

**AMENDMENT NUMBER FIVE
TO
AGREEMENT
BY AND BETWEEN
COUNTY OF LOS ANGELES
AND
PICTOMETRY INTERNATIONAL CORP.
FOR
DIGITAL AERIAL DATA**

This Amendment Number Five (hereinafter "Amendment") is entered on this Dec. 12, day of 2019, by and between the County of Los Angeles, a political subdivision of the State of California (hereinafter "County"), and Pictometry International Corp, a Delaware corporation (hereinafter "Contractor") and amends that certain Agreement for Digital Aerial Data dated December 3, 2013 (hereinafter "Agreement").

WHEREAS, County and Contractor entered into the Agreement, which was approved and executed by County's Board of Supervisors on December 3, 2013; and

WHEREAS, the Agreement was amended by Amendment One, approved by the County's Board of Supervisors on March 16, 2015, to increase the Maximum Contract Sum; and

WHEREAS, the Agreement was amended by Amendment Two, approved by the County's Board of Supervisors on March 8, 2016, to further increase the Maximum Contract Sum; and

WHEREAS, the Agreement was amended by Change Notice Twelve on September 13, 2016, pursuant to the Board's delegated authority to transfer the administration of the Agreement from the CIO to the Internal Services Department ("ISD"); and

WHEREAS, the Agreement was amended by Amendment Three on May 18, 2017, to extend the term of the Agreement for the first of three optional extensions for one (1) four-year term to acquire additional digital aerial data products under the Agreement accordingly by delegated authority to ISD pursuant to Paragraph 4.3 (Amendments) of the Agreement; and

WHEREAS, the Agreement was amended by Amendment Four on May 22, 2019, to increase the Maximum Contract Sum accordingly by delegated authority to ISD pursuant to Paragraph 4.3 (Amendments) of this Agreement; and

WHEREAS, the Parties wish to further amend the Agreement to extend the term of the Agreement for the second of three optional extensions for one (1) four-year term to acquire additional digital aerial data products under the Agreement accordingly by delegated authority to ISD pursuant to Paragraph 4.3 (Amendments) of the Agreement; and

WHEREAS, the Parties also wish to further amend the Agreement to increase the Maximum Contract Sum under the Agreement accordingly by delegated authority to ISD pursuant to Paragraph 4.3 (Amendments) of the Agreement.

NOW, THEREFORE, in consideration of the foregoing the Parties agree as follows:

1. The Agreement is hereby incorporated by reference, and all of its terms and conditions, including capitalized terms defined therein, shall be given full force and effect as if fully set forth herein.

2. The person executing this Amendment on behalf of Contractor is an authorized agent who has actual authority to bind Contractor to each and every term, condition, and obligation of this Amendment No. 5 and all requirements of Contractor have been fulfilled to provide such actual authority.
3. Paragraph 8.1 (Maximum Contract Sum) of the Agreement is hereby deleted in its entirety and replaced with revised Paragraph 8.1 (Maximum Contract Sum) to read as follows:

8.1 MAXIMUM CONTRACT SUM

The Contract Sum under this Agreement shall be the total monetary amount payable by County to Contractor for supplying all the tasks, subtasks, deliverables, goods, services and other Work required or requested by County under this Agreement. All Work completed by Contractor must be approved in writing by County in accordance with Paragraph 2.4. If County does not approve Work in writing, no payment shall be due Contractor for that Work. The Contract Sum, including all applicable taxes and Pool Dollars, authorized by County hereunder shall not exceed Eleven Million, Three Hundred Fifty-Two Thousand, Five Hundred Ninety-One Dollars and Ninety Cents (\$11,352,591.90), as further detailed in Section 5 (Scope of Work - Schedule of Payments) of Exhibit A (Scope of Work), unless the Contract Sum is modified pursuant to a duly approved Amendment to this Agreement by County's and Contractor's authorized representative(s) pursuant to Paragraph 4 (Change Notices and Amendments). The Contract Sum under this Agreement shall cover the authorized payments for all Work provided by Contractor, including the Required Work and any Optional Work.

4. Exhibit A (Scope of Work), Exhibit A.1 (Statement of Work – Oblique Images for Digital Aerial Data), Exhibit A.2 (Statement of Work – Orthogonal Images for Digital Aerial Data), and Exhibit A.3 (Statement of Work – Building Representations for Digital Aerial Data) to the Agreement are hereby deleted in its entirety and replaced with revised Exhibit A (Scope of Work), Exhibit A.1 (Statement of Work – Oblique Images for Digital Aerial Data), Exhibit A.2 (Statement of Work – Orthogonal Images for Digital Aerial Data), and Exhibit A.3 (Statement of Work – Building Representations for Digital Aerial Data) attached hereto.
5. Except as provided in this Amendment Number Five, all other terms and conditions of the Agreement shall remain unchanged and in full force and effect.

IN WITNESS WHEREOF, County and Contractor by their duly authorized signatures have caused this Amendment Number Five to be entered into on the day, month and year first above written.

COUNTY OF LOS ANGELES:
INTERNAL SERVICES DEPARTMENT


SIGNATURE

Christie Carr


NAME

Contract Manag

TITLE
12/12/2019
06:40 PM PST

DATE

CONTRACTOR:
PICTOMETRY INTERNATIONAL, CORP.

DocuSigned by:

SIGNATURE

Brian Brockmann

NAME

Corporate Vice President

TITLE

12/5/2019

DATE

APPROVED AS TO FORM:
MARY C. WICKHAM
County Counsel

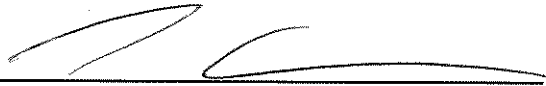
By 
MICHAEL OWENS
Deputy County Counsel

EXHIBIT A
SCOPE OF WORK
FOR
DIGITAL AERIAL DATA

1. GENERAL

1.1 INTRODUCTION

This Exhibit A (Scope of Work) consists of tasks, subtasks, deliverables, goods, services and other work the selected Contractor shall be required to provide around the period from December 2019 through December 2022, weather and Air Traffic Control (ATC) permitting.

The following Exhibits are attached to and form part of this Scope of Work:

1. Exhibit A.1 (Statement of Work – Oblique Images)
2. Exhibit A.2 (Statement of Work – Orthogonal Images)
3. Exhibit A.3 (Statement of Work – Building Representations)
4. Exhibit A.4 (Statement of Work – Digital Terrain Data)

1.2 SCOPE OF WORK AND DELIVERABLES

1.2.1 REQUIRED WORK

Contractor shall deliver the following digital mapping products (Digital Aerial Data) under this Scope of Work, as described in Exhibits A.1 through A.4 to this Exhibit A.

1. Oblique Images: See Exhibit A.1 (Statement of Work – Oblique Images) to this Exhibit A.
2. Orthogonal Images: See Exhibit A.2 (Statement of Work – Orthogonal Images) to this Exhibit A.
3. Building Representations: See Exhibit A.3 (Statement of Work - Building Representations) to this Exhibit A.
4. Digital Terrain Data: See Exhibit A.4 (Statement of Work – Digital Terrain Data) to this Exhibit A.

1.2.2 OPTIONAL WORK

County may from time to time, during the term of the Agreement, submit to Contractor written requests for Optional Work relating to the Licensed Products or Licensed Services, including any type of Digital Aerial Data, as further provided in Paragraph 5.2 (Optional Work) of the Base Agreement and the corresponding Tasks and Deliverables in each of Exhibits A.1 through A.4 of this Exhibit A.

1.2.3 APPROVAL OF WORK

All Work must be approved by County, as evidenced by County's Project Manager and County's Project Director, as provided in Paragraph 2.4 (Approval of Work) of the Base Agreement.

1.3 DEFINITIONS

The capitalized terms listed below that are used throughout this Exhibit A shall have the definitions given to such terms in this Exhibit A. All other capitalized terms used in this Exhibit A without definitions shall have the meanings given to such terms in the Agreement, as applicable.

1. Building Representation

The term "Building Representation" shall have the meaning specified in Exhibit A.3 (Statement of Work – Building Representations).

2. Community Image(s)

The term “Community Image” shall have the meaning specified in Exhibit A.1 (Statement of Work – Oblique Images).

3. Digital Elevation Model (DEM)

The terms “Digital Elevation Model” and “DEM” shall have the meaning specified in Exhibit A.4 (Statement of Work – Digital Terrain Data).

4. Digital Surface Model (DSM)

The terms “Digital Surface Model” and “DSM” shall have the meaning specified in Exhibit A.4 (Statement of Work – Digital Terrain Data).

5. Digital Terrain Model (DTM)

The terms “Digital Terrain Model” and “DTM” shall have the meaning specified in Exhibit A.4 (Statement of Work – Digital Terrain Data).

6. Images

The term “Image(s)”, whether singular or plural, shall mean digital images, automatically captured from airborne platforms without geo-referencing.

7. LiDAR Point Cloud

The term “LiDAR Point Cloud” shall have the meaning specified in Exhibit A.4 (Statement of Work – Digital Terrain Data).

8. Neighborhood Image

The term “Neighborhood Image” shall have the meaning specified in Exhibit A.1 (Statement of Work – Oblique Images).

9. Primary Site

The term “Primary Site” shall have the meaning specified in Exhibit A.1 (Statement of Work – Oblique Images).

10. Planimetric Feature

The term “Planimetric Feature” shall have the meaning specified in Exhibit A.3 (Statement of Work – Building Representations).

11. Oblique Images

The term “Oblique Image” shall mean an oblique digital image (including vector trapezoids), automatically captured and geo-referenced from airborne platforms in accordance with Exhibit A.1 (Statement of Work – Oblique Images).

12. Project Area 1; Area 1

The terms “Project Area 1” and “Area 1” shall mean the “urban” areas of Los Angeles County encompassing approximately 2,898 square miles and Santa Catalina Island, an island off the coast of Los Angeles County encompassing approximately 75 square miles, as set forth in Section 1.7 (Reference Maps) of Exhibit A.2 (Statement of Work – Orthogonal Images).

13. Project Area 2; Area 2

The terms “Project Area 2” and “Area 2” shall mean the national forest areas of Los Angeles County encompassing approximately 1,056 square miles, as set forth in Section 1.7

(Reference Maps) of Exhibit A.2 (Statement of Work – Orthogonal Images).

4. Sector

The terms “Image Sector” and “Sector” shall have the meaning specified in Exhibit A.1 (Statement of Work – Oblique Images).

2. QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC PROCESS)

All finished products and final deliverables under this Agreement will be subject to systematic Quality Assurance and Quality Control (“QA/QC”), which will be done by an independent photogrammetric firm, whose services will be solicited by County in conjunction with the Agreement.

For this purpose, the County and cooperating cities/agencies (Participating Entities) will prepare a set of “hidden” control points, which will be used by the above mentioned firm(s). Also, County and Participating Entities will do additional random QA/QC to assure that all received products are in compliance with specified technical specifications and standards.

3. LICENSING

All finished products and final deliverables (excluding access to the Licensed Services) will be perpetually licensed to County upon completion of the Work in accordance with the License terms set forth in Paragraphs 10.1 (Scope of License for Licensed Products) through 10.4 (Software Updates) of the Base Agreement.

The Licensed Services shall be subject to the License terms set forth in Paragraph 10.5 (License for Licensed Services) of the Base Agreement.

4. DATA PROVIDED BY COUNTY

1. County will make available the following countywide information to Contractor:

- a) LAR-IAC Project Area Boundaries (shapefile format)
- b) Detailed County/City Boundaries (for orientation only - shapefile format)
- c) Grid for project tiles (shapefile format)
- d) Oblique Aerial Digital Imagery 1 sq. mile sector grid (for orientation only – shapefile format)
- e) Boundary of Urban Canyons “Downtown Areas” high-rise areas (shapefile format)
- f) Parcel vector database (for orientation only – shapefile format)
- g) Existing control cadastral monuments (shapefile format)
- h) Existing LAR-IAC deliverables in various formats as mutually agreed upon (ie. DTM and/or DSM, first generation 4” ortho imagery)
- i) Proposed Delivery Areas (shapefile format)
- j) Proposed Mosaic Tile Areas (shapefile format)
- k) Boundary of locations that could potentially have large changes in elevation (ie. Significant grading) that would affect ortho imagery rectification
- l) Other relevant GIS layers mutually determined by the Contractor and County.

2. Digital Elevation Data (from LiDAR and stereo compilation) provided by County for Contractor will be in ESRI raster format in California State Plane Coordinate System, Zone 5, NAD83, NAVD88.

3. All vector data sets provided by County for Contractor will be in ESRI shapefile format in California State Plane Coordinate System, Zone 5, NAD83, U.S. Survey Feet.
4. County will be responsible for:
 - a) Assignment of all point numbers;
 - b) Provision of blank monument record forms;
 - c) Providing the County Survey Monuments digital files.

5. SCHEDULE OF PAYMENTS

The Contract Sum includes amounts allocated for the following components of Work to be provided by Contractor to County during the term of the Agreement:

	Initial Phase	Phase 2	Phase 3
Scope of Work – Oblique Images	\$1,169,057.50	\$1,219,057.50	\$1,154,952.00
Scope of Work – Orthogonal Images	\$757,038.35	\$1,016,144.60	\$2,153,863.95
Scope of Work – Building Representations	\$135,000	\$200,000.00	\$180,000.00
Scope of Work – Digital Terrain Data	\$1,617,478.00	\$0	\$0
Optional Work (Pool Dollars)	\$500,000.00	\$650,000.00	\$600,000.00
PHASE SUBTOTAL	\$4,178,573.85	\$3,085,202.10	\$4,088,815.95
TOTAL MAXIMUM CONTRACT SUM	\$11,352,591.90		

EXHIBIT A.1
SCOPE OF WORK – OBLIQUE IMAGES
FOR
DIGITAL AERIAL DATA

SECTION 1 – STATEMENT OF WORK

[Insert Exhibit A.1 (Statement of Work – Oblique Images)]

SECTION 2 – SCHEDULE OF DELIVERABLES AND PAYMENTS

2.1 DELIVERABLES

Contractor shall complete the Required Work Deliverables, including all Tasks and Subtasks associated therewith as specified in the applicable Statement of Work, by the associated Due Dates listed below.

Initial Phase:

DELIVERABLE NUMBER	DESCRIPTION	AMOUNT	DUE DATE*
1	Provided and Configured Software	\$0	July 1, 2014
2	Provided Hosted Solution	\$0	July 1, 2014
3	Provided Oblique Images	\$0	July 1, 2014
4	Technical Support, Documentation and Training	\$0	n/a
5	Final Acceptance	50% of Total Cost (\$584,528.75)	September 1, 2014
	Second Year Payment due	50% of Total Cost (\$584,528.75)	July 1, 2015
6	Optional Work	TBD	n/a

* Due dates are approximate and dependent on image capture and processing. Such capture dates may be affected by weather conditions and/or Air Traffic Control.

Phase 2:

DELIVERABLE NUMBER	DESCRIPTION	AMOUNT	DUE DATE*
1	Provided and Configured Software	\$0	July 1, 2017
2	Provided Hosted Solution	\$0	July 1, 2017
3	Provided Oblique Images	\$0	July 1, 2017
4	Technical Support, Documentation and Training	\$0	n/a
5	Final Acceptance	50% of Total Cost (\$534,528.75)	March 31, 2018
	Second Year Payment due	50% of Total Cost (\$534,528.75)	July 1, 2018
6	Optional Work	TBD	n/a

* Due dates are approximate and dependent on image capture and processing. Such capture dates may be affected by weather conditions and/or Air Traffic Control.

Phase 3:

DELIVERABLE NUMBER	DESCRIPTION	AMOUNT	DUE DATE*
1	Provided and Configured Software	\$0	July 1, 2020
2	Provided Hosted Solution	\$150,000	July 1, 2020
3	Provided Oblique Images	\$0	July 1, 2020
4	Technical Support, Documentation and Training	\$12,495.00	February 1, 2020
5	Final Acceptance	50% of Total Cost (\$496,228.50)	March 31, 2021
	Second Year Payment due	50% of Total Cost (\$496,228.50)	July 1, 2021
6	Optional Work	TBD	n/a

* Due dates are approximate and dependent on image capture and processing. Such capture dates may be affected by weather conditions and/or Air Traffic Control.

All invoices shall be prepared and paid in accordance with the terms of the Agreement. In the event Contractor fails to achieve Final Acceptance by the due date above, County will assess credits for delay as described in Paragraph 6.4 (Credits for Delays) of the Base Agreement.

2.2 PAYMENT TERMS

The fee components for the Required Work relating to Oblique Images under this Agreement are as follows:

Initial Phase:

TASK	DESCRIPTION	QUANTITY	UNIT COST	COST
1.1	Provide Desktop Software	1	\$0	\$0
1.2	Provide ArcGIS Extension Software	1	\$0	\$0
1.3	Provide Ability to View Existing Oblique Images	1	\$0	\$0
1.4	Provide Other Software	1	\$0	\$0
1.5	Provide Public Safety Answering Point Support	1	\$0	\$0
2.1	Provide Hosted Solution	2 years	\$50,000	\$100,000
2.2	Provide Application Programming Interface	1	\$0	\$0
2.3	Maintain GIS Layers for Hosted Solution	1	\$0	\$0
	SUBTOTAL FOR TASKS 1 & 2			\$100,000
3	Community 2-Way Oblique images (Area 1 – Urban)	3075	\$45	\$138,375
	Community 4-Way Oblique images (Catalina)	107	\$45	\$4,815
	Neighborhood 4-Way Oblique images	3182	\$275	\$875,050
	Community 2-Way Oblique images (Area 2 – National Forest)	1031.5	\$45	\$46,417.50

TASK	DESCRIPTION	QUANTITY	UNIT COST	COST
	Neighborhood 8-Way Oblique images	16	\$275	\$4,400
	SUBTOTAL FOR TASK 3			\$1,069,057.50
4	Provide Technical Support, Documentation and Training		n/a	\$0
5	Correct Image Deficiencies – Final Acceptance		n/a	\$0
6	Provide Optional Work		\$	\$0
	IMAGING COST			\$1,169,057.50

Phase 2:

TASK	DESCRIPTION	QUANTITY	UNIT COST	COST
1.1	Provide Desktop Software	1	\$0	\$0
1.2	Provide ArcGIS Extension Software	1	\$0	\$0
1.3	Provide Ability to View Existing Oblique Images	1	\$0	\$0
1.4	Provide Other Software	1	\$0	\$0
1.5	Provide Public Safety Answering Point Support	1	\$0	\$0
2.1	Provide Hosted Solution	3 years	\$50,000	\$150,000
2.2	Provide Application Programming Interface	1	\$0	\$0
2.3	Maintain GIS Layers for Hosted Solution	1	\$0	\$0
	SUBTOTAL FOR TASKS 1 & 2			\$150,000
3	Community 2-Way Oblique images (Area 1 – Urban)	3075	\$45	\$138,375
	Community 4-Way Oblique images (Catalina)	107	\$45	\$4,815
	Neighborhood 4-Way Oblique images	3182	\$275	\$875,050
	Community 2-Way Oblique images (Area 2 – National Forest)	1031.5	\$45	\$46,417.50
	Neighborhood 8-Way Oblique images	16	\$275	\$4,400
	SUBTOTAL FOR TASK 3			\$1,069,057.50
4	Provide Technical Support, Documentation and Training		n/a	\$0
5	Correct Image Deficiencies – Final Acceptance		n/a	\$0
6	Provide Optional Work		\$	\$0
	IMAGING COST			\$1,219,057.50

Phase 3:

TASK	DESCRIPTION	QUANTITY	UNIT COST	COST
1.1	Provide Desktop Software	1	\$0	\$0
1.2	Provide ArcGIS Extension Software	1	\$0	\$0
1.3	Provide Ability to View Existing Oblique Images	1	\$0	\$0

TASK	DESCRIPTION	QUANTITY	UNIT COST	COST
1.4	Provide Other Software	1	\$0	\$0
1.5	Provide Public Safety Answering Point Support	1	\$0	\$0
2.1	Provide Hosted Solution	3 years	\$50,000	\$150,000.00
2.2	Provide Application Programming Interface	1	\$0	\$0
2.3	Maintain GIS Layers for Hosted Solution	1	\$0	\$0
	SUBTOTAL FOR TASKS 1 & 2			\$150,000.00
3	Community 2-Way Oblique images (Area 1 – Urban)	3075	\$42	\$129,150.00
	Community 4-Way Oblique images (Catalina)	107	\$42	\$4,494.00
	Neighborhood 4-Way Oblique images	3182	\$255	\$811,410.00
	Community 2-Way Oblique images (Area 2 – National Forest)	1031.5	\$42	\$43,323.00
	Neighborhood 8-Way Oblique images	16	\$255	\$4,080.00
	SUBTOTAL FOR TASK 3			\$992,457.00
4	Provide Technical Support, Documentation and Training	5	\$2,499	\$12,495.00
5	Correct Image Deficiencies – Final Acceptance		n/a	\$0
6	Provide Optional Work		\$	\$0
	SUBTOTAL FOR TASK 4			\$12,495.00
	IMAGING COST			\$1,154,952.00

2.3 OPTIONAL WORK

Optional Work, including any Optional Products and Optional Services, shall be provided by Contractor in accordance with Paragraph 5.2 (Optional Work) of the Base Agreement. The discounts granted by Contractor for such Optional Work shall be no less than the discounts guaranteed by Contractor for the Required Work.

EXHIBIT A.2
SCOPE OF WORK – ORTHOGONAL IMAGES
FOR
DIGITAL AERIAL DATA

SECTION 1 – STATEMENT OF WORK

[Insert Exhibit A.2 (Statement of Work – Orthogonal Images)]

SECTION 2 – SCHEDULE OF DELIVERABLES AND PAYMENTS

2.1 DELIVERABLES

Contractor shall complete the Required Work Deliverables, including all Tasks and Subtasks associated therewith as specified in the applicable Statement of Work, by the associated Due Dates listed below.

Initial Phase:

DELIVERABLE NUMBER	DESCRIPTION	AMOUNT	DUE DATE*
1	Project Work Plan	10%	January 1, 2014
2	Geodetic Control and Pre-Marking	0%	April 1, 2014
3	Aerial Triangulation	20%	March 1, 2014
4	DTM Updates – Project Area 1	0%	July 1, 2014
5	Ortho Imagery (True Color) – Project Area 1	30%	July 1, 2014
6	Ortho Imagery (True Color) – Project Area 2	10%	July 1, 2014
7	DTM Updates – Project Area 2	0%	July 1, 2014
8	Final Acceptance	30%	September 15, 2014

* Due dates are approximate and dependent on image capture and processing. Such capture dates may be effected by weather conditions and/or Air Traffic Control.

**N/A indicates that scope of work is included for reference only

Phase 2:

DELIVERABLE NUMBER	DESCRIPTION	AMOUNT	DUE DATE*
1	Project Work Plan	10%	January 31, 2017
2	Geodetic Control and Pre-Marking	0%	April 1, 2017
3	Aerial Triangulation	20%	June 30, 2017
4	DTM Updates – Project Area 1	0%	N/A
5	Ortho Imagery (True Color with Near Infra-Red) – Project Area 1	30%	November 15, 2017
6	Ortho Imagery (True Color with Near Infra-Red) – Project Area 2	10%	November 15, 2017
7	DTM Updates – Project Area 2	0%	N/A
8	Final Acceptance	30%	March 31, 2018

* Due dates are approximate and dependent on image capture and processing. Such capture dates may be effected by weather conditions and/or Air Traffic Control.

**N/A indicates that scope of work is included for reference only

Phase 3:

DELIVERABLE NUMBER	DESCRIPTION	AMOUNT	DUE DATE*
1	Project Work Plan	10%	January 1, 2020
2	Geodetic Control and Pre-Marking	0%	April 1, 2020
3	Aerial Triangulation	20%	September 30, 2020
4	DTM Updates – Project Area 1	0%	N/A
5	Ortho Imagery (True Color with Near Infra-Red) – Project Area 1	30%	November 30, 2020
6	Ortho Imagery (True Color with Near Infra-Red) – Project Area 2	10%	November 30, 2020
7	DTM Updates – Project Area 2	0%	N/A
8	Final Acceptance	30%	March 31, 2021
9	Additional Orthogonal Capture Projects	100%	January 15, 2021 July 15, 2021, January 15, 2022 July 15, 2022, December 31, 2022

* Due dates are approximate and dependent on image capture and processing. Such capture dates may be effected by weather conditions and/or Air Traffic Control.

**N/A indicates that scope of work is included for reference only

All invoices shall be prepared and paid in accordance with the terms of Agreement. In the event Contractor fails to achieve Final Acceptance by the due date above, County may assess credits for delay as described in Paragraph 6.4 (Credits for Delays) of the Base Agreement.

2.2 PAYMENT TERMS

The fee components for the Required Work relating to Orthogonal Images under this Agreement are as follows:

Initial Phase:

TASK	DESCRIPTION	COST
1	Develop Project Work Plan	\$0
2	Provide Geodetic Control and Pre-Marking	\$35,200
3	Perform Aerial Triangulation	\$180,000
4	Provide DTM Updates – Project Area 1	\$18,829
5	Generate Ortho Imagery (True Color) – Project Area 1	\$479,435.60
6	Generate Ortho Imagery (True Color) – Area 2	\$37,472.75
7	Provide DTM Updates – Project Area 2	\$6,101
	Total	\$757,038.35

Phase 2:

TASK	DESCRIPTION	COST
1	Develop Project Work Plan	\$0
2	Provide Geodetic Control and Pre-Marking	\$35,200
3	Perform Aerial Triangulation	\$386,500
4	Provide DTM Updates – Project Area 1	N/A**
5	Generate Ortho Imagery with Near Infra-Red – Project Area 1	\$551,350.94
6	Generate Ortho Imagery with Near Infra-Red– Area 2	\$43,093.66
7	Provide DTM Updates – Project Area 2	N/A**
	Total	\$1,016,144.60

**N/A indicates that scope of work is included for reference only

Phase 3:

TASK	DESCRIPTION	COST
1	Develop Project Work Plan	\$0
2	Provide Geodetic Control and Pre-Marking	\$62,389.80
3	Perform Aerial Triangulation	\$386,500.00
4	Provide DTM Updates – Project Area 1	N/A**
5	Generate Ortho Imagery with Near Infra-Red – Project Area 1	\$495,127.33
6	Generate Ortho Imagery with Near Infra-Red – Project Area 2	\$38,690.82
7	Provide DTM Updates – Project Area 2	N/A**
8	Correct Image Deficiencies	N/A**
9	Provide Optional Work	N/A**
10	Additional Orthogonal Capture Project 1	\$211,400.00
10	Additional Orthogonal Capture Project 2	\$211,400.00
11	Additional Orthogonal Capture Project 3 (with Near Infra-Red) (Optional)	\$249,452.00
11	Additional Orthogonal Capture Project 4 (with Near Infra-Red) (Optional)	\$249,452.00
11	Additional Orthogonal Capture Project 5 (with Near Infra-Red) (Optional)	\$249,452.00
	Total	\$2,153,863.95

**N/A indicates that scope of work is included for reference only

2.3 OPTIONAL WORK

Optional Work, including any Optional Products and Optional Services, shall be provided by Contractor in accordance with Paragraph 5.2 (Optional Work) of the Base Agreement. The

discounts granted by Contractor for such Optional Work shall be no less than the discounts guaranteed by Contractor for the Required Work.

EXHIBIT A.3
SCOPE OF WORK – BUILDING REPRESENTATIONS
FOR
DIGITAL AERIAL DATA

SECTION 1 – STATEMENT OF WORK

[Insert Exhibit A.3 (Statement of Work – Building Representations)]

SECTION 2 – SCHEDULE OF DELIVERABLES AND PAYMENTS

2.1 DELIVERABLES

Contractor shall complete the Required Work Deliverables, including all Tasks and Subtasks associated therewith as specified in the applicable Statement of Work, by the associated Due Dates listed below.

Initial Phase:

DEL	TITLE	TOTAL COST	DUE DATE*
1	Project Work Plan	\$0	December 21, 2013
2	Final Acceptance	\$135,000	August 1, 2014
3	Optional Work		
3.1			
3.2			
3.3			

* Actual due dates are dependent on the Agreement Effective Date and image capture and processing. Such capture dates may be effected by weather conditions and/or Air Traffic Control.

Phase 2:

DEL	TITLE	TOTAL COST	DUE DATE*
1	Project Work Plan		TBD
2	Final Acceptance	TBD	TBD
3	Optional Work		
3.1			
3.2			
3.3			

* Actual due dates are dependent on the effective date of Amendment No. 3 to the Agreement and image capture and processing. Such capture dates may be effected by weather conditions and/or Air Traffic Control.

Phase 3:

DEL	TITLE	TOTAL COST	DUE DATE*
1	Project Work Plan	0%	January 1, 2020
2	Update Building Representations	100%	TBD

* Actual due dates are dependent on the effective date of Amendment No. 5 to the Agreement and image capture and processing. Such capture dates may be affected by weather conditions and/or Air Traffic Control.

All invoices shall be prepared and paid in accordance with the terms of Agreement. In the event Contractor fails to achieve Final Acceptance by the due date above, County may assess credits for delay as described in Paragraph 6.4 (Credits for Delay) of the Base Agreement.

2.2 PAYMENT TERMS

The fee components for the Required Work relating to Building Representations under this Agreement are as follows:

Initial Phase:

DEL	TITLE	TOTAL COST
1	Project Work Plan	\$0
2	Final Acceptance	\$135,000
3	Optional Work	
3.1		
3.2		
3.3		

Phase 2:

DEL	TITLE	TOTAL COST
1	Project Work Plan	
2	Final Acceptance	\$200,000*
3	Optional Work	
3.1		
3.2		
3.3		

* Price is to be determined following selection of a subcontractor, not to exceed \$200,000.00.

Phase 3:

DEL	TITLE	TOTAL COST
1	Project Work Plan	
2	Final Acceptance	\$180,000

2.3 OPTIONAL WORK

Optional Work, including any Optional Products and Optional Services, shall be provided by Contractor in accordance with Paragraph 5.2 (Optional Work) of the Base Agreement. The discounts granted by Contractor for such Optional Work shall be no less than the discounts guaranteed by Contractor for the Required Work.

EXHIBIT A.4
SCOPE OF WORK – DIGITAL TERRAIN DATA
FOR
DIGITAL AERIAL DATA

SECTION 1 – STATEMENT OF WORK

[Insert Exhibit A.4 (Statement of Work – Digital Terrain Data)]

SECTION 2 – SCHEDULE OF DELIVERABLES AND PAYMENTS

2.1 DELIVERABLES

Contractor shall complete the Required Work Deliverables, including all Tasks and Subtasks associated therewith as specified in the applicable Statement of Work, by the associated Due Dates listed below.

Initial Phase:

DELIVERABLE NUMBER	DESCRIPTION	AMOUNT	DUE DATE*
1	Project Work Plan	10%	TBD
2	Digital Terrain Datasets – Project Area 1	20%	TBD
3	1 Foot Contours – Project Area 1	20%	TBD
4	Digital Terrain Datasets – Project Area 2	15%	TBD
5	2 Foot Contours – Project Area 2	15%	TBD
6	Final Acceptance	20%	TBD
7	Optional Work	TBD	TBD

* Due dates are approximate and dependent on image capture and processing. Such capture dates may be effected by weather conditions and/or Air Traffic Control.

Phase 2:

DELIVERABLE NUMBER	DESCRIPTION	AMOUNT	DUE DATE*
1	Project Work Plan	10%	TBD
2	Digital Terrain Datasets – Project Area 1	20%	TBD
3	1 Foot Contours – Project Area 1	20%	TBD
4	Digital Terrain Datasets – Project Area 2	15%	TBD
5	2 Foot Contours – Project Area 2	15%	TBD
6	Final Acceptance	20%	TBD
7	Optional Work	TBD	TBD

* Due dates are approximate and dependent on image capture and processing. Such capture dates may be effected by weather conditions and/or Air Traffic Control.

Phase 3:

DELIVERABLE NUMBER	DESCRIPTION	AMOUNT	DUE DATE*
1	Project Work Plan	10%	TBD
2	Digital Terrain Datasets – Project Area 1	20%	TBD

3	1 Foot Contours – Project Area 1	20%	TBD
4	Digital Terrain Datasets – Project Area 2	15%	TBD
5	2 Foot Contours – Project Area 2	15%	TBD
6	Final Acceptance	20%	TBD
7	Optional Work	TBD	TBD

* Due dates are approximate and dependent on image capture and processing. Such capture dates may be affected by weather conditions and/or Air Traffic Control.

All invoices shall be prepared and paid in accordance with the terms of Agreement. In the event Contractor fails to achieve Final Acceptance by the due date above, County may assess credits for delay as described in Paragraph 6.4 (Credits for Delay) of the Base Agreement.

2.2 PAYMENT TERMS

Initial Phase:

TASK		DESCRIPTION	PRICE
Task 1	Develop Project Work Plan	County approved Project Work Plan	\$0
Task 2	Provide Digital Terrain Datasets (DSM, DTM and DEM) – Project Area 1	Costs of acquisition and production of digital terrain data from LIDAR.	\$1,065,970
Task 3	Generate Contours with One Foot Interval – Project Area 1	Costs of production of 1 foot contour data from Digital Terrain data	\$175,010
Task 4	Provide Digital Terrain Datasets (DSM, DTM and DEM) – Project Area 2	Costs of acquisition and production of digital terrain data from LIDAR.	\$226,930
Task 5	Generate Contours with Two Foot Interval – Project Area 2	Costs of production of 2 foot contour data from Digital Terrain data	\$30,945
Task 6	Correct Digital Terrain Data Deficiencies	Correction of Deficiencies identified by County during the Warranty Period	\$0
		TOTAL	\$1,498,855

Phase 2:

TASK		DESCRIPTION	PRICE
Task 1	Develop Project Work Plan	County approved Project Work Plan	TBD
Task 2	Provide Digital Terrain Datasets (DSM, DTM and DEM) – Project Area 1	Costs of acquisition and production of digital terrain data from LIDAR.	TBD
Task 3	Generate Contours with One Foot Interval – Project Area 1	Costs of production of 1 foot contour data from Digital Terrain data	TBD

TASK		DESCRIPTION	PRICE
Task 4	Provide Digital Terrain Datasets (DSM, DTM and DEM) – Project Area 2	Costs of acquisition and production of digital terrain data from LIDAR.	TBD
Task 5	Generate Contours with Two Foot Interval – Project Area 2	Costs of production of 2 foot contour data from Digital Terrain data	TBD
Task 6	Correct Digital Terrain Data Deficiencies	Correction of Deficiencies identified by County during the Warranty Period	TBD
		TOTAL	TBD

Phase 3:

TASK		DESCRIPTION	PRICE
Task 1	Develop Project Work Plan	County approved Project Work Plan	TBD
Task 2	Provide Digital Terrain Datasets (DSM, DTM and DEM) – Project Area 1	Costs of acquisition and production of digital terrain data from LIDAR.	TBD
Task 3	Generate Contours with One Foot Interval – Project Area 1	Costs of production of 1 foot contour data from Digital Terrain data	TBD
Task 4	Provide Digital Terrain Datasets (DSM, DTM and DEM) – Project Area 2	Costs of acquisition and production of digital terrain data from LIDAR.	TBD
Task 5	Generate Contours with Two Foot Interval – Project Area 2	Costs of production of 2 foot contour data from Digital Terrain data	TBD
Task 6	Correct Digital Terrain Data Deficiencies	Correction of Deficiencies identified by County during the Warranty Period	TBD
		TOTAL	TBD

2.3 OPTIONAL WORK

Optional Work, including any Optional Products and Optional Services, shall be provided by Contractor in accordance with Paragraph 5.2 (Optional Work) of the Base Agreement. The discounts granted by Contractor for such Optional Work shall be no less than the discounts guaranteed by Contractor for the Required Work.

EXHIBIT A.1

**STATEMENT OF WORK – OBLIQUE IMAGES
FOR
DIGITAL AERIAL DATA**

SECTION 1 – STATEMENT OF WORK

1.1 GENERAL

1.1.1 INTRODUCTION

Contractor shall deliver under this Statement of Work Oblique Images collected around the period from approximately December 2019 through April 2020 for each imagery acquisition cycle, weather and Air Traffic Control (ATC) permitting. Definitions and specifications in this Statement of Work are consistent with earlier acquisitions and should be used as guidelines for this project.

1.1.2 DEFINITIONS

In addition to the terms defined in the Base Agreement, the following definitions shall apply throughout this Exhibit A.1 (Statement of Work – Oblique Images):

1. Community Image(s)

The term “Community Image(s)”, whether singular or plural, shall mean a set of images that cover the entire Sector from two (2) or four (4) opposing oblique angles unless rapid elevation changes prohibit flight lines in two (2) directions. Each image will be acquired from an airborne platform at a height above the ground required to meet the GSD and coverage requirements for an area of approximately one (1) square mile.

2. Neighborhood Image(s)

The term “Neighborhood Image(s)”, whether singular or plural, shall mean a set of overlapping, oblique images blanketing an entire Sector, providing for a higher degree of detail. Each image will be acquired from an airborne platform at a height above the ground required to meet the GSD and coverage requirements for an area of approximately one-tenth (0.1) square miles.

3. Primary Site

The term “Primary Site” shall mean the site designated by County for Delivery.

4. Sector(s)

The terms “Image Sector(s)” and “Sector(s)”, whether singular or plural, shall mean a collection of oblique digital images, automatically captured from airborne platforms using Contractor’s hardware and software capture system but without geo-referencing, as further described in this Exhibit A.1.

1.2 TASKS AND DELIVERABLES

TASK 1 – PROVIDE AND CONFIGURE SOFTWARE

SUBTASK 1.1 – PROVIDE DESKTOP SOFTWARE

Contractor shall provide desktop software providing access to oblique imagery meeting the specifications described in Section 1.3 (Image Requirements) and Section 1.5 (Supporting Software Requirements) of this Exhibit A.1. Upon provision, County shall copy the desktop Software from Contractor’s storage media to the County server.

SUBTASK 1.2 – PROVIDE ARCGIS EXTENSION SOFTWARE

Contractor shall provide the latest version of the ESRI ArcGIS Extension Software, meeting the specifications described in Section 1.3 (Image Requirements) and Section 1.5 (Supporting Software Requirements) of this Exhibit A.1.

SUBTASK 1.3 – PROVIDE ABILITY TO VIEW EXISTING OBLIQUE IMAGES

Contractor shall provide desktop software providing access to oblique imagery meeting the specifications described in Section 1.3 (Image Requirements) and Section 1.5 (Supporting Software Requirements) of this Exhibit A.1. Upon provision, County shall copy the desktop Software from Contractor's storage media to the County server.

SUBTASK 1.4 – PROVIDE OTHER SOFTWARE

Contractor shall provide the latest version of other software applications developed as mutually agreed upon (such as SOAP or AJAX solutions, configuration tools, etc.) meeting the specifications described in Section 1.3 (Image Requirements) and Section 1.5 (Supporting Software Requirements) of this Exhibit A.1.

SUBTASK 1.5 – PROVIDE PUBLIC SAFETY ANSWERING POINT SUPPORT

Contractor shall provide support to County and County's Public Safety Answering Point (PSAP) system vendors for the integration of Contractor's Image library with PSAP systems installed by County. Contractor shall provide training in the initial training sessions for these processes and telephone support to County for questions during installation. Contractor shall provide the necessary Software Licenses to allow the integration to function. For integrations, the PSAP system vendors will perform the integration of their system with the installed Contractor's Image library, while Contractor shall provide telephone support for the PSAP system vendors performing integration of their system with Contractor's installed Image library.

DELIVERABLE 1 – PROVIDED AND CONFIGURED SOFTWARE

Contractor shall provide and configure Software in accordance with Task 1 (Provide and Configure Software) with all Subtasks thereto.

TASK 2 – PROVIDE HOSTED SOLUTION

SUBTASK 2.1 – PROVIDE HOSTED SOLUTION

Contractor shall provide a hosted imagery access solution which will enable the creation of a number of Organizational entities, each with unlimited users, representing County Departments and Authorized Entities, as identified by County. This solution will meet the specifications described in Section 1.5.5 (Hosted Software) of this Exhibit A.1.

SUBTASK 2.2 – PROVIDE APPLICATION PROGRAMMING INTERFACE

Contractor shall provide to County an Application Programming Interface (API), including license, which will allow County and/or its agents to access Oblique Images hosted by Contractor through 3rd party applications. This solution will

meet the specifications described in Section 1.5.5 (Hosted Software) of this Exhibit A.1.

SUBTASK 2.3 – MAINTAIN GIS LAYERS FOR HOSTED SOLUTION

Contractor shall make GIS layers provided by the County and Participating Entities available in the hosted solution. This will allow LAR-IAC participants to view these GIS Layers on top of the Oblique Images hosted by Contractor. Contractor will provide a mechanism for LAR-IAC participants to upload and configure their own GIS layers.

DELIVERABLE 2 – PROVIDED HOSTED SOLUTION

Contractor shall successfully provide the hosted solution for Oblique Images in accordance with Task 2 (Provide Hosted Solution) with all Subtasks thereto.

TASK 3 – PROVIDE OBLIQUE IMAGES

Contractor shall provide the Licensed Images meeting the specifications described in Section 1.3 (Image Requirements) of this Exhibit A.1 below. Upon completion of Images, County will copy the Images from Contractor's media to the County server on Primary Site (via a network connection). Contractor shall use the data transport method specified by County for providing and installing the Images.

DELIVERABLE 3 – FINAL ACCEPTANCE

Contractor shall successfully complete and provide Images in accordance with Task 3 (Provide Oblique Images).

TASK 4 – PROVIDE TECHNICAL SUPPORT, DOCUMENTATION AND TRAINING

SUBTASK 4.1 – PROVIDE TECHNICAL SUPPORT

Contractor shall provide up to twenty (20) hours of technical support to the support contacts for County and the Authorized Entities as identified by County. Technical support beyond the limit set forth in this Subtask 4.1 may be provided as Optional Services using Pool Dollars pursuant to Task 6 (Provide Optional Work).

SUBTASK 4.2 – PROVIDE TECHNICAL DOCUMENTATION

Contractor shall furnish to County the latest Documentation for latest versions of Licensed Software and shall update such Documentation during the term of the Base Agreement.

SUBTASK 4.3 – PROVIDE TRAINING

Contractor shall conduct, at a minimum:

- 1) Four (4) 4-hour "End-User" orientation sessions (maximum of 25 attendees per session) via on-line tools such as *GoToMeeting*.
- 2) One (1) 3-hour "Administrator" training to teach LAR-IAC IT and GIS support staff how to install, configure, and support Contractor's desktop software and hosted solutions via on-line tools such as *GoToMeeting*.

- 3) Four (4) advanced technical training sessions (maximum of 15 attendees per session), using on-line tools such as *GoToMeeting*, that will last three (3) hours each.
- 4) Optionally, County may replace training sessions above with customized online training of the same duration.
- 5) Contractor shall provide five (5) seats for training conference. Must be redeemed within three years of Amendment execution date.

DELIVERABLE 4 – TECHNICAL SUPPORT, DOCUMENTATION AND TRAINING

Contractor shall successfully provide technical support, Documentation and training in accordance with Task 4 (Provide Technical Support, Documentation and Training) with all Subtasks thereto.

TASK 5 – CORRECT IMAGE DEFICIENCIES

Contractor shall correct all Image Deficiencies identified by County within the Warranty Period, as further described in Paragraph 6.3.2 (Correction of Deficiencies) of the Base Agreement.

DELIVERABLE 5 – FINAL ACCEPTANCE

Final Acceptance shall be reached when Contractor has successfully corrected all Image Deficiencies pursuant to Task 5 (Correct Image Deficiencies).

TASK 6 – PROVIDE OPTIONAL WORK

SUBTASK 6.1 – PROVIDE OPTIONAL PRODUCTS

If requested and approved by County, Contractor shall provide to County software, tools, images and other products related to the Licensed Products at rates and fees agreed to by the parties. The Optional Products shall be provided in accordance with Paragraph 5.2 (Optional Work) of the Base Agreement.

SUBTASK 6.2 – PROVIDE OPTIONAL SERVICES

If requested and approved by County, Contractor shall provide to County on-site implementation support, additional training and other consulting services related to the Licensed Products, at County facilities or at Contractor's location, at rates and fees agreed to by the parties. The Optional Services shall be provided in accordance with Paragraph 5.2 (Optional Work) of the Base Agreement.

DELIVERABLE 6 – OPTIONAL WORK

Contractor shall successfully provide Optional Work, including Optional Products and Optional Services, in accordance with Task 6 (Provide Optional Work).

1.3 IMAGE REQUIREMENTS

1.3.1 DESCRIPTION

1. Sufficient Sectors of Community 2-Way Images to cover 3309 square miles of the County as indicated in Section 1.7 (Reference Maps) of this Exhibit A.1. Each Sector will have 4 Oblique Images collected, 2 each from two opposing directions over that Sector where elevation conditions permit. Images shall be procured with a minimum camera pixel count to support **1-foot** front-line resolution.

2. Sufficient Sectors of **Community 4-Way** Images to cover 139 square miles of the County as indicated on in Section 1.7 (Reference Maps) of this Exhibit A.1. Each Sector will have approximately 12 Oblique Images collected, 3 from each approximate cardinal direction over that Sector where elevation conditions permit. Images shall be procured with a minimum camera pixel count to support **1-foot** front-line resolution.
3. Sufficient Sectors of **Community 2-Way** Images to 967 square miles of the County as indicated in Section 1.7 (Reference Maps) of this Exhibit A.1. Each Sector will have 6 Oblique Images collected, 3 each from two opposing directions over that Sector where elevation conditions permit. Images shall be procured with a minimum camera pixel count to support **1-foot** front-line resolution.
4. Sufficient Sectors of **Neighborhood 4-Way** Images to the portion of the County as designated on in Section 1.7 (Reference Maps) of this Exhibit A.1. Variances in the number of Images per Sector might occur due to restricted airspace, elevation changes, temporary mechanical failure and environmental occurrences. Over the course of the project it is expected that the average number of Images will be approximately 100 Images per Sector and that all efforts will be made to meet/exceed this standard. Images shall be procured with a minimum camera pixel count to support **4-inch** front-line resolution.
5. Sufficient Sectors of **Neighborhood 8-Way** Images to cover the portion of the County as designated on in Section 1.7 (Reference Maps) of this Exhibit A.1. Variances in the number of Images per Sector might occur due to restricted airspace, elevation changes, temporary mechanical failure and environmental occurrences. Over the course of the project it is expected that the average number of Images will be approximately 200 Images per Sector and that all efforts will be made to meet/exceed this standard. Each of the eight views will vary in azimuth by approximately 45 degrees from its nearest neighbors. Images shall be procured with a minimum camera pixel count to support **4-inch** front-line resolution.
6. Contractor will deliver shapefiles representing the oblique footprint of each image trapezoid in California State Plane Coordinate System, Zone V, NAD 83, and U.S. Survey Feet.

1.3.2 IMAGE SPECIFICATIONS

1. DIGITAL SPECIFICATIONS

Images shall to be delivered with a compression ratio of approximately 6:1 and a per image size of approximately 5-7 MB for Oblique Images. Imagery specifications below are from earlier acquisitions and should be used as guidelines for image capture.

a. Community Oblique

Image sensor: 4,872 x 3,250 pixels

Footprint (Nominal):

Front Line: 4,754 feet / 1,447 meters

Back Line: 6,682 feet / 2,036 meters

Front to Back: 5,932 feet / 1,808 meters

Resolution (Nominal):

Front Line: 0.98 feet/pixel 0.30 meters/pixel

Back Line: 1.37 feet/pixel 0.42 meters/pixel

b. Neighborhood Oblique

Image sensor: 4,872 x 3,250 pixels

Footprint (Nominal):

Front Line: 1,600 feet / 488 meters

Back Line: 2,254 feet / 687 meters

Front to Back: 2,000 feet / 610 meters

Resolution (Nominal):

Front Line: 0.33 feet/pixel 0.10 meters/pixel

Back Line: 0.46 feet/pixel 0.14 meters/pixel

2. EXPORT

a. *Image Export:* JPEG

With associated geography file for import into GIS. The proprietary image format can be directly read into GIS packages that can import JPEG files or the file can be converted to any of the following image formats (TIFF or BMP).

b. *Geo-data Export:* Delineated text files or ESRI shapefiles

Geo-data may be exported as points, lines, poly-lines, or polygons to a delineated text file or ESRI shapefile for import into GIS.

1.4 ACCEPTANCE CRITERIA

1.4.1 TECHNICAL SPECIFICATIONS

Licensed Images shall be governed by the following technical specifications:

1. Shapefiles of image trapezoids and rectangles – Some quality control will be done on oblique image trapezoids to ensure coverage of entire County in four directions (for neighborhood shots) and two or four directions (for community shots). Provide image rectangles of ortho images captured for the entire County.
2. DEM data derived from LiDAR (and stereo compilation for National Forest areas) stored as part of Neighborhood and Community Oblique Imagery will be vertically and horizontally similar with DEM data transferred by County to Contractor. Quality Control will randomly select easily identifiable points in the ortho imagery and oblique imagery and compare the data with the original DEM.
3. County Quality Control will compare spatial consistency between shapefiles for parcels and Neighborhood Oblique Imagery. Only clearly identifiable parcel lines (such as fences, edges of roadways, etc.) will be compared with their equivalents on the imagery. The linear difference is expected to be within 2 to 5 meters as demonstrated in the three sample data sets. In cases of dispute between County and

Contractor, County will provide GPS data confirming that the vector data or related construction are the precise location (+/- 1 foot) as were transferred to Contractor. From 64 total Neighborhood Images, only 2% does not need to meet these specifications but only in the case where there is another overlapping Neighborhood Image, which could replace the “defective” Image, as further described in Section 1.4.3 (Image Quality) below.

4. Visual quality of all Oblique Imagery is expected to be the same or better quality than was presented for previous LAR-IAC projects and as further described in Sections 1.4.2 (Image Format), 1.4.3 (Image Quality) and 1.4.4 (Accuracy) below. Sample imagery from the first few days of flying may be gathered based on imagery collection capture and provided to the County for their review.

1.4.2 IMAGE FORMAT

Proprietary Image trailer tacked onto industry standard image format. Images may be exported to a number of formats. If applicable, County DEM with up to 0.7 m spacing will be included in Image trailer. Contractor will work County to provide the most practicable postings (5m spacing may be used in National Forest areas). Testing will be done for tessellated ground plane based on provided DEM.

1.4.3 IMAGE QUALITY

Images will have clear views of the ground and will be free from obstruction by clouds; however, there may be occasional cloud and other shadows. In controlled airspace, around airports, etc., the image resolutions may vary. Quality of Images will be comparable to images from previous LAR-IAC projects given comparable resolutions.

1.4.4 ACCURACY

Neighborhood Oblique Images:

1. Relative Image Accuracy: Expected to be within approximately 5 meters or less over 1,000 meters. This standard assumes an accurate DEM.
2. Benchmark Accuracy: Expected to be in accordance with three (3) sample Sectors delivered by Contractor and reviewed in benchmark by County (proposed for February 2008). Observed accuracy of neighborhood oblique imagery to be within 2m from “GPS verified ground true location.” This standard assumes an accurate DEM.
3. Sensor Positional Accuracy: 30 cm absolute
4. Sensor Directional Accuracy: 0.01 degrees absolute

1.5 SUPPORTING SOFTWARE REQUIREMENTS

1.5.1 DESKTOP SOFTWARE

Contractor shall provide a sophisticated aerial imaging solution that allows end-users to have high-resolution images of neighborhoods, landmarks, roads, and complete municipalities at the click of a mouse.

Desktop Software shall have the following minimal capabilities:

1. Distance Tool – measure lengths, widths, and perimeters
2. Height Tool – determine the height of any feature

3. Location Tool – obtain geo-coordinates of items in the image
4. Area Tool – Measure acreage or square footage of any area
5. Elevation Tool – Access ground elevation
6. Bearing Tool – Determine directional (from True North) location
7. Select Tool – locate by client supplied data such a street address, tax account number or coordinates
8. Link Tool – link an unlimited amount of additional data/text per image
9. Text Annotation Tool – describe features within an image
10. Line Drawing Tool – draw straight or free-form lines to highlight a feature
11. Circle Drawing Tool – create circular boundaries/perimeters from specific locations
12. Navigate Tool – allows for easy navigation through your image warehouse by opening next adjacent image in approximate scale and same direction.
13. Search by Address Tool – ability to search from pre-defined queries of parcel address data.
14. Zoom – zoom in and out of all images
15. Search – search GIS data and address information and zoom to features that have been found.
16. GIS Data Overlay - display GIS shapefile format data on top of oblique imagery.
17. Export – export oblique imagery for use for display and other purposes.
18. Export to GIS - export orthogonal images with corresponding coordinate mapping files for use with GIS.

1.5.2 ARCGIS EXTENSION

Contractor shall supply Software extension to Environmental Systems Research Institute (ESRI®) ArcGIS Desktop and ArcGIS Pro that will enable users to access the oblique imagery with measurement tools inside of ESRI's latest ArcGIS desktop software (currently ArcMap version 10.6 and ArcGIS Pro 2.1).

1.5.3 CHANGE ANALYSIS

Contractor shall supply Software that enables users to compare imagery of an area over time in a side-by-side configuration. As an example, a user could type in an address or search on a map and see images from 2014 side-by-side with imagery from 2008. The user can then easily view and detect changes to properties and land over time. This application can be used with Pictometry oblique and orthogonal imagery from 2003, 2006, 2008, 2011, 2014, 2017, and 2020 (upon completion) under perpetual license from Pictometry International, as well as with any existing geo-referenced orthogonal imagery that the user may have.

1.5.4 OTHER SOFTWARE

Other software could include SOAP or AJAX solutions or configuration tools as mutually agreed upon by Contractor and LA County.

1.5.5 HOSTED SOFTWARE

1. HOSTED ONLINE ACCESS

Contractor shall deliver a hosted online access solution that uses HTTP and standard internet technologies to provide web-based access to the oblique aerial imagery acquired by the LAR-IAC and under perpetual license from Pictometry International Corp. Contractor will host and make the Oblique Images available to LAR-IAC participants through their **hosted online access** product. Contractor shall make best effort to ensure solution will be available 99.9% of the time. If County determines availability is not acceptable, Contractor shall allow termination of this subscription. The solution shall allow access to all prior LAR-IAC Oblique Images (2003, 2006, 2008, 2011, 2014, and 2017) under perpetual license from Pictometry.

The solution will include the following capabilities:

a. LAR-IAC Master Account

The LAR-IAC master account shall provide the ability to:

1. Create/delete/update sub-organizations within the LAR-IAC project.
2. Create/delete/update users both within its organization and within sub-organizations.
3. Upload and manage GIS layers that shall be stored within the contractor's computer systems, and displayed on the oblique imagery in the hosted solution.

b. Sub-Organization:

Each sub-organization will represent a LAR-IAC participating agency or its delegate, and enable the participant to establish user accounts that have common startup and data overlay requirements. An example would be an individual LAR-IAC Participating Entity. When a user from that city logs into the hosted solution, he/she will be presented with that entity's selected GIS layers and starting point. Each group will have an administrator who can work with Contractor to provide and select those layers, and add or remove named accounts from the group. County will work with Participating Entities to assign an administrator for each sub-organization. The administrator will work with Contractor to establish the GIS data layers and starting location for that group. Contractor will develop and provide a work flow to LAR-IAC participants to administer their GIS layers and workspace. The administrator will be able to update the data layers at any time during the period covering this Statement of Work.

c. Named Users:

Contractor's hosted solution will provide an unlimited number of individual named accounts, assigned to either the LAR-IAC master account or a Sub-Organization. Each of these accounts can save its session and then return in the future to continue working. Contractor will track the number of individuals logged in, and be able to limit the total number of concurrent users logged in. There will be a globally configured timeout for users that are not active.

d. Generic user:

Contractor's hosted solution will enable the creation of one or more generic users for each organization. The generic user login will allow multiple concurrent logins on that account. This login will show users GIS layers to be managed by each organization's administrator. The generic user account will not allow the saving of sessions/workspaces.

2. APPLICATION PROGRAMMING INTERFACE (API)

Contractor will develop capabilities that enable connectivity for an unlimited number of concurrent unnamed web-based users to APIs that will be used for embedding hosted functionality into other web-based systems (e.g. Latitude Geographics). The total number of "hits" will be tracked. A "hit" is defined as loading a single image, and doing all functions (panning, zooming, overlays) within that image. Contractor will create a different key for each 3rd party vendor or Web application and track usage for each key. Contractor will provide a monthly report detailing the total number of "hits" as well as the hits by API key. Contractor will provide documentation on the API to County, participants, and their vendors as required. The API will allow LAR-IAC participants to make the functionality available to the public without the measurement tools or workspaces. The API will allow 3rd party vendors to integrate GIS data layers onto the Oblique Images. At the end of the period covered under this Statement of Work, Contractor will provide a usage report detailing the number of hits for all LAR-IAC third party vendors and Web applications.

Contractor shall provide all updates of its API software to County during the term of the Agreement.

1.5.6 OPERATING PLATFORMS

The Desktop software shall run on most Windows platforms such as Windows XP, Vista, Windows 7, 2003 or 2008 Server.

1.6 COUNTY OBLIGATIONS

1.6.1 SYSTEM REQUIREMENTS

County will provide the following:

1. Contractor will ship storage media (storage appliance, server, single PC) for data to be transferred in-house to County systems. Contractor will avoid opening up County's PCs or servers, or attaching external hard drives to County's PCs or servers, with the exception of the use of Fire Wire or storage appliance, for which County must install an interface prior to Contractor delivering the data.
2. County will also make available on County server enough disk storage space to accommodate the Licensed Images and Licensed Software. This is estimated to be approximately 3.5 TB. County will also provide a 100 Mb/s network link to the server.
3. County shall also have installed and operational ArcGIS software meeting the specifications described in Section 1.5.2 (ArcGIS Extension) of this Exhibit A.1.

1.6.2 COUNTY RESPONSIBILITIES

1. County will make available the following countywide information to Contractor at the following URL: <http://egis3.lacounty.gov/dataportal/lariac/lar-iac4/rfp-data/>

- a) LAR-IAC6 Project Areas (shapefile format)
 - b) Detailed County/City Boundary (shapefile format)
 - c) Oblique Aerial Digital Imagery 1 sq. mile sector grid (for orientation only – shapefile format)
 - d) Digital Elevation Data based on LiDAR (Area 1) and stereo compilation (Area 2) from current or previous LAR-IAC Projects.
- 2. Digital Elevation Data provided by County for Contractor will be in ESRI raster format in California State Plane Coordinate System, Zone 5, NAD83, NAVD88.
 - 3. All vector data sets provided by County for Contractor will be in ESRI shapefile format in California State Plane Coordinate System, Zone 5, NAD83, U.S. Survey Feet.
 - 4. County shall be responsible for selecting Authorized Users who are qualified to operate the Licensed Software and are familiar with the information, calculations, and reports that serve as input and output of the Licensed Software.

1.7 REFERENCE MAPS

1.7.1 IMAGERY GRID AND CAPTURE TYPES

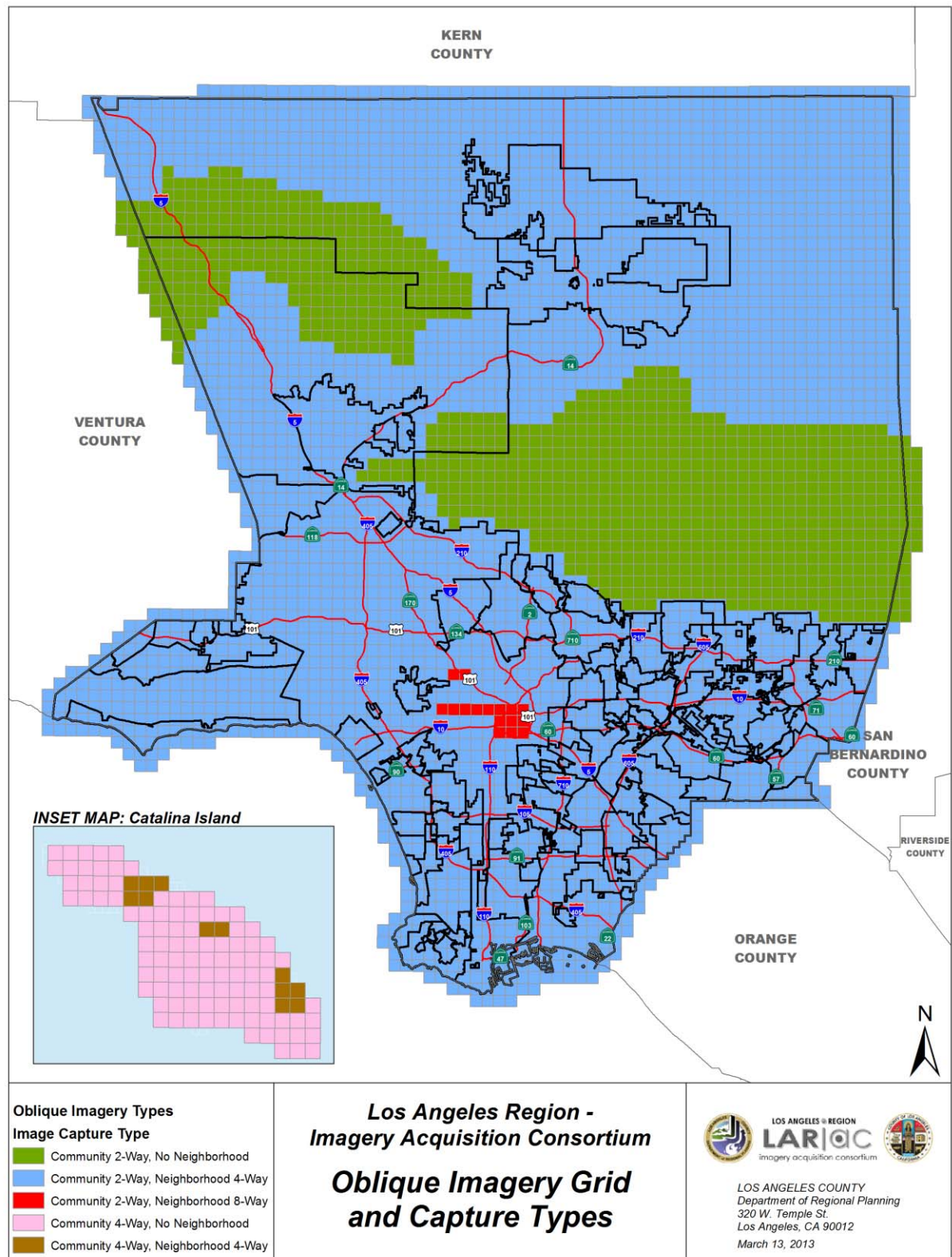


EXHIBIT A.2
STATEMENT OF WORK – ORTHOGONAL IMAGES
FOR
DIGITAL AERIAL DATA

SECTION 1 – STATEMENT OF WORK

1.1 GENERAL

1.1.1 INTRODUCTION

Contractor shall deliver under this Statement of Work Orthogonal Images collected from approximately December 2019 through April 2020 (and as applicable for additional orthogonal captures) for each imagery acquisition cycle, weather and Air Traffic Control (ATC) permitting.

1.1.2 DEFINITIONS

In addition to the terms defined in the Base Agreement, the following definitions shall apply throughout this Exhibit A.2 (Statement of Work – Orthogonal Images): No additional definitions.

1.2 TASKS AND DELIVERABLES

TASK 1 – DEVELOP PROJECT WORK PLAN

Contractor shall review and analyze the Image Requirements for the Orthogonal Images to be provided under this Agreement and develop a Project Work Plan, which shall be used to accomplish the following:

1. Guide project planning;
2. Document project planning assumptions and constraints;
3. Document project-planning decisions regarding alternatives chosen;
4. Facilitate communication between project stakeholders;
5. Define key management reviews as to content, extent and timing; and
6. Provide a baseline for progress measurement and project control.

DELIVERABLE 1 – PROJECT WORK PLAN

Contractor shall provide for County approval a Project Work Plan document in Word and Portable Document Format (PDF) developed in accordance with Task 1 (Develop Project Work Plan).

TASK 2 – PROVIDE GEODETIC CONTROL AND PRE-MARKING

If it is determined to be necessary by Contractor, Contractor shall be responsible for up to four hundred (400) additional ground control points, which Contractor deems necessary to perform the photogrammetric mapping. Contractor should utilize the surveying methodology that provides the most cost effective method of generating any control required to support the photogrammetric mapping. Any survey control generated for this project will be provided as a deliverable to County and shall comply at a minimum with the following requirements:

1. Ground control acquisition shall be overseen and approved by a California Licensed Surveyor, who shall affix a signature and seal to approve all ground control reports.
2. The survey shall utilize existing durable cadastral monuments, which can be referenced on a recorded document (tract map, parcels maps or record of

survey) as control monuments wherever possible. Where no cadastral monument exists the Contractor will set a durable monument.

3. Horizontal accuracy shall be consistent with Second Order, Class I, i.e. ninety-five percent (95%) confidence interval of 2 cm base error and 20 parts per million linear errors.
4. Vertical accuracy shall be third order.
5. Survey shall be constrained to National Geodetic Survey (NGS) First Order control monuments, Epoch date 2010.0
6. All GPS surveys will follow procedures spelled out in NOAA Technical Memorandum NOS NGS-58 (Guidelines for establishing GPS-derived ellipsoid heights, 2 cm accuracy)
7. A monument record form shall be prepared for each point providing a description of the monument as well as its location.
8. Vertical datum shall be NAVD88. All vertical stations set will be tied directly to NGS monuments whose orthometric height was determined by differential leveling and adjusted by the NGS on, or after June 1995.
9. Units shall be U.S. Survey Feet.
10. All coordinates will conform to the California Coordinate System of 1983, Zone5. Longitude and latitude will be based on the North American Datum of 1983(2011).

DELIVERABLE 2 – GEODETIC CONTROL AND PRE-MARKING

Contractor shall provide the following Deliverables in accordance with Task 2 (Provide Geodetic Control and Pre-Marking):

- 2.1 Approval of all Geodetic Control reports by signature and seal from a California Licensed Surveyor.
- 2.2 ArcGIS shapefiles with cadastral monuments as points (with geodetic data as attributes).
- 2.3 GPS observation data in RINEX format.
- 2.4 Record Forms for cadastral monuments.
- 2.5 ASCII comma-delimited file, Point Number, Northing, Easting, orthometric height, description
- 2.6 ASCII comma-delimited file, Point Number, longitude, latitude, ellipsoid height, orthometric height, description

TASK 3 – PERFORM AERIAL TRIANGULATION

Contractor shall perform aerial triangulation to support planimetric topographic mapping for deliverables required under this Agreement as well as the update of the Digital Terrain Model (DTM) data. Aerial triangulation shall comply with the following requirements:

1. Aerial Triangulation shall be overseen and approved by a California Licensed Surveyor, who shall affix a signature and seal to approve to final aerial triangulation solutions.
2. The aerial triangulation shall be performed using a bundle adjustment.
3. The RMS of control and tie points in the final block adjustment shall be in the order of 10 microns.
4. The RMS derived by comparison of survey check points not used in the block adjustment with aerial triangulation results shall not exceed 12 microns at digital photo scale

DELIVERABLE 3 – AERIAL TRIANGULATION

Contractor shall provide the following Deliverables in accordance with Task 3 (Perform Aerial Triangulation):

- 3.1 Approval of all Aerial Triangulation information by signature and seal from a California Licensed Surveyor.
- 3.2 Block adjustment printout showing all statistical data pertaining to the adjustment.
- 3.3 ASCII files containing coordinate values of aerial triangulation points.
- 3.4 PATB output containing model settings.

TASK 4 – PROVIDE DTM UPDATES – PROJECT AREA 1

Contractor shall produce Digital Terrain Model (DTM) updates for *Project Area 1* to support generation and rectification of ortho imagery in the event that an imagery acquisition cycle does not include a new LIDAR-based digital terrain data. The DTM updates shall be produced from stereo compilation and shall comply with the following requirements:

1. The DTM spacing shall be 5 foot or less.

DELIVERABLE 4 – DTM UPDATES – PROJECT AREA 1

Contractor shall provide the following Deliverables in accordance with Task 4 (Provide DTM Updates – Project Area 1):

- 4.1 Project documentation outlining procedures and data collected, and reports of accuracy evaluation.
- 4.2 Bare-earth DTM incorporating the terrain updates in ArcGIS grid format
- 4.3 FGDC compliant metadata.

TASK 5 (OPTION A) – GENERATE ORTHO IMAGERY (TRUE COLOR) – PROJECT AREA 1

Contractor shall generate Orthogonal Images with four inch pixel resolution for *Project Area 1* using Deliverables 1 (Project Work Plan), 2 (Geodetic Control and Pre-Marking) and 3 (Aerial Triangulation), which shall meet the following requirements:

1. Ortho imagery shall be true color (three bands – RGB);

2. Ortho imagery over large water bodies shall be color balanced to ensure uniform and visually consistent water;
3. Ortho imagery shall be color balanced and seamlessly mosaicked;
4. Ortho rectification process shall incorporate bridge elevation data;
5. Ortho imagery will be tiled to specific grid system (the same grid used for the LAR-IAC with slight modifications proposed by County); and
6. Ortho imagery files will be processed in NAD83, CA State Plane Coordinate System, Zone 5, US Survey Feet.

DELIVERABLE 5A – ORTHO IMAGERY (TRUE COLOR) – PROJECT AREA 1

Contractor shall provide the following Deliverables in accordance with Task 5A (Generate Ortho Imagery – Project Area 1):

5.A.1 The three-band ortho imagery shall be delivered in Geo-TIFF file format upon approval by County.

5.A.2 FGDC compliant metadata.

TASK 5 (OPTION B) – GENERATE ORTHO IMAGERY WITH NEAR INFRA-RED – PROJECT AREA 1

Contractor shall generate Orthogonal Images with four inch pixel resolution for *Project Area 1* using Deliverables 1 (Project Work Plan), 2 (Geodetic Control and Pre-Marking) and 3 (Aerial Triangulation), which shall meet the following requirements:

1. Ortho imagery shall be four bands, with the first three bands being true color (RGB) and the fourth band being Near Infrared (NIR);
2. Ortho imagery over large water bodies shall be color balanced to ensure uniform and visually consistent water;
3. Ortho imagery shall be color balanced and seamlessly mosaicked;
4. Ortho rectification process shall incorporate bridge elevation data;
5. Ortho imagery will be tiled to specific grid system (the same grid used for the LAR-IAC with slight modifications proposed by County); and
6. Ortho imagery files will be processed in NAD83(2011), CA State Plane Coordinate System, Zone 5, US Survey Feet.

DELIVERABLE 5B – ORTHO IMAGERY WITH NEAR INFRA-RED – PROJECT AREA 1

Contractor shall provide the following Deliverables in accordance with Task 5A (Generate Ortho Imagery – Project Area 1):

5.B.1 The four-band ortho imagery shall be delivered in Geo-TIFF file format upon approval by County. The hosted solution will provide access to only the three band RGB imagery.

5.B.2 FGDC compliant metadata.

TASK 6 (OPTION A) – GENERATE ORTHO IMAGERY (TRUE COLOR) – PROJECT AREA 2

Contractor shall generate Orthogonal Images with nine inch pixel resolution for *Project Area 2* using Deliverables 1 (Project Work Plan), 2 (Geodetic Control and Pre-Marking) and 3 (Aerial Triangulation), which shall meet the following requirements:

1. Ortho imagery shall be true color (three bands – RGB);
2. Ortho imagery over large water bodies shall be color balanced to ensure uniform and visually consistent water;
3. Ortho imagery shall be color balanced and seamlessly mosaicked;
4. Ortho rectification process shall incorporate bridge elevation data;
5. Ortho imagery will be tiled to specific grid system (the same grid used for the LAR-IAC with slight modifications proposed by County); and
6. Ortho imagery files will be processed in NAD83(2011), CA State Plane Coordinate System, Zone 5, US Survey Feet.

DELIVERABLE 6A – ORTHO IMAGERY (TRUE COLOR) – PROJECT AREA 2

Contractor shall provide the following Deliverables in accordance with Task 6 (Generate Ortho Imagery – Project Area 2):

- 6.A.1** The three-band ortho imagery shall be delivered in Geo-TIFF file format upon approval by County.
- 6.A.2** FGDC compliant metadata.

TASK 6 (OPTION B) – GENERATE ORTHO IMAGERY WITH NEAR INFRA-RED – PROJECT AREA 2

Contractor shall generate Orthogonal Images with nine inch pixel resolution for *Project Area 2* using Deliverables 1 (Project Work Plan), 2 (Geodetic Control and Pre-Marking) and 3 (Aerial Triangulation), which shall meet the following requirements:

1. Ortho imagery shall be four bands, with the first three bands being true color (RGB) and the fourth band being Near Infrared (NIR);
2. Ortho imagery over large water bodies shall be color balanced to ensure uniform and visually consistent water;
3. Ortho imagery shall be color balanced and seamlessly mosaicked;
4. Ortho rectification process shall incorporate bridge elevation data;
5. Ortho imagery will be tiled to specific grid system (the same grid used for the LAR-IAC with slight modifications proposed by County); and
6. Ortho imagery files will be processed in NAD83(2011), CA State Plane Coordinate System, Zone 5, US Survey Feet.

DELIVERABLE 6B – ORTHO IMAGERY WITH NEAR INFRA-RED – PROJECT AREA 2

Contractor shall provide the following Deliverables in accordance with Task 6B (Generate Ortho Imagery with Near Infra-Red) – Project Area 2):

6.B.1 The four-band ortho imagery shall be delivered in Geo-TIFF file format upon approval by County. (NOTE: Only three band RGB imagery will be made available via the online hosted solution.)

6.B.2 FGDC compliant metadata.

TASK 7 – PROVIDE DTM UPDATES – PROJECT AREA 2

Contractor shall produce Digital Terrain Model (DTM) updates for *Project Area 2* to support generation and rectification of ortho imagery in the event that an imagery acquisition cycle does not include a new LIDAR-based digital terrain data. The DTM updates shall be produced by using automatic stereo compilation and shall comply with the following requirements:

1. The DTM spacing shall be 5 meters or less.

DELIVERABLE 7 – DTM UPDATES – PROJECT AREA 2

Contractor shall provide the following Deliverables in accordance with Task 7 (Provide DTM Updates – Project Area 2):

- 7.1** Project documentation outlining procedures and data collected, and reports of accuracy evaluation.
- 7.2** Bare-earth DTM incorporating the last return data in ArcGIS raster format.
- 7.3** FGDC compliant metadata.

TASK 8 – CORRECT IMAGE DEFICIENCIES

Contractor shall correct all Image Deficiencies identified by County within the Warranty Period, as further described in Paragraph 6.3.2 (Correction of Deficiencies) of the Base Agreement of Appendix A (Required Agreement) to the RFP.

DELIVERABLE 8 – FINAL ACCEPTANCE

Final Acceptance shall be reached when Contractor has corrected all Image Deficiencies pursuant to Task 8 (Correct Image Deficiencies).

TASK 9 – PROVIDE OPTIONAL WORK

SUBTASK 9.1 – PROVIDE OPTIONAL PRODUCTS

If requested and approved by County, Contractor shall provide to County software, tools, images and other products related to the Licensed Products at the rates and fees set forth in Section 2 (Schedule of Deliverables and Payments) of the applicable Scope of Work. The Optional Products shall be provided in accordance with Paragraph 5.2 (Optional Work) of the Base Agreement of Appendix A (Required Agreement) to the RFP.

SUBTASK 9.2 – PROVIDE OPTIONAL SERVICES

If requested and approved by County, Contractor shall provide to County on-site implementation support, additional training and other consulting services related

to the Licensed Products, at County facilities or at Contractor's location, at the rates and fees set forth in Section 2 (Schedule of Deliverables and Payments) of the applicable Scope of Work. The Optional Services shall be provided in accordance with Paragraph 5.2 (Optional Work) of the Base Agreement of Appendix A (Required Agreement) to the RFP.

DELIVERABLE 9 – OPTIONAL WORK

Contractor shall successfully provide Optional Work, including Optional Products and Optional Services, in accordance with Task 9 (Provide Optional Work).

TASK 10 – PROVIDE ADDITIONAL ORTHOGONAL CAPTURE IMAGERY (TRUE COLOR)

Contractor shall generate Orthogonal Images with a nominal three inch or better pixel resolution for the delivery area identified in Section 1.7.3. Images shall be generated semi-annually during two of the four Contractor flight seasons (Winter, Spring, Summer, Fall), which will be mutually agreed-to between the Contractor and County prior to initiation of the Task.

The images shall meet the following requirements:

- Capture Window: solar elevation >30 degrees or most optimal 4-hour window
- 24-bit RGB natural color
- 3-inch or better Ground Sample Distance
- Best available elevation surface (publicly available or County-supplied) to rectify imagery
- Spatial Accuracy: RMSE (x or y) 3.00 feet or better

Task 10 shall be exercised by the County for the initial two contracted captures at the rates and fees set forth in Section 2 (Schedule of Deliverables and Payments) of the applicable Scope of Work.

DELIVERABLE 10 – PROVIDE ADDITIONAL ORTHOGONAL CAPTURE IMAGERY (TRUE COLOR)

Contractor shall successfully provide imagery in accordance with Task 10. Imagery shall be delivered via publicly available Web Map Services (WMS/ ESRI Tile Service) and Web Map Tile Service (WMTS/ ESRI Tile Service), as well as through the Hosted Solution via active subscription.

An optional physical delivery of Imagery Tiles may be requested by the County. In this case, the tiles will be generated and delivered in accordance with the Contractor's standard specification, provided on a physical hard drive, in GeoTIFF format, at the rates and fees set forth in Section 2 (Schedule of Deliverables and Payments) of the applicable Scope of Work

TASK 11 – PROVIDE ADDITIONAL ORTHOGONAL CAPTURE IMAGERY (WITH NEAR INFRA-RED) (OPTIONAL)

Contractor shall generate Orthogonal Images with a nominal three inch or better pixel resolution for the delivery area identified in Section 1.7.3. Images shall be generated semi-annually during two of the four Contractor flight seasons (Winter, Spring, Summer, Fall), which will be mutually agreed-to between the Contractor and County prior to initiation of the Task.

The images shall meet the following requirements:

- Capture Window: solar elevation >30 degrees or most optimal 4-hour window
- The first three bands shall be true color (RGB) and the fourth band Near Infrared (NIR)
- 3-inch or better Ground Sample Distance
- Best available elevation surface (publicly available or County-supplied) to rectify imagery
- Spatial Accuracy: RMSE (x or y) 3.00 feet or better

Task 11 shall not be exercised by the County until the Contractor's Fall 2021 capture season (commencing October 1, 2021) at the rates and fees set forth in Section 2 (Schedule of Deliverables and Payments) of the applicable Scope of Work. Exercising of Task 11 shall be contingent on the County and Contractor's mutual review and written agreement of this Task 11 by December 31, 2020.

DELIVERABLE 11 – PROVIDE ADDITIONAL ORTHOGONAL CAPTURE IMAGERY (WITH NEAR INFRA-RED) (OPTIONAL)

If exercised, Contractor shall successfully provide imagery in accordance with Task 11. Imagery shall be delivered via publicly available Web Map Services (WMS/ ESRI Tile Service) and Web Map Tile Service (WMTS/ ESRI Tile Service), as well as through Hosted Solution via active subscription. The delivery will include two separate three-band layers:

- RGB (True Color)
- CIR (Red, Green, False-Color)

An optional physical delivery of Imagery Tiles may be requested by the County. In this case, the tiles will be generated and delivered in accordance with the contractor's standard specification, provided on a physical hard drive, in GeoTIFF format at rates and fees set forth in Section 2 (Schedule of Deliverables and Payments) of the applicable Scope of Work.

1.3 IMAGE REQUIREMENTS

1.3.1 DATA REQUIREMENTS

Remote-sensed digital orthogonal aerial imagery will be collected to provide source data for creation of orthophotography, stereo models and updates to the digital terrain model.

1.3.2 AERIAL IMAGERY REQUIREMENTS

Due to the County's desire to have a very high resolution digital aerial orthophoto, all aerial imagery shall be collected to support a minimum 4" Ground Sample Distance (GSD) for urban areas and maximum 9" GSD for national forest areas. Stereo pairs must be provided to County upon request and exhibit a 66% overlap at the time of exposure. For the urban project area, where tall structures more than 4 stories tall are present, forward overlap will be 80% and sidelap will be 60% to allow mitigation of building lean.

1.3.3 EQUIPMENT REQUIREMENTS

Prior to commencing flyovers, Contractor shall clearly identify the equipment (aircraft, digital sensor, etc.) to be used to collect imagery.

1.3.4 CONTROL ESTABLISHMENT

If it is determined to be necessary by Contractor, additional ground control points, augmenting the county's control points as needed (approximately 200 to 300) to meet the accuracy requirements of this proposal, will be collected by Contractor. All control used in the production of products for this effort shall conform to acceptable errors as set forth by the FGDC. If additional control points are generated as a result of this effort, Contractor will be required to provide these points as an attributed feature layer. The Project Work Plan shall contain a detailed explanation of control methodology and a listing of control data that will be provided under this effort (survey/AT reports, POS EO data, or other control data unique to the control method used). Collection of up to one hundred (100) additional ground control points may be considered Optional Work that may be provided by Contractor at the price and fees agreed to by the parties.

Contractor shall provide a detailed description of the process by which the accuracy standards will be met. This should include a description of how the existing control network might be used, additional control that might be required, source for control survey crews, etc. If fully analytical aero triangulation procedures are used then Contractor shall describe the process to include hardware and software. If direct georeferencing is proposed, Contractor shall fully describe the process and equipment used to eliminate conventional aero triangulation, and the corrective procedures to be employed in the event of equipment failure.

1.3.5 DIRECT DIGITAL AERIAL IMAGERY ACQUISITION

Contractor shall describe the overall methodology for direct digital aerial imagery collection to include flight scheduling/planning, flight plan, procedures for ensuring image quality, photo scale/GSD, etc.

1.3.6 COLLECTION CONDITIONS

All imagery shall conform to the American Society for Photogrammetry and Remotes Sensing (ASPRS) Positional Accuracy Standards for Digital Geospatial Data, Edition 1, Version 1.0, November 2014. https://www.asprs.org/wp-content/uploads/2015/01/ASPRS_Positional_Accuracy_Standards_Edition1_Version10_0_November2014.pdf with the exception of all requirements specific to film and/or shuttered cameras.

For the Project, capture window requirements will be as follows:

DATE	START TIME	SOLAR ALTITUDE	END TIME	SOLAR ALTITUDE
January 1, 2014	10:00	26.64	14:00	25.95
January 15, 2014	09:45	25.97	14:15	26.60
February 1, 2014	09:30	26.85	14:30	28.70
February 15, 2014	09:30	30.34	14:45	30.29
March 1, 2014	09:00	29.70	15:00	31.55

March 15, 2014	09:00	34.18	15:15	32.21
DATE	START TIME	SOLAR ALTITUDE	END TIME	SOLAR ALTITUDE
January 1, 2017	10:00	26.65	14:00	25.99
January 15, 2017	09:45	26.00	14:15	26.66
February 1, 2017	09:30	26.91	14:30	28.77
February 15, 2017	09:30	30.42	14:45	30.36
March 1, 2017	09:00	29.78	15:00	31.61
March 15, 2017	09:00	34.27	15:15	32.26
DATE	START TIME	SOLAR ALTITUDE	END TIME	SOLAR ALTITUDE
January 1, 2020	10:00	26.63	14:00	25.89
January 15, 2020	09:45	25.92	14:15	26.51
February 1, 2020	09:30	26.75	14:30	28.59
February 15, 2020	09:30	30.22	14:45	30.16
March 1, 2020	09:00	29.87	15:00	31.68
March 15, 2020	09:00	34.36	15:15	32.32

Solar angles calculated using SunAngle tool available at: <http://susdesign.com/sunangle/> using a location definition of 34.00 N, 118.25 W, and elevation of 0; times given are clock time.

1.3.7 RE-FLIGHTS

If required, the Contractor will correct unacceptable digital aerial imagery at no additional cost to County. All re-flight coverage shall overlap the accepted photography by at least two stereo models.

1.3.8 PROTOTYPE (TEST) AREA

Contractor will provide County with sample imagery displaying the tonal balancing and color enhancements that will provide the best imagery to County. This sample data will be provided to the QA/QC vendor as well as to County. County will have an opportunity to review the samples, and will give written acceptance of the enhancements prior to the Contractor processing the remainder of the project.

1.3.9 METADATA

FGDC-compliant metadata will be provided for the deliverable orthophotography data sets. These metadata will be completed using standard industry metadata tools and output in standard file formats for viewing in all widely available viewing utilities.

1.3.10 ACCURACY STANDARDS

All orthogonal digital imagery should conform to the industry accuracy and quality standards established by the Federal Geographic Data Committee (FGDC) and the American Society for Photogrammetry and Remote Sensing (ASPRS), as specified below:

1. Standard FGDC-STD-007.3-1998, Geospatial Positioning Accuracy Standard Part 3: National Standard for Spatial Data Accuracy,
<http://www.fgdc.gov/standards/documents/standards/accuracy/chapter3.pdf>
2. Orthographic imagery produced under this effort shall conform to FGDC-STD-008-1999 Content Standard for Digital Orthoimagery,
http://www.fgdc.gov/standards/status/sub3_6.html.
 - a. Accuracy of 4” Orthogonal Images shall conform to the requirements specified below.
 - b. Accuracy of 9” Orthogonal Images shall conform with requirements specified below.

1.4 ACCEPTANCE CRITERIA

**** Contractor is responsible for providing GeoTIFF ortho tiles to County’s QA/QC vendor meeting the format and specifications below.**

1.4.1 ACCEPTANCE CRITERIA A: COMPLETENESS AND AESTHETICS

	RESPONSIBLE COMPANY	TESTED CHARACTERISTIC	MEASURE OF ACCEPTABILITY
A		All Scales Orthoimagery	
A.1.	Contractor	Information will be delivered by contractor to County, who will load data onto County servers.	All files successfully copied to County servers, all files accessible, no files corrupted.
A.2.	Contractor	File organization	Files written in tile sheet order
A.3.	Contractor	File name	Conforms to required convention- based on CA SPCS Zone 5 L4_xxxx_yyya (a-d) for 4 inch and L4_xxxx_yyyy for 1 foot orthos
A.4.	Contractor	GeoTIFF format	File reads in ESRI (see sample of GeoTIFF header)
A.5.	Contractor	Files must open in correct location	Files must open with ESRI software
A.6.	Contractor	Pixel definition	GeoTIFF file must reference to the center of the pixel located in the upper left hand corner of the tile as the point of origin
A.7.	Contractor	Georeferencing	For correct pixel size 0.33 ft (4 inch) and 9-inch.
A.8.	Contractor	Vertical Datum	NAVD88
A.9.	Contractor	Projection	NAD 1983 State Plane – California Zone V
A.10.	Contractor	Horizontal Datum	NAD 83 reference datum
A.11.	Contractor	Units	U.S. Survey Feet
A.12.	Contractor	24 bit natural color, plus 8 bit NIR	256 levels of value for each band, 0=black, 255=white

	RESPONSIBLE COMPANY	TESTED CHARACTERISTIC	MEASURE OF ACCEPTABILITY
A		All Scales Orthoimagery	
A.13	Contractor	Conformance with tile index grid	Tile matches grid, no gaps between tiles at 1:1 view.
A.14.	Contractor	Coverage	Full tiles; no data holidays. As indicated in County Data and Reference Maps. The basic rule is at least 500' buffer around County boundary (no partial tiles, no seams and no overlaps). Flying and image capture teams should be aware of this.
A.15.	Contractor	Tile grid layout	Full tiles only with no gaps or seams between 4 inch and 9 inch areas. Flying and image capture teams should be aware of this.
A.16.	Contractor	Metadata	Complies with standard (to be determined by County; to match LAR-IAC metadata). Meets minimum FGDC Content Standard.
A.17.	Contractor	Mosaic lines	Minimize mosaic lines through buildings. No mosaic lines through above-ground transportation structures carrying automobiles or trains unless unavoidable, as well as foot bridges crossing 2-lane roads or larger. Mosaic lines may pass through power transmission towers, cars, trucks and railroad cars.
A.18.	Contractor	Building lean within Downtown areas (polygons provided by County)	The maximum displacement of a 10 story building at the edge of a model will be 16 feet (approximately 1.6 feet per story)
A.19.	Contractor	Bridges (polylines provided by LA County)	For accuracy of multi-layered bridge decks identified by County, 3D breaklines are required to ensure continuity of deck surfaces. County will provide bridge locations countywide in shapefile format (polyline layer)
A.20.	Contractor	"Governor's Test"	Imagery should not cause alarm by giving false impression that a bridge is sagging or that there are serious hazards to public safety.
A.21.	Contractor	Shadows	TBD
A.22.	N/A	Leaf-off	N/A
A.23	Contractor	Urban Canyon (polygons provided by County)	Specified "Downtown Areas" have been indicated via shapefile and sent to Contractor and external QAQC provider. Special care will be made in these areas to reduce building lean and shadows. Flying patterns may need to be adjusted for this

EXHIBIT A.2 – STATEMENT OF WORK – ORTHOGONAL IMAGES

	RESPONSIBLE COMPANY	TESTED CHARACTERISTIC	MEASURE OF ACCEPTABILITY
A		All Scales Orthoimagery	
			including restricting capture times to optimal sun angles.

1.4.2 ACCEPTANCE CRITERIA B: 9-INCH GSD

B	9 inch GSD, equivalent to 1"=200'-scale (1:2400)	
B.1.	Ground Resolution	0.75 U.S. survey foot (2 decimals)
B.2.	Tile size	5280' x 5280'
B.3.	Mismatch of features along mosaic lines and production block boundaries of equal scale	Equal to or less than 3 pixels on well defined ground features (roads, sidewalks, curbs).

1.4.3 ACCEPTANCE CRITERIA C: 4-INCH GSD

C	4 inch GSD, equivalent to 1"=100'-scale (1:1200)	
C.1.	Ground Resolution	0.33 U.S. survey foot (2 decimals)
C.2.	Tile size	2640' x 2640' (8000 pixels x 8000 pixels)
C.3.	RMSE of known ground points measured on the image <i>See ASPRS Class I Standards Page 8, Table 16, and NSSDA Part 3, Appendices 3-A and 3-D for explanation of formulas.</i>	RMSE _x = RMSE _y = 1.0-ft RMSE _r = 1.4142*RMSE _x = 1.4142*RMSE _y = 1.41-ft
C.4.	NSSDA radial accuracy	NSSDA accuracy (20+ points) such that 1.73 * RMSE _r < 2.5'
C.5.	Mismatch of features along mosaic lines between pixel resolution blocks of equal scale	Equal to or less than 4 pixels on well defined ground features (roads, sidewalks, curbs).
C.6.	Mismatch of features between 1-foot and 4-inch images	Equal to or less than the combination of the B.3. and C.5. criteria (4.3') on well defined ground features (roads, sidewalks, curbs).

1.4.4 ACCEPTANCE CRITERIA D: AEROTRIANGULATION – CONTRACTOR RESPONSIBILITY

D	Tested Characteristic	Measure of Acceptability
D.1.	Report Format	Conforms to required convention
D.2.	Report Completeness	All information complete and readable; reviewed and signed by a CP.

D	Tested Characteristic	Measure of Acceptability
D.3.	PATB format ASCII AT files	Camera data, photo coordinates (PATB), adjusted control (ptXYZ), Orientations (ORI), and AT log files (aat.log)
D.4.	1"=100' map scale AT Horizontal accuracy against ground control	For 100' AT blocks, RMSE _x and RMSE _y values are acceptable up to 0.35'. RMSE _r is acceptable up to 0.5'. Higher RMSE values are subject to review.
D.5.	1"=200' map scale AT Horizontal accuracy against ground control	For 200' AT blocks, RMSE _x and RMSE _y values are acceptable up to 0.6'. RMSE _r is acceptable up to 0.84'. Higher RMSE values are subject to review.
D.6.	RMSE of control and tie points.	<10 micron in x and y. Higher RMSE values are subject to review.
D.7.	RMSE of survey check points	Not to exceed 12 micron in x and y.
D.8.	NSSDA analysis [E, N] of 20+ QA points	95% within 1.73 * RMSE for corresponding scale
D.9.	Approval	CA Licensed Surveyor Signature and Seal

1.4.5 ACCEPTANCE CRITERIA E: GROUND CONTROL ACCEPTANCE – COUNTY AND CONTRACTOR RESPONSIBILITY

E	Tested Characteristic	Measure of Acceptability
E.1.	Report Format	Conforms to required convention
E.2.	Report Completeness	All information complete and readable
E.3.	Approval	CA Licensed Surveyor Signature and Seal
E.4.	Monument Record Form	Sufficient information to revisit point, description and picture
E.5.	Network	Meet NGS specifications for Order and Class
E.6.	Geodetic Survey: Horizontal Accuracy	Second Order Class 1 tied to NGS monuments.
E.7.	Geodetic Survey: Vertical Accuracy	Third Order.
E.8.	Coordinate System	California Coordinate System of 1983, Zone 5,
E.9.	Epoch	Epoch date: 2010.0

1.4.6 ACCEPTANCE CRITERIA F: DIGITAL TERRAIN MODEL QA (SUITABLE ONLY FOR ORTHORECTIFICATION) – CONTRACTOR RESPONSIBILITY

F	Tested Characteristic All Scales	Measure of Acceptability
F.1.	Information will be delivered by contractor to County, who will load data onto County servers.	All files successfully copied to County servers, all files accessible, no files corrupted.

F	Tested Characteristic All Scales	Measure of Acceptability
F.2.	File organization	Files written one per ortho tile provided. Only updated tiles are provided.
F.3.	File name	Conforms to required convention
F.4.	Format	Arc generate .lin and pnt files
F.5.	Format	Microstation .dgn Version V8.
F.6.	Georeferencing	Locates in proper tile grid cell
F.7.	Mass point locations	Mass points updated as needed to accurately build terrain to support orthophotos;
F.8.	Breakline locations	Breaklines updated as needed to control bridges, edge of pavement, hydrographic features, ridgelines, retaining walls as needed for orthorectification, none in open water.
F.9.	Continuity	No spikes, holes or blunders; no gaps of sufficient size to affect orthorectification, regardless of perspective center.
F.10.	Breakline Format	Arc generated .lin and pnt files

1.4.7 ACCEPTANCE CRITERIA G: HORIZONTAL AQ/QC POINT

G	Tested Characteristic All Scales	Measure of Acceptability
G.1.	Visibility on digital imagery	QA/QC checkpoints must be clearly photo-identifiable on images at map scales evaluated (4-inch)
G.2.	Well defined	Points must be clearly visible and not elevated (no fence posts, fire hydrants, etc.) that cast shadows
G.3.	Documentation	Each point is documented to describe the photo-identifiable feature surveyed
G.4.	Terrestrial images	Each point is photographed from the ground to help in photo-identification
G.5.	Survey accuracy and description of survey procedure used	Accuracy estimate, to include description of survey procedures used to achieve such accuracy

1.5 SOFTWARE REQUIREMENTS

1.5.1 SOFTWARE

Orthophotography from the project can be viewed using any software that can read and display the TIFF file formats. The TIFF v6 format is widely used and software that supports this file format can generally be grouped into two categories; image viewers and GIS software.

1.5.2 RASTER IMAGE VIEWING SOFTWARE

Image viewing software will display raster images like the project deliverables. The images can generally only be viewed one tile at a time. With viewer software images do not have any geo-referencing. Therefore, any measurements made on the photo are reported in photo units rather than in ground units.

“Imaging for Windows” by Kodak which comes by default with the Windows2000 operating system is an example of image viewing software. Additional information on TIFF viewers can be found at http://hazmat.dot.fov/ntsb/ntsb_viewer_help.htm.

1.6 COUNTY OBLIGATIONS

1.6.1 SYSTEM REQUIREMENTS

County's system for use of the orthogonal imagery in GEOTIFF or various other formats (MrSID, ECW, etc.) will have sufficient capabilities and capacity to view and manage digital images.

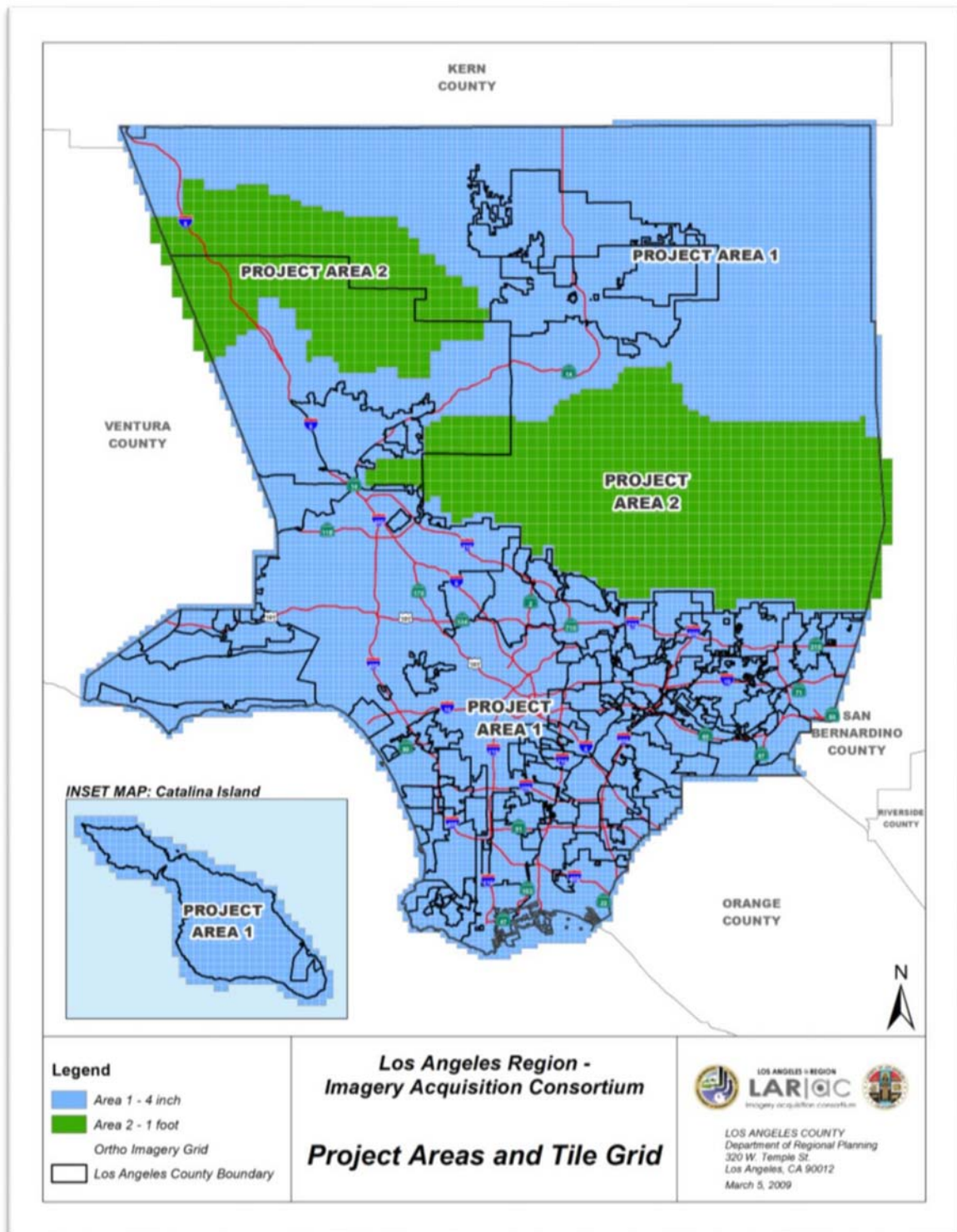
1.6.2 COUNTY RESPONSIBILITIES

1. County will make available the following countywide information to Contractor at the following URL: <http://egis3.lacounty.gov/dataportal/lariac/lar-iac4/rfp-data/>
 - a) LAR-IAC Project Area Boundaries (shapefile format)
 - b) Detailed County/City Boundaries (for orientation only - shapefile format)
 - c) Grid for project tiles (shapefile format)
 - d) Oblique Aerial Digital Imagery 1 sq. mile sector grid (for orientation only – shapefile format)
 - e) Boundary of Urban Canyons “Downtown Areas” high-rise areas (shapefile format)
 - f) Parcel vector database (for orientation only – shapefile format)
 - g) Existing control cadastral monuments (shapefile format)
 - h) Existing LAR-IAC deliverables in various formats as mutually agreed upon (ie. DTM and/or DSM, first generation 4” ortho imagery)
 - i) Proposed Delivery Areas (shapefile format)
 - j) Proposed Mosaic Tile Areas (shapefile format)
 - k) Boundary of locations that could potentially have large changes in elevation (ie. Significant grading) that would affect ortho imagery rectification
 - l) Other relevant GIS layers mutually determined by the Contractor and County.
2. Digital Elevation Data (from LiDAR and stereo compilation) provided by County for Contractor will be in ESRI raster format in California State Plane Coordinate System, Zone 5, NAD83, NAVD88.
3. All vector data sets provided by County for Contractor will be in ESRI shapefile format in California State Plane Coordinate System, Zone 5, NAD83, U.S. Survey Feet.
4. County will be responsible for:

- a) Assignment of all point numbers;
- b) Provision of blank monument record forms;
- c) Providing the County Survey Monuments digital files.

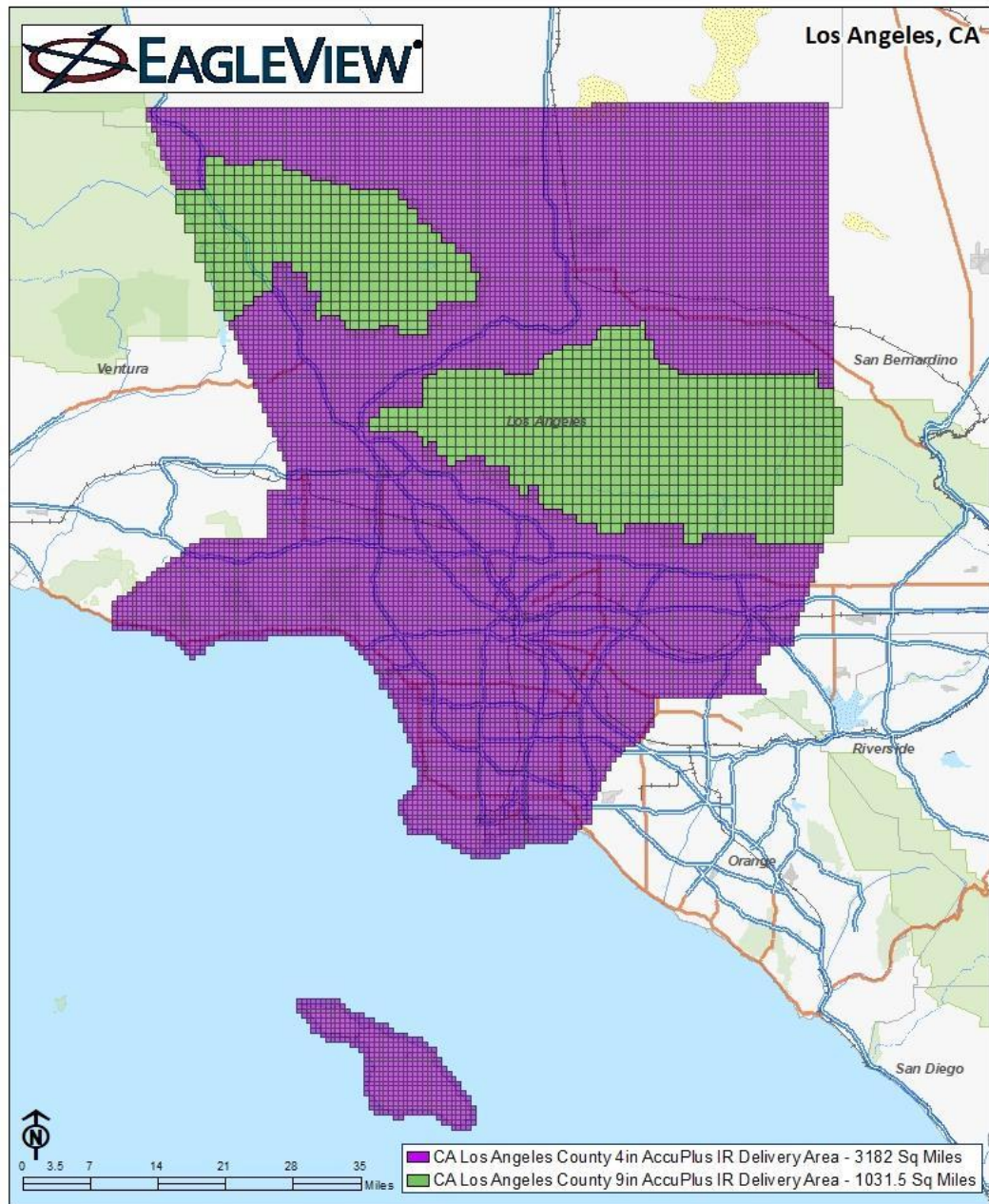
1.7 REFERENCE MAPS

1.7.1 PROJECT AREAS AND TILE GRID



1.7.2 [REMOVED]

1.7.3 DELIVERY AREAS



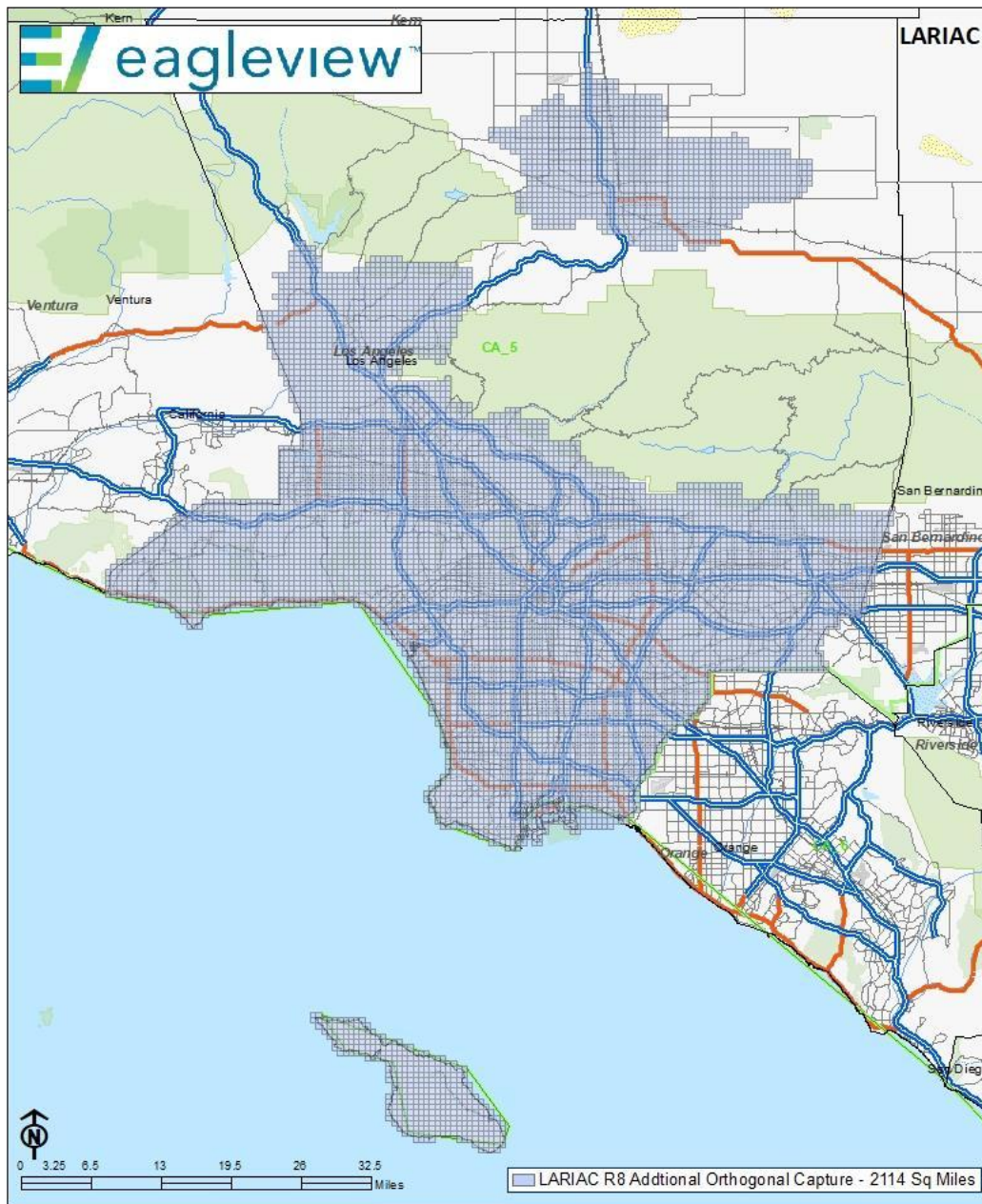


EXHIBIT A.3

**STATEMENT OF WORK – BUILDING REPRESENTATIONS
FOR
DIGITAL AERIAL DATA**

SECTION 1 – STATEMENT OF WORK

1.1 GENERAL

1.1.1 INTRODUCTION

Contractor shall deliver under this Statement of Work Building Representations collected from stereo imagery. The planimetric features (building representations) shall be topologically correct and meet the American Society for Photogrammetry and Remote Sensing (ASPRS) accuracy standards for large scale class 1 maps for 1" = 100' (and 1" = 200' for some areas) mapping in order to be incorporated into existing participants' GIS systems.

1.1.2 DEFINITIONS

In addition to the terms defined in the Base Agreement, the following definitions shall apply throughout this Exhibit A.3 (Statement of Work – Building Representations):

1. Planimetric Features

The term "Planimetric Feature(s)" shall mean representations of structures and other geographic features extracted from aerial photography. Examples of Planimetric Features include building representations, paved surfaces, curb lines, fences, manholes, signals, runways, dams, culverts, etc.

2. Building Representation

The term "Building Representation" shall mean Planimetric Feature representing the representation of an erect building (not under construction or ruin) that serves a primary business, government, or residential function.

1.2 TASKS AND DELIVERABLES

TASK 1 – DEVELOP PROJECT WORK PLAN

Contractor shall review and analyze the Data Requirements for the Building Representations to be provided under this Agreement and develop a Project Work Plan, which shall be used to accomplish the following:

1. Guide project planning;
2. Document project planning assumptions and constraints;
3. Document project-planning decisions regarding alternatives chosen;
4. Facilitate communication between project stakeholders;
5. Define key management reviews as to content, extent and timing;
6. Provide a baseline for progress measurement and project control; and
7. Provide a cost per representation for that will be used to develop project cost based upon building size and number of buildings, which will be entered into Section 2 (Schedule of Deliverables and Payments) of the Scope of Work.

DELIVERABLE 1 – PROJECT WORK PLAN

Contractor shall provide for County approval a Project Work Plan document in Word and Portable Document Format (PDF) developed in accordance with Task 1 (Develop Project Work Plan).

TASK 2 – UPDATE BUILDING REPRESENTATIONS

Contractor should utilize stereo imagery to update the existing building representations. This method will allow for data extraction without radial displacement and delineation of features obstructed by building lean. Existing LAR-IAC building representations will be provided for building edits/updates. Contractor shall provide deliverables that enable LARIAC to identify buildings that have been demolished, modified, replaced, or added since last capture/creation.

1. Horizontal accuracy shall be consistent with Second Order, Class I, i.e. ninety-five percent (95%) confidence interval of 2 cm base error and 20 parts per million linear errors.
2. Data creation shall be constrained to American Society for Photogrammetry and Remote Sensing (ASPRS) accuracy standards for large scale class 1 maps for 1" = 100'.
3. Vertical datum shall be NAVD88. All vertical stations set will be tied directly to NGS monuments whose orthometric height was determined by differential leveling and adjusted by the NGS on, or after June 1995.
4. Units shall be U.S. Survey Feet.
5. All features will conform to the California Coordinate System of 1983, Zone 5. Longitude and latitude will be based on the North American Datum of 1983(2011).
6. Each enclosed building representation polygon shall contain two "z" (elevation) attributes representing the highest point on the building (building height above ground and mean sea level), excluding flagpoles, chimneys, and other features smaller than 4 square feet.
7. Original building IDs shall be maintained with new building IDs generated for updated/new buildings. A separate data set for demolished/removed building representations will also be created.

DELIVERABLE 2 – FINAL ACCEPTANCE

Contractor shall provide the following Deliverables in accordance with Task 2 (Update Building Representations):

- 2.1** ArcGIS shapefile with building representations as of imagery capture date represented as closed polygons (with height and elevation or "z" values as attributes for each feature), including attributes identifying source of change (modification, new construction, replacement) and links to prior building IDs. When factors such as shadows or occlusions exist building shapes can be "interpreted" but should be attributed as such.
- 2.2** ArcGIS shapefile of all buildings that have been updated, to support change analysis and detection, including attributes identifying source of change (demolition, modification, new construction, replacement) and links to current building IDs.
- 2.3** FGDC Compliant metadata.

TASK 3 – PROVIDE OPTIONAL WORK

Optional work, including any Optional Products and Optional Services, shall be provided by Contractor in accordance with Paragraph 5.2 (Optional Work) and Paragraph 4 (Change Notices and Amendments) of the Base Agreement.

Optional work shall be limited to additional work related to building representations and/or Planimetric Features.

Examples of Optional Work:

1. **Level of Detail:** Participants may request enhanced levels of detail as provided by Contractor, including enhanced three-dimensional modeling, addition of textures and applied imagery, etc. as supported by Contractor.
2. **Building Size:** Participants may request the capture of building representations for buildings smaller than the original scope of work (300 sq. ft.).
3. **Attribute Information:** Participants may request the capture and addition of address information to their building representations. This may include the addition of the primary, secondary, and fractional addresses, construction types, or use types.
4. **Non-Permanent Features:** Participants may seek to capture non-permanent features such as mobile homes, boats, Recreational Vehicles, or other features not specified in the original scope of work.
5. **Other Items:** Participants may seek to capture other items not specified in the original scope of work and not currently envisioned.

DELIVERABLE 6 – OPTIONAL WORK

Contractor shall successfully provide Optional Work deliverables in accordance with Task 3 (Provide Optional Work).

1.3 SPECIFICATIONS

1.3.1 DATA REQUIREMENTS

Remote-sensed digital orthogonal aerial imagery will be collected to provide source data for creation of building representations. Existing LAR-IAC building representations will be provided for building updates (demolition, modification, new construction, replacement).

1.3.2 EQUIPMENT REQUIREMENTS

Due Prior to commencing processing, Contractor shall clearly identify the equipment (stereo software, hardware, etc.) to be used to process building representations.

1.3.3 DIRECT DIGITAL AERIAL IMAGERY ACQUISITION

Contractor shall describe the overall methodology for building representations collection and processing and procedures for ensuring accuracy standards of data are met.

1.3.4 PROTOTYPE (TEST) AREAS

Contractor will provide County with sample building representations displaying the same processing standards as will be done for the project. This sample data will be

provided to the QA/QC vendor as well as to County. County will have an opportunity to review the samples, and will give written acceptance of the enhancements prior to the Contractor processing the remainder of the project.

1.3.5 METADATA

FGDC-compliant metadata will be provided for the deliverables (building representations). These metadata will be completed using standard industry metadata tools and output in standard file formats for viewing in all widely available viewing utilities.

1.3.6 ACCURACY STANDARDS

All building representations should conform to the industry accuracy and quality standards established by the American Society for Photogrammetry and Remote Sensing (ASPRS) for Large Scale Mapping Class 1 Maps for 1" = 100' mapping.

1.4 ACCEPTANCE CRITERIA

Contractor (and subcontractor) acknowledges that all finished products and final deliverables will be subject to systematic QA/QC, which will be done by an independent firm, whose services will be solicited by County in conjunction with this contract.

For this purpose, the County and participating cities will do additional random QA/QC to assure that all received building representations are in compliance with specified technical specifications and standards.

The Acceptance Criteria Table with "Tested Characteristics" and "Measure of Acceptability" will be finalized by Contractor and County's QA/QC vendor during the first weeks of the project. Contractor will provide in its subcontractor's Project Work Plan (which is Contractor's first project deliverable) and County's QA/QC vendor will provide in its Quality Plan document.

1.4.1 ACCEPTANCE CRITERIA: COMPLETENESS AND AESTHETICS – BUILDING REPRESENTATIONS

**** Contractor is responsible for delivering building representations to County's QA/QC vendor meeting the format and specifications below. QA/QC vendor will assure final delivery to County is in the correct format.**

	RESPONSIBLE COMPANY	TESTED CHARACTERISTIC	MEASURE OF ACCEPTABILITY
A		Building Representations	
A.1.	Contractor to QA/QC vendor; QA/QC vendor to LAR-IAC	Media: USB External hard drives	Media is readable, all files accessible, no files corrupted
A.2.	QA/QC vendor	Media label	As specified by County
A.3.	Contractor	File name	Buildings
A.4.	Contractor	File format	ESRI shapefile

	RESPONSIBLE COMPANY	TESTED CHARACTERISTIC	MEASURE OF ACCEPTABILITY
A		Building Representations	
A.5.	Contractor	Files must open in correct location	Files must open with ESRI software
A.6.	Contractor	Vertical Datum	NAVD88
A.7.	Contractor	Projection	NAD 1983 State Plane – California Zone V
A.8.	Contractor	Horizontal Datum	NAD 83 reference datum
A.9.	Contractor	Units	U.S. Survey Feet
A.10.	Contractor	Spatial accuracy standards	ASPRS Accuracy Standards for Large Scale Maps Class 1 Maps 1" = 100' and 1" = 200' (national forest areas)
A.11.	Contractor	Feature	Features captured will represent building representations for permanent structures that meet the minimum size requirements. This excludes RV parks and free-standing solar structures.
A.12.	Contractor	Feature Types	<p>Primary building - Polygon enclosing all erect buildings (not under construction or ruin) that serve primary business and residential functions (i.e., houses, apartments, commercial facilities). Includes attached covered porches, permanent overhangs, carport roofs, covered sidewalks, etc. as part of the building. Do not show common rooflines (e.g., between town homes, or interior sections/firewalls in commercial buildings).</p> <p>Courtyard or Atrium - Polygon created inside a primary building that is fully encompassing of an open area.</p> <p>Secondary building – Polygon enclosing all erect buildings (not under construction or ruin) that serve as secondary or minor buildings (garage/outbuilding). Includes the following:</p> <p>Smokestack - A closed circle enclosing the base of a large cylindrical smokestack.</p> <p>Silo/Bin - Polygon enclosing a large cylindrical receptacle for farm product storage.</p> <p>Tank - Polygon enclosing commercial storage tank features (Oil, chemical and propane). Do not capture small private / residential propane tanks.</p> <p>Water tower - Polygon enclosing water tower.</p> <p>Do not capture temporary structures such as construction trailers or tool storage sheds.</p>

	RESPONSIBLE COMPANY	TESTED CHARACTERISTIC	MEASURE OF ACCEPTABILITY
A		Building Representations	
A.13.	Contractor	Vector data	Features should be closed polygons that are snapped and joined to create continuous segments without overruns and gaps.
A.14.	Contractor	Buildings/townhouses and parcels	Features will be cut by parcel lines (downtown core buildings only) unless extending 1' or less into the next parcel. In this case, it should be snapped to the parcel. Townhouses and contiguous buildings crossing parcel lines will not be cut.
A.15.	Contractor	Buildings connected by corridors, covers, and walkways	Each building portion shall be created or digitized as a separate polygon (when possible).
A.16.	Contractor	Building generalization	Building shapes can be "interpreted" (and attributed as such) when factors such as shadows or occlusions exist.
A.17.	Contractor	Vertical or "Z" values and building IDs	Z-values for height above ground and mean sea level will be gathered from the highest point of the roof (rounded to the nearest 1/10 th of a foot). This excludes non-structural features such as chimneys, air conditioning units, antennas, and flag poles. Original building IDs will be maintained with new IDs generated for updated/new buildings. Demolished/removed building representations will be consolidated into a separate data set.
A.18.	Contractor	Minimum building size	Building shapes (polygons) should be created for all structures 300 sq. ft. or larger in size.
A.19.	Contractor	Minimum segment length	1.5' excluding awnings
A.20.	Contractor	Minimum size for change	Buildings that have roofline changes greater than 100 square feet.
A.21.	Contractor	Metadata	Complies with standard (to be determined by LA County; to match LAR-IAC metadata deliverable). Meets minimum FGDC Content Standard.

1.5 **SOFTWARE REQUIREMENTS**

Building Representations from the LAR-IAC Project can be viewed using any software that can read and display the shapefile format.

1.6 **COUNTY OBLIGATIONS**

1.6.1 **SYSTEM REQUIREMENTS**

County's system for use of the building representations in shapefile format will have sufficient capabilities and capacity to view and manage the digital GIS datasets.

1.6.2 COUNTY RESPONSIBILITIES

1. County will make available the following countywide information to Contractor at the following URL: <http://egis3.lacounty.gov/dataportal/lariac/lar-iac4/rfp-data/>
 - a) LAR-IAC Project Area Boundaries (shapefile format)*
 - b) Detailed County/City Boundaries (for orientation only - shapefile format)*
 - c) Grid for project tiles (shapefile format)*
 - d) Oblique Aerial Digital Imagery 1 sq. mile sector grid (for orientation only – shapefile format)*
 - e) Boundary of Urban Canyons “Downtown Areas” high-rise areas (shapefile format)*
 - f) Parcel vector database (for orientation only – shapefile format)
 - g) Existing control cadastral monuments (shapefile format)
 - h) Existing LAR-IAC deliverables in various formats as mutually agreed upon (ie. DTM and/or DSM, first generation 4” ortho imagery)
 - i) Other relevant GIS layers mutually determined by the Contractor and County.

*These shapefiles will be provided to all Proposers as a necessary input to the preparation of their response to this RFP.

2. All data sets provided by County for Contractor will be in ESRI shapefile format in California State Plane Coordinate System, Zone 5, NAD83, U.S. Survey Feet.

1.7 REFERENCE MAPS

1.7.1 BUILDING REPRESENTATION AREA (BRA)

Contractor (and subcontractor) shall start the building representation process by beginning with Area 1 (as described below), followed by Area 2. Maps of these areas are shown below.

BRA	RESPONSIBLE COMPANY	AREA	AREA DESCRIPTION
BRA1	Contractor	Project Area 1	All primary and secondary structures meeting the standards set forth in the acceptance criteria however, building shapes (polygons) should be created for all structures 300 sq. ft. or larger in size, per the requirements in Section 1.4.1. This area covers all areas inside the County of Los Angeles except for those areas falling within the Angeles and Los Padres National Forests
BRA2	Contractor	Project Area 2	All primary and secondary structures meeting the standards set forth in the acceptance criteria falling within the Angeles and Los Padres National Forests

1.7.2 PROJECT AREA MAPS

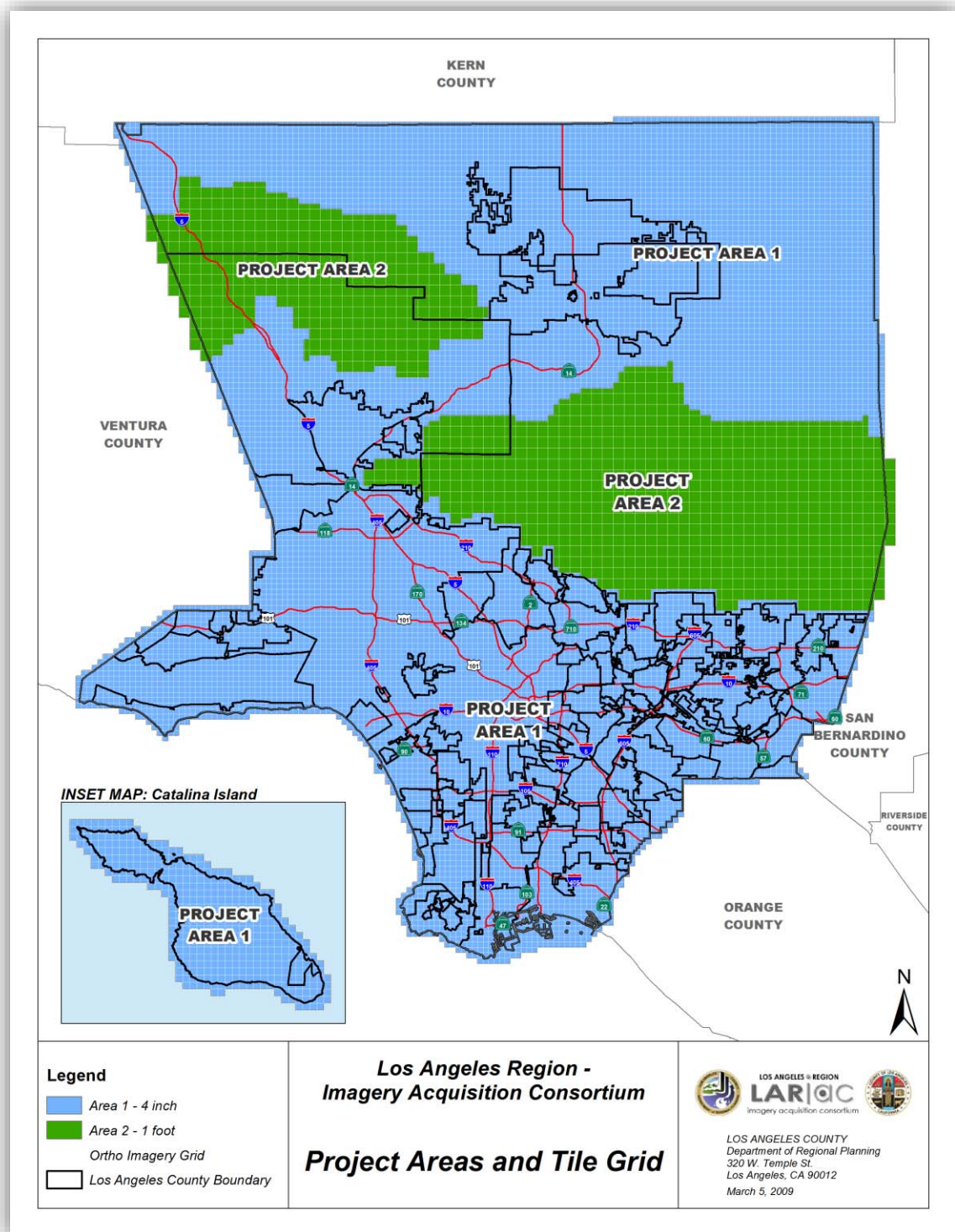


EXHIBIT A.4

**STATEMENT OF WORK – DIGITAL TERRAIN DATA
FOR
DIGITAL AERIAL DATA**

SECTION 1 – STATEMENT OF WORK

1.1 GENERAL

1.1.1 INTRODUCTION

Contractor shall deliver under this Statement of Work Digital Terrain Data collected and Delivered in accordance with the USGS LiDAR Base Specification V1.0, 2012, but with two (2) different Quality Levels for Project Area 1 and Project Area 2.

1.1.2 DEFINITIONS

In addition to the terms defined in the Base Agreement, the following definitions shall apply throughout this Exhibit A.3 (Statement of Work – Building Representations): No additional definitions.

1. Digital Terrain Model (DTM)

The terms “Digital Terrain Model” and “DTM” shall mean the bare earth terrain, LAS Class 2, from which elevated surface features, such as buildings and trees, have been reclassified as LAS Class 1, with the addition of breaklines as needed for hydro-flattening of water bodies.

2. Digital Elevation Model (DEM)

The terms “Digital Elevation Model” and “DEM” shall mean the bare earth terrain (like the DTM), LAS Class 2, from which elevated surface features, such as buildings and trees, have been reclassified as LAS Class 1 – but is represented as a raster (regularly spaced GRID).

3. Digital Surface Model (DSM)

The terms “Digital Surface Model” and “DSM” shall mean the top reflective surface and includes all objects on it (including buildings and trees). Sometimes referred to as “first return” data.

4. LiDAR Point Cloud

The term “LiDAR Point Cloud” shall mean a large set of three dimensional points, collected from LiDAR. Points clouds are almost always 3D. Point clouds have an order of magnitude more features than point datasets. Individual features in point clouds do not typically possess individually meaningful attributes; the information value in a point cloud is derived from the relations among large numbers of features.

1.2 TASKS AND DELIVERABLES

TASK 1 – DEVELOP PROJECT WORK PLAN

Contractor shall review and analyze the Digital Terrain Data deliverable to be provided under this Agreement and develop a Project Work Plan, which shall be used to accomplish the following:

1. Guide project planning;
2. Document project planning assumptions and constraints;
3. Document project-planning decisions regarding alternatives chosen;
4. Facilitate communication between project stakeholders;

5. Define key management reviews as to content, extent and timing; and
6. Provide a baseline for progress measurement and project control.

DELIVERABLE 1 – PROJECT WORK PLAN

Contractor shall provide for County approval a Project Work Plan document in Word and Portable Document Format (PDF) developed in accordance with Task 1 (Develop Project Work Plan).

TASK 2 – PROVIDE DIGITAL TERRAIN DATASETS (DSM, DTM AND DEM) – PROJECT AREA 1

Contractor shall produce Digital Terrain Datasets for **Project Area 1** to support generation of ortho imagery, 3D visualization, change detection and 1 foot contour generation with breakline data. Digital Terrain Datasets should be produced using LiDAR technology with a combination of stereo compilation for breaklines specified in Acceptance Criterion C.8 for control of bridges, edge of pavement, hydrographic features, ridgelines, and retaining walls as needed for orthorectification and contouring.

The Digital Terrain Datasets shall comply with the following requirements:

1. The DTM nominal pulse spacing (NPS) shall be 0.707 meters or less per LiDAR swath to achieve a density of 2 points per square meter or better.
2. The DTM's vertical accuracy shall be suitable for 1 foot contouring, i.e., Accuracy (z) of 0.60 foot at the ninety-five percent (95%) confidence level.
3. The DTM's horizontal accuracy shall be suitable for 1:1200 mapping, i.e., Accuracy (r) of 3.80 foot at the ninety-five percent (95%) confidence level.
4. The DEM with cell size no greater than 0.7 meters or 2.5 feet, and no less than the design Nominal Pulse Spacing (NPS). Delivery should be in an industry-standard, GIS compatible, 32-bit floating point raster format (ERDAS .IMG preferred). Tiled delivery without overlap; and will show no edge artifacts or mismatch.
5. DEM Void areas 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 (for example, .aux).
6. The DSM is usually referred to as 'first return data'; requirements are the same as the DTM; with a different delivery format.

DELIVERABLE 2 – DIGITAL TERRAIN DATASETS – PROJECT AREA 1

Contractor shall provide the following Deliverables in accordance with Task 2 (Provide Digital Terrain Datasets (DSM), DTM and DEM) – Project Area 1):

- 2.1** Project documentation outlining procedures and data collected, and reports of accuracy evaluation.
- 2.2** First return data (DSM) in ArcGIS compatible format and CAD compatible format.
- 2.3** Bare-earth DTM incorporating the last return LiDAR data in ArcGIS raster format and CAD compatible format.

2.4 Raw point cloud data that includes the following:

- a) All swaths, returns, and collected points, fully calibrated and adjusted to ground, by swath.
- b) Fully compliant LAS v 1.2 or v1.3, point Data Record Format 1, 3, 4 or 5.
- c) LAS v1.3 deliverables with waveform data are to use external auxiliary files with the extension .wdp for the storage of waveform packet data.
- d) Correct and properly formatted georeferenced information must be included in all LAS file headers.
- e) GPS times are to be recorded as Adjusted GPS Time, at a precision sufficient to allow unique timestamps for each pulse.
- f) One file per swath per file, file size not to exceed 2 GB.

2.5 Classified point cloud includes the information in 2.3 above; but also includes a classification scheme. Minimum classified point cloud classification scheme should be as follows:

CODE	DESCRIPTION
1	Processed, but unclassified
2	Bare-earth ground
7*	Noise (low or high; manually identified; if needed)
9	Water
10*	Ignored Ground (Breakline proximity
11	Withheld (if the Withheld is not implemented in processing software)

* Class 7, Noise, is included as an adjunct to the Withheld bit. All noise points are to be identified using on of these two methods.

* 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 DEM generation.

2.6 FGDC compliant metadata.

TASK 3 – GENERATE CONTOURS WITH ONE FOOT INTERVAL – PROJECT AREA 1

Contractor shall generate contours with 1 foot intervals for **Project Area 1** using DTM prepared in Task 2 (Provide Digital Terrain Datasets (DSM, DTM and DEM) – Project Area 1). Contour lines should be seamless for the entire area as specified in the Statement of Work.

DELIVERABLE 3 – 1 FOOT CONTOURS – PROJECT AREA 1

Contractor shall provide the following Deliverables in accordance with Task 3A (Contours with One Foot Interval – Project Area 1):

- 3.1 ArcGIS shapefiles with contours tiled to LAR-IAC grid system.
- 3.2 AutoCAD drawing file with contours tiled to LAR-IAC grid system.

TASK 4 – PROVIDE DIGITAL TERRAIN DATASETS (DSM, DTM AND DEM) – PROJECT AREA 2

Contractor shall produce Digital Terrain Datasets for **Project Area 2** to support generation of ortho imagery, 3D visualization, change detection and 2 foot contour generation. DTM can be produced by using automatic stereo compilation (from ortho imagery) or can be produced by using LiDAR.

The Digital Terrain Datasets, if created by LIDAR, shall comply with the following requirements:

1. The DTM nominal pulse spacing (NPS) shall be 1.414 meters or less per LiDAR swath to achieve a density of 0.5 points per square meter or better.
2. The DTM's vertical accuracy shall be suitable for 2 foot contouring, i.e., Accuracy (z) of 1.19 feet at the ninety-five percent (95%) confidence level.
3. The DTM's horizontal accuracy shall be suitable for 1:2400 mapping, i.e., Accuracy (r) of 3.80 foot at the ninety-five percent (95%) confidence level.
4. The DEM with cell size no greater than 1 meters or 3.5 feet, and no less than the design Nominal Pulse Spacing (NPS). Delivery should be in an industry-standard, GIS compatible, 32-bit floating point raster format (ERDAS .IMG preferred). Tiled delivery without overlap; and will show no edge artifacts or mismatch.
5. DEM Void areas 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 (for example, .aux).
6. The DSM is usually referred to as 'first return data'; requirements are the same as the DTM; with a different delivery format.

DELIVERABLE 4 – DIGITAL TERRAIN DATASETS – PROJECT AREA 2

Contractor shall provide the following Deliverables in accordance with Task 4 (Provide Digital Terrain Datasets (DSM), DTM and DEM) – Project Area 2):

- 4.1** Project documentation outlining procedures and data collected, and reports of accuracy evaluation.
- 4.2** First return data (DSM) in ArcGIS compatible format and CAD compatible format.
- 4.3** Bare-earth DTM incorporating the last return LiDAR data in ArcGIS raster format and CAD compatible format.
- 4.4 Raw point cloud data that includes the following:**
 - a) All swaths, returns, and collected points, fully calibrated and adjusted to ground, by swath.
 - b) Fully compliant LAS v 1.2 or v1.3, point Data Record Format 1, 3, 4 or 5.
 - c) LAS v1.3 deliverables with waveform data are to use external auxiliary files with the extension .wdp for the storage of waveform packet data.
 - d) Correct and properly formatted georeferenced information must be included in all LAS file headers.

- e) GPS times are to be recorded as Adjusted GPS Time, at a precision sufficient to allow unique timestamps for each pulse.
- f) One file per swath per file, file size not to exceed 2 GB.

4.5 Classified point cloud includes the information in 2.3 above; but also includes a classification scheme. Minimum classified point cloud classification scheme should be as follows:

CODE	DESCRIPTION
1	Processed, but unclassified
2	Bare-earth ground
7*	Noise (low or high; manually identified; if needed)
9	Water
10*	Ignored Ground (Breakline proximity)
11	Withheld (if the Withheld is not implemented in processing software)

** Class 7, Noise, is included as an adjunct to the Withheld bit. All noise points are to be identified using one of these two methods.*

** 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 DEM generation.*

4.6 FGDC compliant metadata.

TASK 5– GENERATE CONTOURS WITH TWO FOOT INTERVAL – PROJECT AREA 2

Contractor shall generate contours with 2 foot intervals for **Project Area 2** using DTM prepared in Task 4 (Provide Digital Terrain Datasets (DSM, DTM and DEM) – Project Area 2). Contour lines should be seamless for the entire area as specified in the Statement of Work.

DELIVERABLE 5 – 2 FOOT CONTOURS – PROJECT AREA 2

Contractor shall provide the following Deliverables in accordance with Task 5A (Contours with Two Foot Interval – Project Area 2):

- 5.1** ArcGIS shapefiles with contours tiled to LAR-IAC grid system.
- 5.2** AutoCAD drawing file with contours tiled to LAR-IAC grid system.

TASK 6 – CORRECT DIGITAL TERRAIN DATA DEFICIENCIES

Contractor shall correct all Digital Terrain Data Deficiencies identified by County within the Warranty Period, as further described in the Base Agreement of Appendix A (Required Agreement) to the RFP.

DELIVERABLE 6 – FINAL ACCEPTANCE

Final Acceptance shall be reached when Contractor has corrected all Digital Terrain Data Deficiencies.

TASK 7 – PROVIDE OPTIONAL WORK

SUBTASK 7.1 – PROVIDE OPTIONAL PRODUCTS

If requested and approved by County, Contractor shall provide to County software, tools, data, and other products related to the Digital Terrain data. The Optional Products shall be provided in accordance with Paragraph 5.2 (Optional Work) and Paragraph 4 (Change Notices and Amendments) of the Base Agreement of Appendix A (Required Agreement) to the RFP.

SUBTASK 7.2 – PROVIDE OPTIONAL SERVICES

If requested and approved by County, Contractor shall provide to County on-site implementation support, additional training and other consulting services related to the Digital Terrain Data. The Optional Services shall be provided in accordance with Paragraph 5.2 (Optional Work) and Paragraph 4 (Change Notices and Amendments) of the Base Agreement of Appendix A (Required Agreement) to the RFP.

DELIVERABLE 7 – OPTIONAL WORK

Contractor shall successfully provide Optional Work, including Optional Products and Optional Services, in accordance with Task 7 (Provide Optional Work).

1.3 DIGITAL TERRAIN REQUIREMENTS

1.3.1 DATA REQUIREMENTS

Remote-sensed digital terrain data will be collected to provide source data for creation of the digital terrain model. Due to the County's desire to have a very high resolution digital terrain data, all data shall be collected to support a minimum 0.707 meter nominal pulse spacing (NPS) for urban areas (Project Area 1) and 1.414 meter NPS for national forest areas (Project Area 2).

1.3.2 EQUIPMENT REQUIREMENTS

Prior to commencing flyovers, Contractor shall clearly identify the equipment (aircraft, digital sensor, etc.) to be used to collect data.

1.3.3 CONTROL ESTABLISHMENT

If it is determined to be necessary by Contractor, additional ground control points, augmenting the county's control points as needed (approximately 200 to 300) to meet the accuracy requirements of this proposal, will be collected by Contractor. All control used in the production of products for this effort shall conform to acceptable errors as set forth by the FGDC. If additional control points are generated as a result of this effort, Contractor will be required to provide these points as an attributed feature layer. The Project Work Plan shall contain a detailed explanation of control methodology and a listing of control data that will be provided under this effort. Collection of up to one hundred (100) additional ground control points may be considered Optional Work.

1.3.4 COLLECTION

Specifications and methodology for the LiDAR flight should include documentation of mission date(s), time, flight altitude, overlap, and airspeed. Flight plans shall be generated and should cover the proposed project areas. Proposal should address how various

environmental conditions will be handled and any special considerations for areas of dense coverage (e.g., locations containing dense foliage).

A complete survey control plan shall be submitted to include collection, processing and incorporation of survey control in the LiDAR processing. The plan should include a detailed description of survey control for quality control and validation checks of the LiDAR dataset.

Specifications for the data collection should include scan angle, along-track, and cross-track, pulse spacing, pulse width and density, and number of returns. LiDAR derived data will have the accuracy required to produce topographic maps including 1-foot elevation contours. Proposed data products shall be prepared to meet the accuracy requirements of ASPRS Guidelines for Vertical Accuracy Reporting for LiDAR Data, Version 1, May 2004.

Proposer should describe the production process used for LAS classification of vegetation or structures in order to determine bare-earth representation. Proposer should describe the approach to definition and resolution of data voids and data artifacts resulting from the mission. Proposer should describe quality assurance and quality control (QA/QC) procedures to ensure the integrity of the LiDAR data. Proposer should describe acceptance test procedures to be used to ensure data conforms to the accuracy requirements.

1.3.5 ACCURACY

DTM accuracy testing will be performed by LAR-IAC consistent with ASPRS Guidelines for Vertical Accuracy Reporting for LiDAR Data, Version 1, May 2004.

In Project Area 1, the Fundamental Vertical Accuracy (FVA) in open terrain shall be 18.13-cm or better at the 95% confidence level, based on RMSEz of 9.25-cm in open terrain. The Consolidated Vertical Accuracy (CVA) in all land cover categories combined shall be 27.2-cm at the 95th percentile.

In Project Area 2, the Fundamental Vertical Accuracy (FVA) in open terrain shall be 36.26-cm or better at the 95% confidence level, based on RMSEz of 18.5-cm in open terrain. The Consolidated Vertical Accuracy (CVA) in all land cover categories combined shall be 54.4-cm at the 95th percentile.

Proposer should describe the methodology for creating the Digital Terrain Datasets using stereo edited LiDAR data. To generate accurate contours at a 1 and 2 foot interval the LiDAR DTM points will be enhanced with photogrammetrically or lidargrammetrically compiled breaklines. Breaklines are defined as ridgelines, retaining walls, edges of pavements or hydrographic features. The LiDAR data points together with the breaklines will form a TIN (Triangular Irregular Network) from which the contours are generated.

Proposals should provide a detailed description of the input data, production process, quality assurance/quality control, and proposed acceptance test methodology for providing the digital terrain data required by this effort.

1.3.6 RE-FLIGHTS

If required, the Contractor will correct unacceptable digital terrain data at no additional cost to LA County. All re-flight coverage shall overlap the accepted LiDAR data by at least two swaths.

1.3.7 PROTOTYPE (TEST) AREA

Contractor will provide County with sample digital terrain data, which will be provided to the QA/QC vendor as well as to County. County will have an opportunity to review the samples, and will give written acceptance of the enhancements prior to the Contractor processing the remainder of the project.

1.3.8 METADATA

FGDC-compliant metadata will be provided for the deliverable digital terrain data and elevation contours data sets. These metadata will be completed using standard industry metadata tools and output in standard file formats for viewing in all widely available viewing utilities.

1.4 ACCEPTANCE CRITERIA

Contractor (and subcontractor) acknowledges that all finished products and final deliverables will be subject to systematic QA/QC, which will be done by an independent geospatial firm, whose services will be solicited by County in conjunction with this Agreement.

The Acceptance Criteria Table with “Tested Characteristics” and “Measure of Acceptability” will be finalized by Contractor and County’s QA/QC vendor during the first month of the project. Contractor will provide in its subcontractor’s Project Work Plan (which is Contractor’s first project deliverable) and County’s QA/QC vendor will provide in its Quality Plan document.

1.4.1 ACCEPTANCE CRITERIA: COMPLETENESS

	TESTED CHARACTERISTIC	MEASURE OF ACCEPTABILITY
A	All Scales	
A.1.	Information will be delivered by contractor to County, who will load data onto County Servers.	All files successfully copied to County servers, all files accessible, no files corrupted.
A.2.	File organization	Files written in tile sheet order
A.3.	File name	Conforms to required convention- based on CA SPCS Zone 5 L4_XXXX_YYYY (a-d).
A.4.	Files must open in correct location	Files must open with ESRI software
A.5.	Vertical Datum	NAVD88 (Feet to 2 decimal places)
A.6.	Projection	NAD 1983 State Plane – California Zone V
A.7.	Horizontal Datum	NAD 83 reference datum
A.8.	Units	U.S. Survey Feet (to 2 decimal places)
A.9	Conformance with tile index grid	Tile matches grid, no gaps between tiles at 1:1 view.
A.10.	Coverage	Full tiles; no data holidays. As indicated in County Data and Reference Maps. The basic rule is at least 500’ buffer around County boundary (no partial tiles, no seams and no overlaps). Flying and image capture teams should be aware of this.

	TESTED CHARACTERISTIC	MEASURE OF ACCEPTABILITY
A	All Scales	
A.11.	Tile grid layout	Full tiles only with no gaps or seams between 4 inch and 1 ft. areas. Flying and image capture teams should be aware of this.
A.12.	Metadata	Complies with standard (to be determined by County; to match LAR-IAC4 metadata). Meets minimum FGDC Content Standard.

1.4.2 ACCEPTANCE CRITERIA B: GROUND CONTROL ACCEPTANCE – COUNTY AND CONTRACTOR RESPONSIBILITY

B	Tested Characteristic	Measure of Acceptability
B.1.	Report Format	Conforms to required convention
B.2.	Report Completeness	All information complete and readable
B.3.	Approval	CA Licensed Surveyor Signature and Seal
B.4.	Monument Record Form	Sufficient information to revisit point, description and picture
B.5.	Network	Meet NGS specifications for Order and Class
B.6.	Geodetic Survey: Horizontal Accuracy	Second Order Class 1 tied to NGS monuments.
B.7.	Geodetic Survey: Vertical Accuracy	Third Order.
B.8.	Coordinate System	California Coordinate System of 1983, Zone 5, US Feet
B.9	Epoch	Epoch date: 2004.0 unless otherwise determined.

1.4.3 ACCEPTANCE CRITERIA C: DIGITAL TERRAIN MODEL QA (SUITABLE ONLY FOR ORTHORECTIFICATION) – CONTRACTOR RESPONSIBILITY

C	Tested Characteristic All Scales	Measure of Acceptability
C.1.	Information will be delivered by contractor to County, who will load data onto County Servers.	All files successfully copied to County servers, all files accessible, no files corrupted.
C.2.	File organization	Files written one per ortho tile provided. Only updated tiles are provided.
C.3.	File name	Conforms to required convention
C.4.	Format	ArcGIS compatible format
C.5.	Format	CAD compatible format
C.6.	Georeferencing	Locates in proper tile grid cell

C	Tested Characteristic All Scales	Measure of Acceptability
C.7.	Mass point locations	Mass points updated as needed to accurately build terrain to support orthophotos;
C.8.	Breakline locations	Breaklines updated as needed to control bridges, edge of pavement, hydrographic features, ridgelines, retaining walls as needed for orthorectification and contouring, none in open water.
C.9.	Continuity	No spikes, holes or blunders; no gaps of sufficient size to affect orthorectification, regardless of perspective center.
C.10.	Breakline Format	Arc generated .lin and pnt files

1.5 SOFTWARE REQUIREMENTS

Digital Terrain Data from the project can be viewed using any software that can read and display standard digital terrain data file formats. The LAS format is widely used and software that supports this file format can generally be grouped into two categories; LiDAR viewers and GIS software.

1.6 COUNTY OBLIGATIONS – ORTHOGONAL IMAGES

1.6.1 SYSTEM REQUIREMENTS

County's system for use of the digital terrain data will have sufficient capabilities and capacity to view and manage digital images.

1.6.2 COUNTY RESPONSIBILITIES

1. County will make available the following countywide information to Contractor at the following URL: <http://egis3.lacounty.gov/dataportal/lariac/lar-iac4/rfp-data/>
 - g) LAR-IAC Project Area Boundaries (shapefile format)
 - h) Detailed County/City Boundaries (for orientation only - shapefile format)
 - i) Grid for project tiles (shapefile format)
 - j) Oblique Aerial Digital Imagery 1 sq. mile sector grid (for orientation only – shapefile format)
 - k) Boundary of Urban Canyons “Downtown Areas” high-rise areas (shapefile format)
 - l) Parcel vector database (for orientation only – shapefile format)
 - m) Existing control cadastral monuments (shapefile format)
 - n) Existing LAR-IAC deliverables in various formats as mutually agreed upon (ie. DTM and/or DSM, first generation 4” ortho imagery)
 - o) Proposed Delivery Areas (shapefile format)
 - p) Proposed Mosaic Tile Areas (shapefile format)
 - q) Boundary of locations that could potentially have large changes in elevation (ie. Significant grading) that would affect ortho imagery rectification
 - r) Other relevant GIS layers mutually determined by the Contractor and County.

2. Digital Terrain Data (from LiDAR and stereo compilation) provided by County for Contractor will be in ESRI raster format in California State Plane Coordinate System, Zone 5, NAD83, NAVD88.
3. All vector data sets provided by County for Contractor will be in ESRI shapefile format in California State Plane Coordinate System, Zone 5, NAD83, U.S. Survey Feet.
4. County will be responsible for:
 - a) Assignment of all point numbers;
 - b) Provision of blank monument record forms;
 - c) Providing the County Survey Monuments digital files.

1.7 REFERENCE MAPS

1.7.1 PROJECT AREAS AND TILE GRID

