values are integer values as they represent a true count of ground classified points (i.e. they are not averaged or interpolated values.) Ground classified point density is output as ascii text and converted to ESRI raster format. This process determined unclassified data (Class 1), bare-earth points (Class 2), noise (Class 7), water (Class 9) and ignored ground (Class 10).</procdesc>

<procdate>20101223</procdate>

<proccont>

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 <cntorgp>

 <cntorg>U.S. Geological Survey</cntorg>

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 <cntaddr>

 <addrtype>Mailing and physical address</addrtype>

 <address>Customer Services</address>

 <address>U.S. Geological Survey</address>

 <address>EROS Data Center</address>

 <address>47914 252nd Street</address>

 <city>Sioux Falls</city>

 <state>SD</state>

 <postal>57198-0001</postal>

 <country>US</country>

 </cntaddr>

 <cntvoice>1-800-252-4547</cntvoice>

 <cnttdd>1-605-594-6933</cnttdd>

 <cntfax>1-605-594-6589</cntfax>

 <cntemail>custserv@usgs.gov</cntemail>

 <hours>Monday through Friday 8:00 AM to 4:00 PM (Central Time)</hours>

 <cntinst> The above is the contact information for EROS Data Center in

 Sioux Falls, SD. this is the digital data storage and distribution

 center for the USGS. For best service, identify your question

 as related to "CLICK Lidar Data".

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