S A W P A

SANTA ANA WATERSHED PROJECT AUTHORITY
11615 Sterling Avenue, Riverside, California 92503 • (951) 354-4220

PURSUANT TO THE PROVISIONS OF EXECUTIVE ORDER N-29-20 ISSUED BY GOVERNOR GAVIN NEWSOM ON MARCH 19, 2020, THIS MEETING WILL BE CONDUCTED VIRTUALLY. ALL VOTES TAKEN DURING THIS VIRTUAL MEETING WILL BE CONDUCTED BY ORAL ROLL CALL.

This meeting will be accessible as follows:

Meeting Access Via Computer (Zoom)*:	**Meeting Access Via Telephone*:**
• https://sawpa.zoom.us/j/93434813691	• 1 (669) 900-6833
• Meeting ID: 934 3481 3691	• Meeting ID: 934 3481 3691
***Participation in the meeting via the Zoom app (a free download) is strongly encouraged; there is no way to protect your privacy if you elect to call in by phone to the meeting.**	

NOTICE OF REGULAR MEETING OF THE PROJECT AGREEMENT 22 COMMITTEE

Interregional Landscape Water Demand Reduction Program

Committee Members:
Shivaji Deshmukh, General Manager, Inland Empire Utilities Agency
Heather Dyer, General Manager, San Bernardino Valley Municipal Water District
Paul D. Jones, General Manager, Eastern Municipal Water District, Chair
Michael Markus, General Manager, Orange County Water District, Vice Chair
Craig Miller, General Manager, Western Municipal Water District

TUESDAY, APRIL 13, 2021 – 8:30 A.M.

AGENDA

1. **CALL TO ORDER/PLEDGE OF ALLEGIANCE (Paul D. Jones, Chair)**

2. **PUBLIC COMMENTS**

   Members of the public may address the Committee on items within the jurisdiction of the Committee; however, no action may be taken on an item not appearing on the agenda unless the action is otherwise authorized by Government Code §54954.2(b).

PLEASE NOTE:
Americans with Disabilities Act: Meeting rooms are wheelchair accessible. If you require any special disability related accommodations to participate in this meeting, please contact (951) 354-4220 or svilla@sawpa.org. Notification at least 48 hours prior to the meeting will enable staff to make reasonable arrangements to ensure accessibility for this meeting. Requests should specify the nature of the disability and the type of accommodation requested.

Materials related to an item on this agenda submitted to the Commission after distribution of the agenda packet are available for public inspection during normal business hours at the SAWPA office, 11615 Sterling Avenue, Riverside, and available at www.sawpa.org, subject to staff's ability to post documents prior to the meeting.

Declaration of Posting

I, Sara Villa, acting Clerk of the Board of the Santa Ana Watershed Project Authority declare that on Wednesday, April 7, 2021, a copy of this agenda has been uploaded to the SAWPA website at www.sawpa.org and posted at the SAWPA office, 11615 Sterling Avenue, Riverside, California.

2021 Project Agreement 22 Committee Regular Meetings

Interregional Landscape Water Demand Reduction Program
Second Tuesday of Every Month
(Note: All meetings begin at 8:30 a.m., unless otherwise noticed, and are held at SAWPA.)

January	**February**
1/12/21 ~~Regular Committee Meeting~~ [cancelled]	2/9/21 Regular Committee Meeting
March	**April**
3/9/21 ~~Regular Committee Meeting~~ [cancelled]	4/13/21 Regular Committee Meeting
May	**June**
5/11/21 Regular Committee Meeting	6/8/21 Regular Committee Meeting
July	**August**
7/13/21 Regular Committee Meeting	8/10/21 Regular Committee Meeting
September	**October**
9/14/21 Regular Committee Meeting	10/12/21 Regular Committee Meeting
November	**December**
11/9/21 Regular Committee Meeting	12/14/21 Regular Committee Meeting

Note: Per Action of the PA 22 Cmte on 1-23-20, (agenda item No. 4.E.), beginning March 2020 the regular PA 22 Committee meetings shall be held at 8:30 a.m. on the second Tuesday of every month.

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PROJECT AGREEMENT 22 COMMITTEE
Interregional Landscape Water Demand Reduction Program
REGULAR MEETING MINUTES
February 9, 2021

COMMITTEE MEMBERS PRESENT

Shivaji Deshmukh, General Manager, Inland Empire Utilities Agency
Heather Dyer, General Manager, San Bernardino Valley Municipal Water District
Paul D. Jones, General Manager, Eastern Municipal Water District [Chair]
Michael Markus, General Manager, Orange County Water District [Vice Chair]
Craig Miller, General Manager, Western Municipal Water District

COMMITTEE MEMBERS ABSENT

None.

STAFF PRESENT

Jasmin A. Hall, T. Milford Harrison, Richard Haller, Karen Williams, Mark Norton, Dean Unger, Pete Vitt, Zyanya Ramirez

OTHERS PRESENT

Andrew D. Turner, Lagerlof, LLP; Andrew Brenner, Quantum Spatial

1. CALL TO ORDER

The regular meeting of the PA 22 Committee was called to order at 8:30 a.m. by Chair Paul Jones on behalf of the Santa Ana Watershed Project Authority, 11615 Sterling Avenue, Riverside, California. Pursuant to the provisions of Executive Order N-25-30, this meeting was conducted virtually.

2. PUBLIC COMMENTS

There were no public comments; there were no public comments received via email.

3. APPROVAL OF MEETING MINUTES: NOVEMBER 10, 2020

MOVED, approve the November 10, 2020 meeting minutes.

Result:	**Adopted by Roll Call Vote (Unanimously)**
Motion/Second:	Deshmukh/Dyer
Ayes	Deshmukh, Dyer, Jones, Markus, Miller
Nays:	None
Abstentions:	None
Absent:	None

4. COMMITTEE DISCUSSION ITEMS

A. WATER EFFICIENCY BUDGET ASSISTANCE PROJECT – CONSULTANT CONTRACT APPROVAL (PA22#2021.1)

Mark Norton provided the PowerPoint presentation contained in the agenda packet on pages 15-30.

As approved at the previous PA 22 Committee meeting, SAWPA released a Request for Proposals for a consultant to implement the Water Efficiency Budget Assistance sub-task under the Santa Ana River Conservation and Conjunctive Use Program (SARCCUP).

Through this sub-task, SAWPA will assist five-to-ten retail water agencies in the Santa Ana River Watershed by creating water use efficiency budgets for their dedicated irrigation meter customers.

Three firms responded to the RFP and were interviewed by a six-person panel composed of the Municipal Water District of Orange County (MWDOC), Inland Empire Utilities Agency, SAWPA, and Laguna Beach County Water District. The panel unanimously recommended Quantum Spatial, Inc. Mr. Norton stated that due to the present economic challenges, participating agencies will not be asked to submit a cost share; however, there was a cost share for the member agencies under Amendment 1 of the SARCCUP agreement.

Vice Chair Markus expressed his concerns relative to retaining retail agencies' participation in the Water Efficiency Budget Assistance program. Mr. Norton affirmed that the member agencies have done great work promoting the program, and it is anticipated to be welcomed due to new legislation. Nonetheless, if there are retail agencies that back out of the program, SAWPA will seek additional participants. Currently, the Quantum Spatial contract is set to manage approximately 12,000 retail customers. If there are more retail agencies interested in receiving assistance, SAWPA would return to the Committee with a change order. Vice Chair Markus suggested staff add legal language to encourage retail agencies to remain in the program.

Vice Chair Markus questioned the difference in price between Quantum Spatial and the other firms who participated in the RFP relative to the two dedicated landscape meter customer groups (reference page 23-24 of agenda packet). Andrew Brenner, Senior Program Director at Quantum Spatial, stated that although their price for customer group 2 is higher than the other firms, most of the customers they will be dealing with are within customer group 1. He noted that it is difficult to compare their cost with the other firms and does not consider the cost to be excessive for the work being produced. Quantum Spatial has experience working with field guides and have scheduled working with approximately five retail agencies a day.

Chair Jones added that the Eastern Municipal Water District's service area has smaller retail agencies that do not have sufficient staff and resources to be able to support this program and possibly do not have meter locations. He was concerned that a large group of agencies would be left behind due to lack of resources and minimal staffing. Chair Jones requested that staff quantify the number of interested retail agencies that fall within customer group 1 and customer group 2 to understand if the program will need updating to be more inclusive.

MOVED, approve the recommended contract with Quantum Spatial for the Water Efficiency Budget Assistance Project for $594,387 and the retail water agency recruitment process that includes milestones with a formal schedule that interested agencies must meet in order to partner on the Project.

Result:	**Adopted by Roll Call Vote (Unanimously)**
Motion/Second:	Miller/Dyer
Ayes	Deshmukh, Dyer, Jones, Markus, Miller
Nays:	None
Abstentions:	None
Absent:	None

B. APPROVAL OF REQUEST FOR PROPOSALS | 2021 UPPER WATERSHED AERIAL IMAGERY (PA22#2021.2)

Dean Unger provided the PowerPoint presentation contained in the agenda packet on pages 96-111.

In July of 2020, the Committee approved funding allocation to acquire aerial imagery for the upper Santa Ana River Watershed as part of the Enhancements to Watershed-Wide Water Budget Decision Support Tool Project (Project). The Project is financed by Proposition 1 IRWM Round 1 grant funding, an in-kind staff time partnership with the Bureau of Reclamation, and cost share from the PA 22 member agencies and the Municipal Water District of Orange County (MWDOC).

To implement the first two tasks of the Project, SAWPA has worked with the Committee member agencies and MWDOC to develop a request for proposals (RFP) for upper watershed aerial imagery. This includes:

- Task 1 Imagery: Evaluate and acquire imagery to evaluate landscape for the entire urbanized Santa Ana River Watershed and South Orange County.
- Task 2 Landscape Analysis: Measure landscapes to provide water budgets to retail agencies to support the achievement of water efficiency targets prescribed by the State.

The RFP asks for consultants to propose prices for a range of different resolutions including 3-inch, 6-inch and 12-inch pixels. It also includes provisions that the imagery would be available to the member agencies as well as available for the Project. A final schedule for the imagery flight will be determined when SAWPA receives the RFP responses and coordinates with the SAWPA member agencies.

The RFP schedule is as follows:

- February 9, 2021 – Issue RFP
- March 9, 2021 (5:00 P.M. PST) – RFP Deadline
- March 9, 2021 through April 1, 2021- SAWPA evaluation period, final negotiations/optional virtual interviews
- April 13, 2021 – PA 22 Committee Meeting for Final Contract Approval

Vice Chair Markus questioned the need for aerial imagery since the State had already provided aerial imagery of the entire state to comply with future regulations. Mr. Unger stated that the imagery being requested will be at a higher resolution and will be current as opposed to the aerial imagery collected by the State in 2018. This will allow for multiple uses of the aerial imagery. Chair Jones added that the residential zones within the Eastern Municipal Water District service area grew exponentially during the last year; current imagery would make a difference in watershed representation.

MOVED, approve distribution of the 2021 Upper Santa Ana River Watershed High Resolution Aerial Imagery Request for Proposals (RFP).

Result:	**Adopted by Roll Call Vote (Unanimously)**
Motion/Second:	Deshmukh/Miller
Ayes	Deshmukh, Dyer, Jones, Markus, Miller
Nays:	None
Abstentions:	None
Absent:	None

5. FUTURE AGENDA ITEMS

- The Committee requested that agenda item 4.A. Water Efficiency Budget Assistance Project be a regular agenda item.
    - Chair Jones requested a status report of the total grant schedule.

6. ADJOURNMENT

There being no further business for review, the meeting ended at 9:28 a.m.

Approved at a Regular Meeting of the Project Agreement 22 Committee on Tuesday, April 13, 2021.

_____
Paul D. Jones, Chair

Attest :

_____
Sara Villa
Acting Clerk of the Board

PA 22 COMMITTEE MEMORANDUM NO. 2021.3

DATE: April 13, 2021

TO: SAWPA Project Agreement 22 Committee

SUBJECT: Project Agreement 22 Committee Budget for Fiscal Years Ending 2022 and 2023

PREPARED BY: Ian Achimore, Senior Watershed Manager

RECOMMENDATION

It is recommended that the Committee adopt the PA 22 Committee Budget for Fiscal Years Ending (FYE) 2022 and 2023.

DISCUSSION

The PA 22 Budget, like the PA Committee 23 Budget employs the standard two-year budget planning timeframe. It excerpts two years' worth of grant and match funds included in two projects that are funded by a Proposition 84 IRWM grant and Proposition 1 IRWM grant, and cost share (i.e. participant fees) from the SAWPA member agencies and the Municipal Water District of Orange County (MWDOC). The two projects and their funding sources are provided in the table below:

Project	Schedule	Grant	Match
SARCCUP Water Budget Assistance	2020 to 2023	Prop 84 IRWM*	Member Agencies
Enhanced Watershed-Wide Decision Support Tool	2020 to 2023	Prop 1 IRWM, Bureau of Rec Cooperative Funding	Member Agencies, MWDOC

*Integrated Regional Water Management

For ease of ratification, once a SAWPA member agency approves the SAWPA Budget, they will have approved the PA 22 Committee Budget. This budget was first developed in January 2021 and reflects the implementation schedules shown in the table above.

For the Enhanced Watershed-Wide Decision Support Tool, expenses include:

- SAWPA project management,
- Aerial Imagery acquisition from a consultant, and
- Web-based tool development by a consultant.

For the SARCCUP Water Budget Assistance Project, expenses include:

- SAWPA project and committee management, and
- Quantum Spatial consultant costs.

Two-Year Budget
SARCCUP and Enhanced Watershed-Wide Project Combined Costs

Revenue

	Current Two Year Budget		Proposed Budget	
Budget Line Item	FYE 2020	FYE 2021	FYE 2022	FYE 2023
Grant	$615,811	$837,184	$516,696	$377,121
Participant Fees	$664,657	$784,626	$905,736	$180,955
TOTAL	$1,280,468	$1,621,810	$1,422,432	$558,076

Expenses

	Current Two Year Budget		Proposed Budget	
Budget Line Item	FYE 2020	FYE 2021	FYE 2022	FYE 2023
SAWPA Labor	$294,251	$355,868	$246,317	$258,135
Legal Fees	$0	$0	$1,300	$1,300
Consulting/Partners	$955,018	$1,203,541	$1,174,815	$685,517
Aerial Imagery Products (Prop 1/USBR)	$290,134	$580,266	$545,268	$157,880
W&C Project Management (SARCCUP)	$257,114	$215,505	$170,000	$160,000
Quantum Spatial (SARCCUP)*	$332,093	$332,093	$459,547	$367,637
Orange County Coastkeeper (SARCCUP)	$75,677	$75,677	$0	$0
TOTAL	**$1,249,269**	**$1,559,409**	**$1,422,432**	**$944,953**

*Before FYE 2022, budget reflects conservation-based water rates implementation estimated expenses.

For FYE 2020 and FYE 2021, the revenues do not match expenses because staff budgeted conservatively at the time of budget preparation due to the Proposition 1 grant applications not being awarded. For FYE 2023, the revenues do not equal the expenses because of cost savings from prior years (reserves) that can be used to cover expenses.

Note that Woodard and Curran (W&C) are shown in the budget as they are the overall project management consultant for SARCCUP (water conservation, water bank, and habitat).

CRITICAL SUCCESS FACTORS

- Administration of the OWOW process and plan in a highly efficient and cost-effective manner.
- Data and information needed for decision-making is available to all.

RESOURCE IMPACTS
None

Attachment:
1. Presentation for Committee Meeting

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Committee Budget for Fiscal Years Ending 2022 & 2023

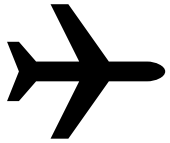
April 13, 2021

Ian Achimore

Senior Watershed Manager

Santa Ana Watershed Project Authority

Projects/Grants that Go Into PA 22 Budget



Project	Schedule	Grant	Match
SARCCUP Water Budget Assistance	2020 to 2023	Prop 84 IRWM*	Member Agencies
Enhanced Watershed-Wide Decision Support Tool	2020 to 2023	Prop 1 IRWM, Bureau of Rec Cooperative Funding	Member Agencies, MWDOC

*Integrated Regional Water Management (IRWM)

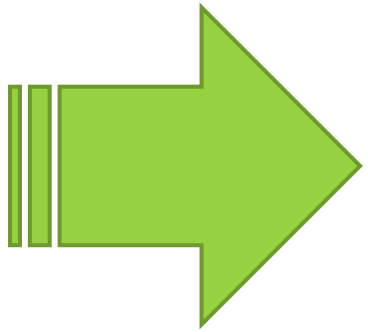
Relation to SAWPA Commission Budget

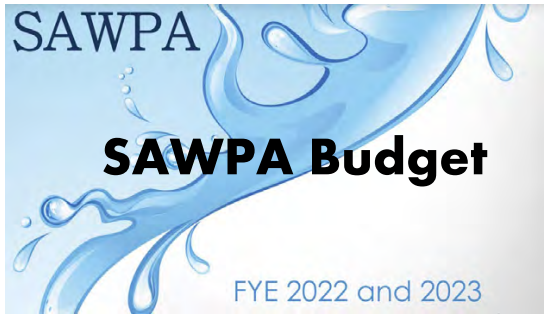
- PA 22 budget required per Section 10 of Project Agreement,
- PA 22 budget is also inserted into SAWPA two-year budget,
  - SAWPA two-year budget to be considered by Commission on April 20, 2021.
  - Specific PA 22 budget does not require separate approval by SAWPA member agency boards.

Prop 84 & Prop 1 Grants: Origin of $ Values in Committee Budget

Grant Agreements (SAWPA and DWR)

(Multi-Year Timeline)





And

PA 22 Committee Budget

(Two Year Timeline)

Separate Documents for Grant

Grant Agreements

Purpose

Transfer grant funding and track local match

Purpose

Committee makes management decision on project

Enhanced Watershed-Wide Decision Support Tool

- Scope: Estimate outdoor water budgets at the parcel level for retail and wholesale water agencies in the Santa Ana River Watershed, South OC and the southern portions of EMWD/WMWD.
- Budgets will be disseminated through a tool that will allow retail water agencies to compare their water usage to the budget.
- Expenses:
  - SAWPA project management,
  - Aerial Imagery acquisition,
  - Web-based tool development.

SARCCUP Water Use Efficiency (WUE)

- Scope: Create dedicated landscape meter service areas (and updated vegetation measurements where needed) for the .
- Budgets will be disseminated through a tool that will allow retail water agencies to compare their water usage to the budget.
- Expenses:
  - SAWPA project management, quality control process and committee management,
  - Quantum Spatial Contract (sub-consultants: Eagle Aerial and Waterfluence).

Note: Woodard and Curran (W&C) are shown in the budget as they are the overall project management consultant for SARCCUP (water conservation, water bank, and habitat)

Proposed Budget (Prop 1 Support Tool)

Revenues

	Current Two Year Budget *		Proposed Budget	
Budget Line Item	**FYE 2020**	**FYE 2021**	**FYE 2022**	**FYE 2023**
Prop 1 Grant	$160,667	$321,334	$179,384	$240,751
Prop 1 Participant Fees	$160,667	$321,334	$472,224	$20,955
TOTAL	**$542,788**	**$642,668**	**$651,608**	**$261,706**

Expenses

	Current Two Year Budget *		Proposed Budget	
Budget Line Item	**FYE 2020**	**FYE 2021**	**FYE 2022**	**FYE 2023**
SAWPA Labor (Prop 1 Related)	$0	$0	$106,340	$103,826
Aerial Imagery Products Consultants	$290,134	$580,266	$545,268	$157,880
TOTAL	**$290,134**	**$580,266**	**$651,608**	**$261,706**

*Revenues ≠expenses as Prop 1 grant was not secured at time of budget development.

Proposed Budget (Prop 84 SARCCUP)

Revenues

Budget Line Item	Current Two Year Budget FYE 2020	Current Two Year Budget FYE 2021	Proposed Budget * FYE 2022	Proposed Budget * FYE 2023
Prop 84 Grant	$455,144	$515,850	$337,313	$136,370
Participant Fees	$503,990	$463,292	$433,512	$160,000
TOTAL	**$959,134**	**$979,142**	**$770,825**	**$296,370**

Expenses

Budget Line Item	Current Two Year Budget FYE 2020	Current Two Year Budget FYE 2021	Proposed Budget * FYE 2022	Proposed Budget * FYE 2023
SAWPA Labor	$294,251	$355,868	$139,978	$154,310
W&C Project Mgmt Consulting	$257,114	$215,505	$170,000	$160,000
Legal Fees	$0	$0	$1,300	$1,300
SARCCUP Water Use Efficiency Consultants/Partners	$407,769	$407,769	$459,547	$367,637
Quantum Spatial (in FYE 2022+)	$332,093	$332,093	$459,547	$367,637
OC Coastkeeper	$75,677	$75,677	$0	$0
TOTAL	**$959,134**	**$979,142**	**$770,824**	**$683,247**

*Revenues ≠ expenses in FYE 2023 as reserves will be utilized for expenses.

Combined Revenues & Expenses

Revenues

Expenses

	Current Two Year Budget		Proposed Budget	
Budget Line Item	**FYE 2020**	**FYE 2021**	**FYE 2022**	**FYE 2023**
Grant	$615,811	$837,184	$516,696	$377,121
Participant Fees	$664,657	$784,626	$905,736	$180,955
TOTAL	$1,280,468	$1,621,810	$1,422,432	$558,076
Budget Line Item	**FYE 2020**	**FYE 2021**	**FYE 2022**	**FYE 2023**
SAWPA Labor	$294,251	$355,868	$246,317	$258,135
Legal Fees	$0	$0	$1,300	$1,300
Consulting/Partners	$955,018	$1,203,541	$1,174,815	$685,517
Aerial Imagery Products (Prop 1/USBR)	$290,134	$580,266	$545,268	$157,880
W&C Project Management (SARCCUP)	$257,114	$215,505	$170,000	$160,000
Quantum Spatial (SARCCUP)*	$332,093	$332,093	$459,547	$367,637
Orange County Coastkeeper (SARCCUP)	$75,677	$75,677	$0	$0
TOTAL	**$1,249,269**	**$1,559,409**	**$1,422,432**	**$944,953**

*Before FYE 2022, budget reflects water rate implementation.

Current Budget: Revenues ≠expenses as Prop 1 grant was not secured at time of budget development.

FYE 2023: Revenues ≠ expenses as reserves will be utilized for expenses.

Combined Totals - Comparison to Actual Spending

Revenues

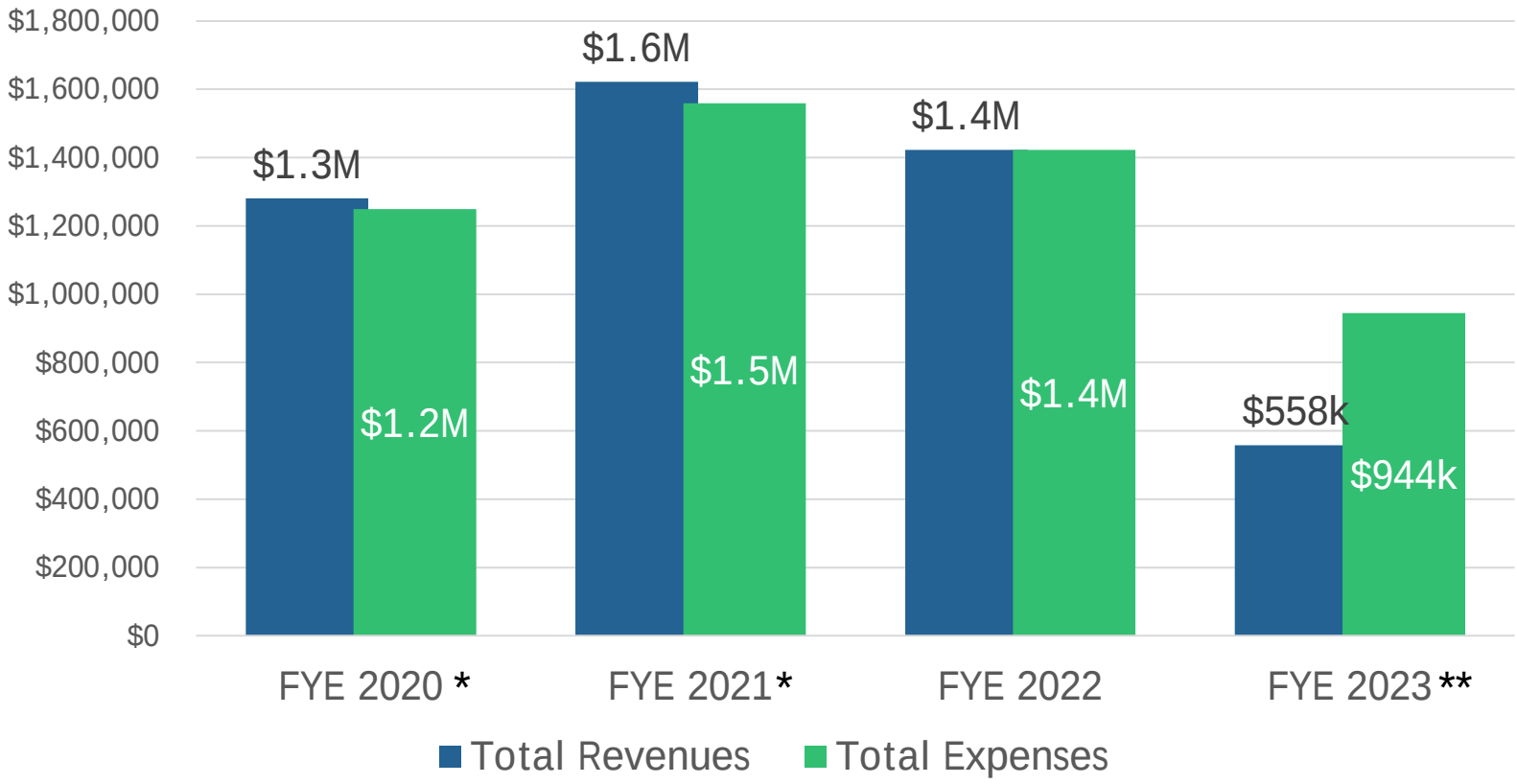
Budget Line Item	Adopted FYE 2020	Adopted FYE 2021	Actual FYE 2020	Projected FYE 2021
Grant	$615,811	$837,184	$166,668	$110,122
Participant Fees	$664,657	$784,626	$503,990	$543,292
TOTAL	$1,280,468	$1,621,810	$670,658	$653,414

Expenses

Budget Line Item	Adopted FYE 2020	Adopted FYE 2021	Actual FYE 2020	Projected FYE 2021
SAWPA Labor	$294,251	$355,868	$69,131	$85,122
Legal Fees	$0	$0	$0	$1,340
Consulting/Partners	$955,018	$1,203,541	$154,973	$171,361
Aerial Imagery Products (Prop 1/USBR)	$290,134	$580,266	$0	$0
W&C Project Management (SARCCUP)	$257,114	$215,505	$154,973	$79,452
Quantum Spatial (SARCCUP)	$332,093	$332,093	$0	$91,909
Orange County Coastkeeper (SARCCUP)	$75,677	$75,677	$0	$0
TOTAL	**$1,249,269**	**$1,559,409**	**$224,104**	**$257,823**

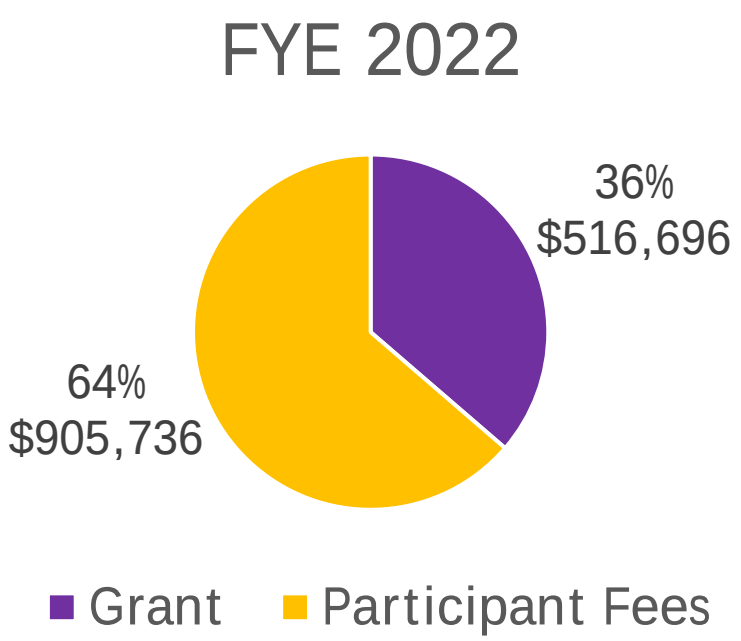
Current Budget: Revenues ≠expenses as Prop 1 grant was not secured at time of budget development.

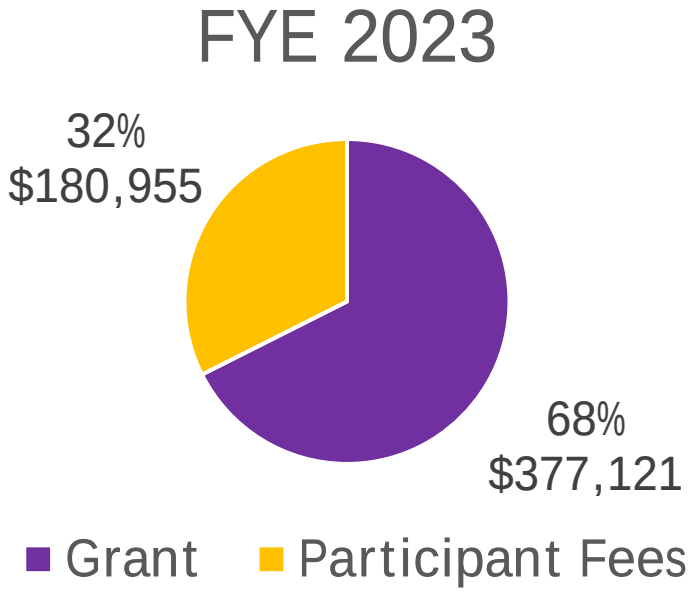
Combined Totals – Revenues and Expenses



*Revenues ≠expenses as Prop 1 grant was not secured at time of budget development.
**Revenues ≠ expenses as reserves will be utilized for expenses.

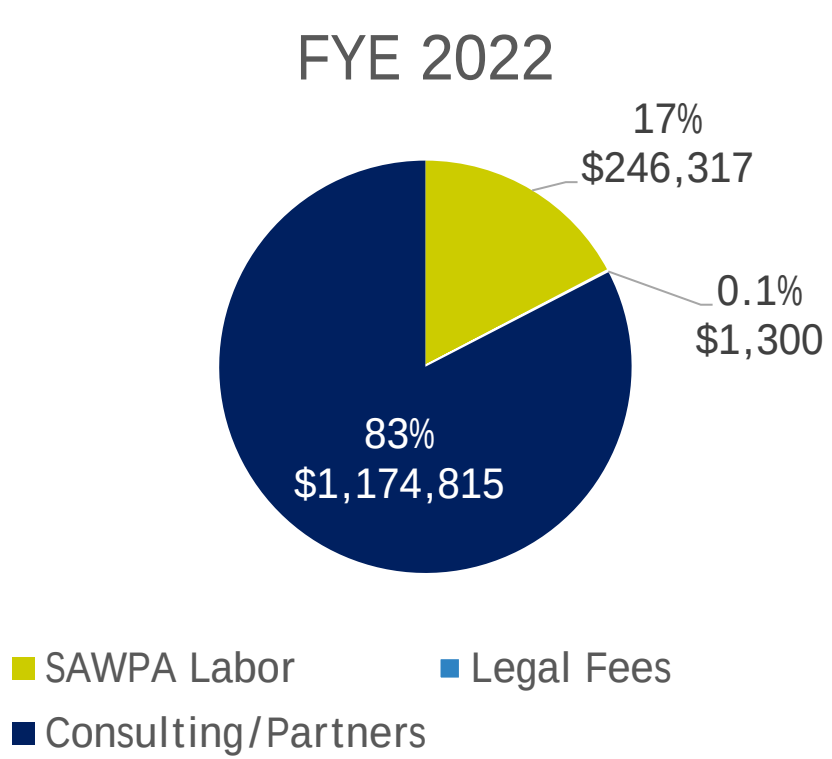
Revenue-Split for Proposed Budget

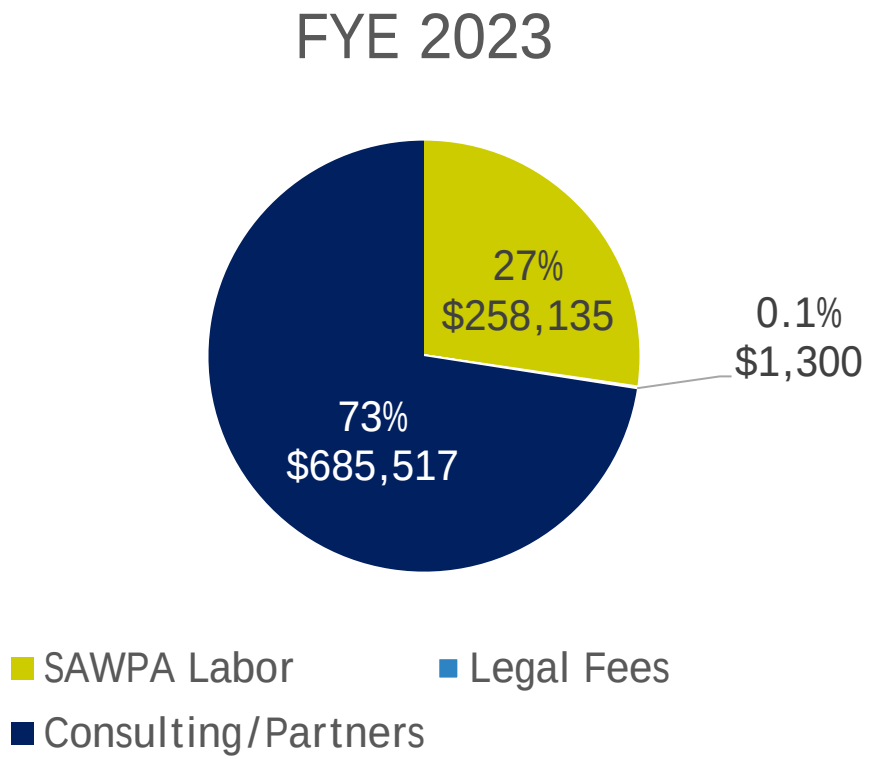




Grant funds: Consultants, SAWPA staff (Committee management).
Participant Fees fund: Consultants, Legal Fees, SAWPA staff (for project management)

Expense-Split for Proposed Budget





Recommendation

It is recommended that the Committee adopt the PA 22 Committee Budget for Fiscal Years Ending 2022 and 2023.

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PA 22 COMMITTEE MEMORANDUM NO. 2021.4

DATE: April 13, 2021

TO: SAWPA Project Agreement 22 Committee

SUBJECT: Approval of Contract for 2021 Upper Watershed Aerial Imagery

PREPARED BY: Ian Achimore, Senior Watershed Manager

RECOMMENDATION

Authorize the General Manager to execute a contract with Geophex Ltd. in the amount of $210,353 for three-inch resolution aerial imagery.

DISCUSSION

The Enhancements to Watershed-Wide Water Budget Decision Support Tool Project (which is funded by a Proposition 1 IRWM Round 1 grant, in-kind staff time partnership with the Bureau of Reclamation, and cost share from the PA 22 agencies and MWDOC) includes the following three tasks:

- **Task 1 – Imagery**: Evaluate and acquire imagery to evaluate landscape for the entire urbanized Santa Ana River Watershed and South Orange County.
- **Task 2 – Landscape Analysis**: Measure landscapes to provide water budgets to retail agencies to support the achievement of water efficiency targets prescribed by the State.
- **Task 3 – Decision Support Tool**: Deploy tool to enable retail agencies to analyze customer water use data to assess customer efficiency, target water over use, and serve as a mechanism for customer outreach.

To implement Tasks 1 and 2, SAWPA needs to procure high resolution watershed imagery. SAWPA, and its partner on the Project for Task 2, the Bureau of Reclamation, will also have access to this imagery. To acquire imagery for the upper Santa Ana River Watershed, SAWPA received PA 22 Committee approval for the Aerial Imagery 2021 Project RFP and received six proposals from the following firms.

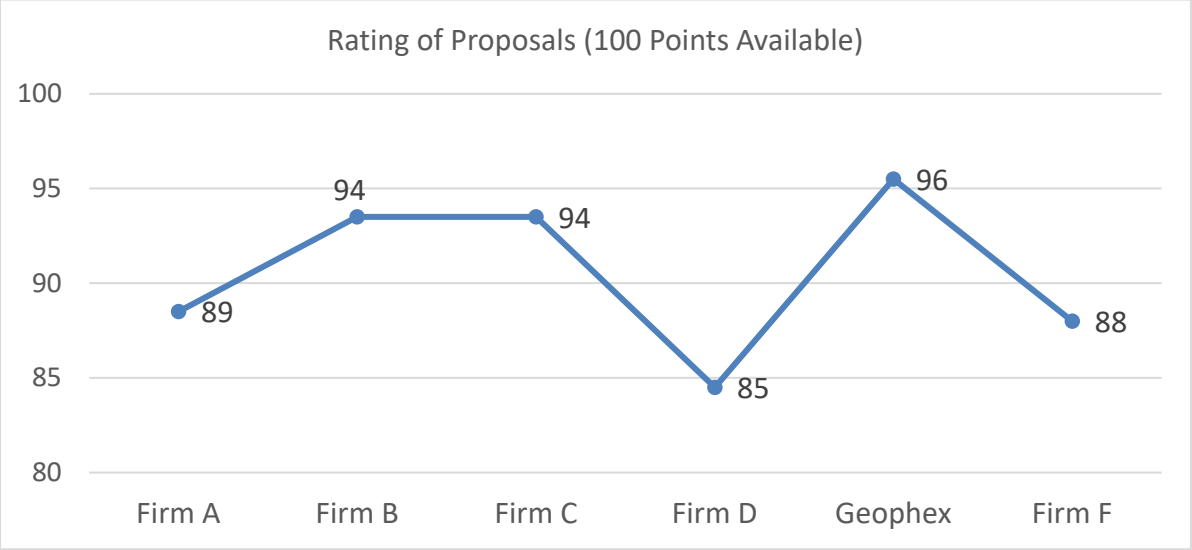
1. Eagle View,
2. Digital Mapping Inc.,
3. Geophex,
4. Sanborn,
5. Surveying & Mapping LLC, and
6. TetraTech.

SAWPA is recommending executing a contact with Geophex as they scored well per the RFP criteria and their price was the lowest (although the RFP does not require SAWPA choose the lowest bid). Geophex's schedule provided was reasonable and they appear well prepared to address the contract specification that each retailer's service area be captured within one flight day. The criteria for reviewing the RFP responses include the following:

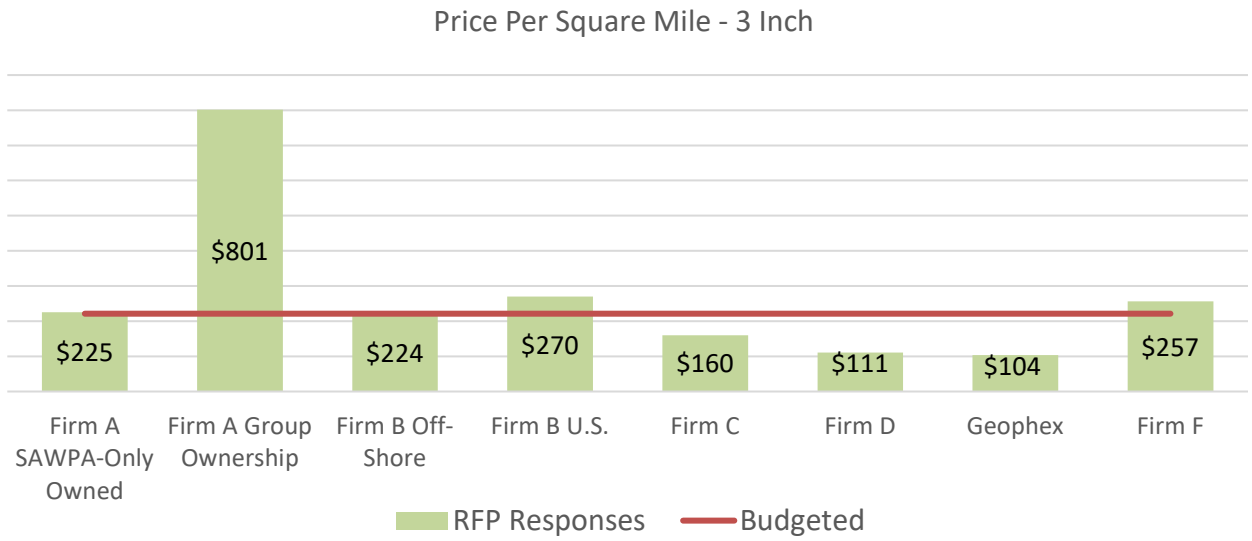
1. Qualifications,

2. Quality of Proposal,
3. Price, and
4. Schedule.

SAWPA scored firms based on their proposals and follow-up clarifying questions (note the specific names of firms, excepted the recommended, are kept confidential):



The prices of the firms are provided below:



Firm A note: SAWPA would only own data (i.e. not transfer it to member agencies without additional fee) unless higher Firm A price is paid.
Firm B note: Off-Shore vs. U.S. pricing reflects the difference between quality control being performed overseas vs. in the U.S.

BACKGROUND

The time frame to complete the overall Watershed-Wide Water Budget Decision Support Tool Project is approximately three years (from early 2020 to late 2022) at an estimated total cost of $1,728,707 as shown in the budget below:

Table 1. Overview of Project Budget

Prop 1 IRWM Grant	Reclamation Support	Cost Share*	Total Cost
$500,000	$597,500	$631,207	$1,728,707

*For both upper watershed and Orange County

The Project will create water budgets based on efficiency at the customer and retail water agency scale through the collection of aerial imagery, weather and other data. It will then be implemented by analyzing high resolution imagery with the aid of imagery processing software to create area measurements of vegetation that is deemed to be irrigated (or has the potential to be irrigated) by the software. By making the water budgets available to retail water agencies through an online decision support tool, retail water agency staff will be able to compare the Project's water budgets and their customer's usage.

As discussed with the PA 22 Committee, the Orange County portion of the watershed (i.e. Orange County Water District and MWDOC service areas) will be receiving high resolution 2020 imagery from their partnership with the Southern California Associations of Government (SCAG).

CRITICAL SUCCESS FACTORS

The following OWOW critical success factors are addressed by this action:

1. Administration of the OWOW process and plan in a highly efficient and cost-effective manner.
2. Data and information needed for decision-making is available to all.

RESOURCE IMPACTS

The costs for the RFP will be covered by cost share (i.e. participant fees) from the four upper watershed SAWPA member agencies as included in the proposed FYE 2022 and 2023 Committee budget. There is costs in the budget to cover the Geophex costs and the four SAWPA member agencies will be billed in July 2021. The amount they will be billed (shown in the able below) is based on their proportion of the imagery's area's population, square mileage and parcel count. The approach of using these three factors to allocate the costs of the imagery was approved by the PA 22 Committee on July 14, 2020.

Table 2. Invoicing to SAWPA Member Agencies Using Approved Ratios

Agency*	Proportion Approved by PA 22 Committee	Geophex Contract Costs Using the Proportions
EMWD	29%	$60,273
IEUA	22%	$45,420
SBVMWD	21%	$43,201
WMWD	29%	$61,460
Total	**100%**	**$210,353**

*OCWD is not shown as they are acquiring imagery through SCAG for Orange County's portion of watershed.

Attachments:

1. PowerPoint Presentation
2. Request for Proposals from Geophex, Ltd.
3. Geophex, Ltd. General Services Agreement
4. Geophex, Ltd. Task Order

Approval of Contract for 2021 Upper Watershed Aerial Imagery

Ian Achimore | Senior Watershed Manager

PA 22 Committee | Agenda Item 4.B.

April 13, 2021

Proposition 1
IRWM Grant

SAWPA

Recommendation

Authorize the General Manager to execute a contract with Geophex Ltd. In the amount of $210,353.

Overall Project Scope

Proposition 1
IRWM Grant

Formal Project Name: Enhancements to Watershed-Wide Water Budget Decision Support Tool

- Task 1 – **Imagery**: Evaluate and acquire imagery to evaluate landscape for the entire urbanized Santa Ana River Watershed and South Orange County.

- Task 2 – **Landscape Analysis**: Measure landscapes to provide water budgets to retail agencies to support the achievement of water efficiency targets prescribed by the State.

- Task 3 – **Decision Support Tool**: Deploy tool to enable retail agencies to analyze customer water use data to assess customer efficiency, target water over use, and serve as a mechanism for customer outreach.

Previous PA 22 Committee Action Related to Project

Meeting Date	Committee Action
March 2019	Approval of: 1) Application submission to Bureau of Reclamation for $597,500 in-kind staff time partnership, 2) Application submission to DWR for $500,000 Prop 1 IRWM Round 1 grant funding.
July 2020	Approval of cost share for upper watershed SAWPA member agencies using formula.
February 2021	Consider approval of RFP for upper watershed imagery and elevation measurements.

Funding for Project

Prop 1 IRWM Grant	Reclamation Support	Cost Share*	**Total Cost**
$500,000	$597,500	$631,207	**$1,728,707**

*For upper watershed and Orange County

Past PA 22 Committee Discussion

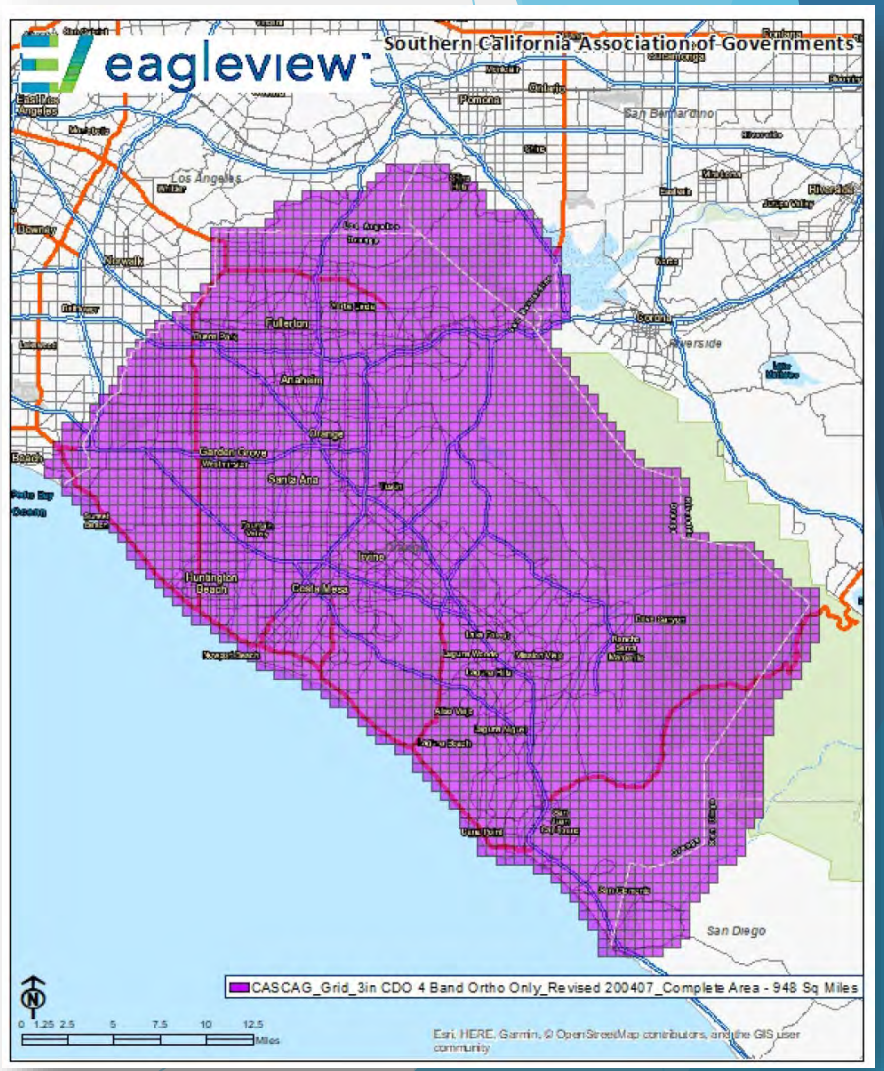
- At July 2020 meeting, PA 22 Committee agreed to proportional share the cost for upper watershed aerial imagery.
- Proportions based on values of these three categories within their wholesale service areas:
  1. Population,
  2. Square mileage and
  3. Parcel amount.

Agency*	Proportion Approved by PA 22 Committee
EMWD	29%
IEUA	22%
SBVMWD	21%
WMWD	29%
Total	**100%**

*OCWD is not shown as they are acquiring imagery through the Southern California Association of Governments (SCAG) for Orange County's portion of watershed.

Orange County Imagery Status

- 3-inch resolution imagery produced by Eagle View via contract with Southern California Association of Governments (SCAG),
- Final GEOTIFF files available for analysis by SAWPA and partner Bureau of Reclamation in July 2022, and
- Effort funded, in part, by OCWD and MWDOC.
  - Not funded by Proposition 1 or USBR partnership, but the 3-inch data is available to SAWPA to implement the Enhanced Decision Support Tool Project.



Purpose of 2021 Upper Watershed Imagery

- Utilize it for Bureau of Reclamation analysis that will create outdoor water budgets,
- Utilize it for residential budgets, as well as CII budgets going forward,
- Utilize it for habitat and vegetation mapping, and
- Utilize it for water agency (including flood control) planning and engineering departments.

- The imagery will be available to the member agencies, in addition to being available for the Project.

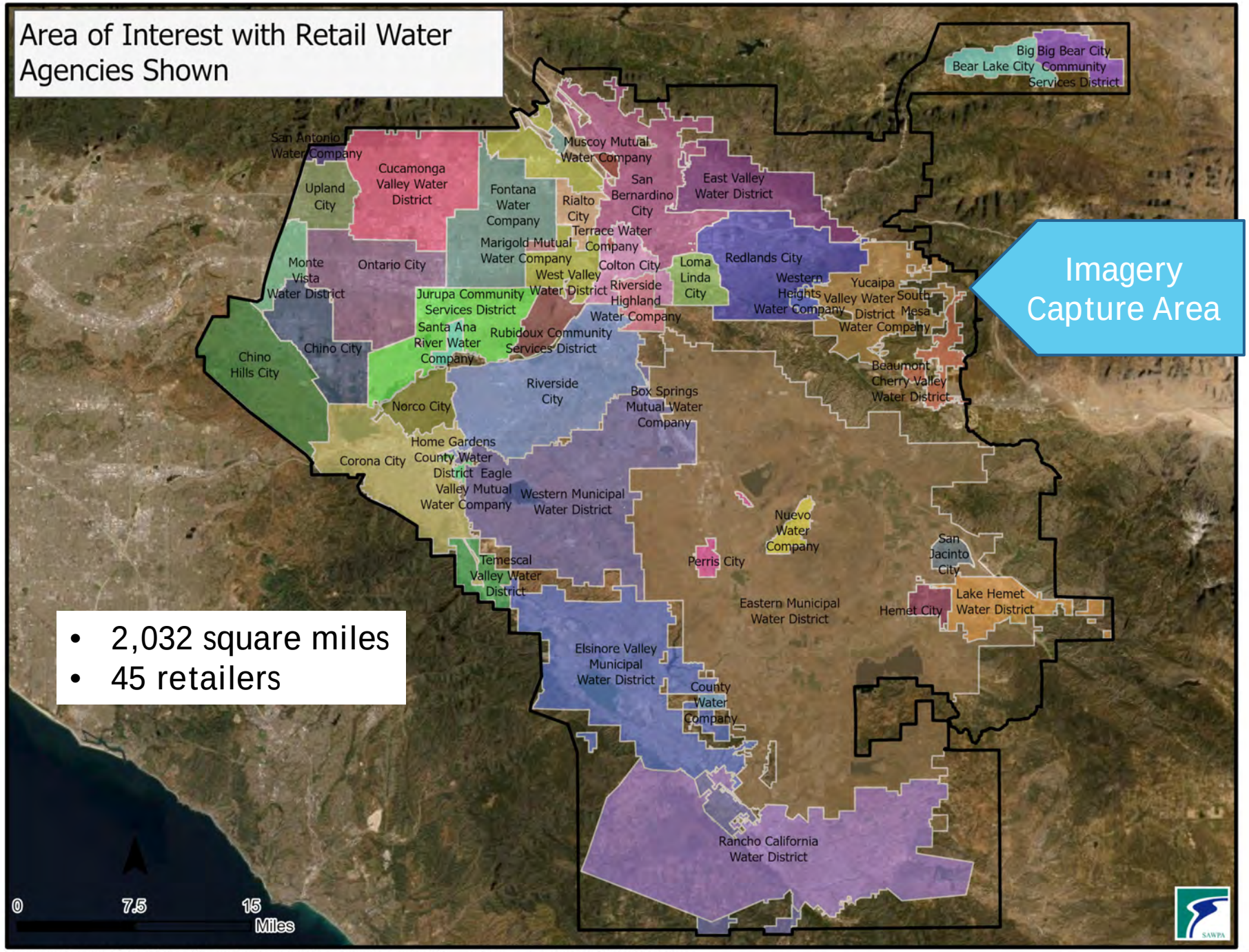
Assembly Bill 1668

Provides for the use of alternative sources of data if alternative sources are shown to be as accurate as, or more accurate than, the data provided by the department.

Request for Proposals Developed

- Similar to 2015 RFP for high resolution watershed imagery
  - Asked for prices for a range of different resolutions including 3-inch and 12-inch pixels.
- Major changes from 2015 RFP:
  - Just upper watershed as OC is covered by SCAG project,
  - Flight paths to be centered around retail water agencies,
  - Elevation deliverables that allow for slope adjustments, and
  - Web-based dashboard to QA/QC imagery after its flown.

- RFP Coordination by SAWPA
  - Coordinated with water conservation advisory group and informed GIS and planning managers of SAWPA member agencies, as well as US Bureau of Reclamation.


Area of Interest with Retail Water Agencies Shown
Big Bear City Community Services District
Bear Lake City
San Antonio Water Company
Cucamonga Valley Water District
Upland City
Muscoy Mutual Water Company
Fontana Water Company
San Bernardino City
East Valley Water District
Rialto City
Terrace Water Company
Marigold Mutual Water Company
Monte Vista Water District
Ontario City
Colton City
Loma Linda City
Redlands City
West Valley Water District
Riverside Highland Water Company
Western Heights Water Company
Yucaipa Valley Water District
South Mesa Water Company
Jurupa Community Services District
Santa Ana River Water Company
Rubidoux Community Services District
Chino Hills City
Chino City
Riverside City
Box Springs Mutual Water Company
Beaumont Cherry Valley Water District
Norco City
Home Gardens County Water District
Corona City
Eagle Valley Mutual Water Company
Western Municipal Water District
Nuevo Water Company
Perris City
San Jacinto City
Temescal Valley Water District
Eastern Municipal Water District
Hemet City
Lake Hemet Water District
Elsinore Valley Municipal Water District
County Water Company
Rancho California Water District
Imagery Capture Area
• 2,032 square miles
• 45 retailers
0
7.5
15
Miles
P:\projects\Prop1SAWPA\UpperWatershedProposalMap\UpperWatershedProposalMap.aprx LoFlightPathUW SW-3014

Contract Deliverables

- Flight Plan
- Project Control Report
- Metadata Report
- Initial Raster Imagery (not orthorectified)
- Final GEOTIFF tiles
- Compression files (ECW)
- Elevation calculation deliverables
- Bi-weekly updates
- Four meeting updates (two to Advisory Group, two to PA 22 Committee)

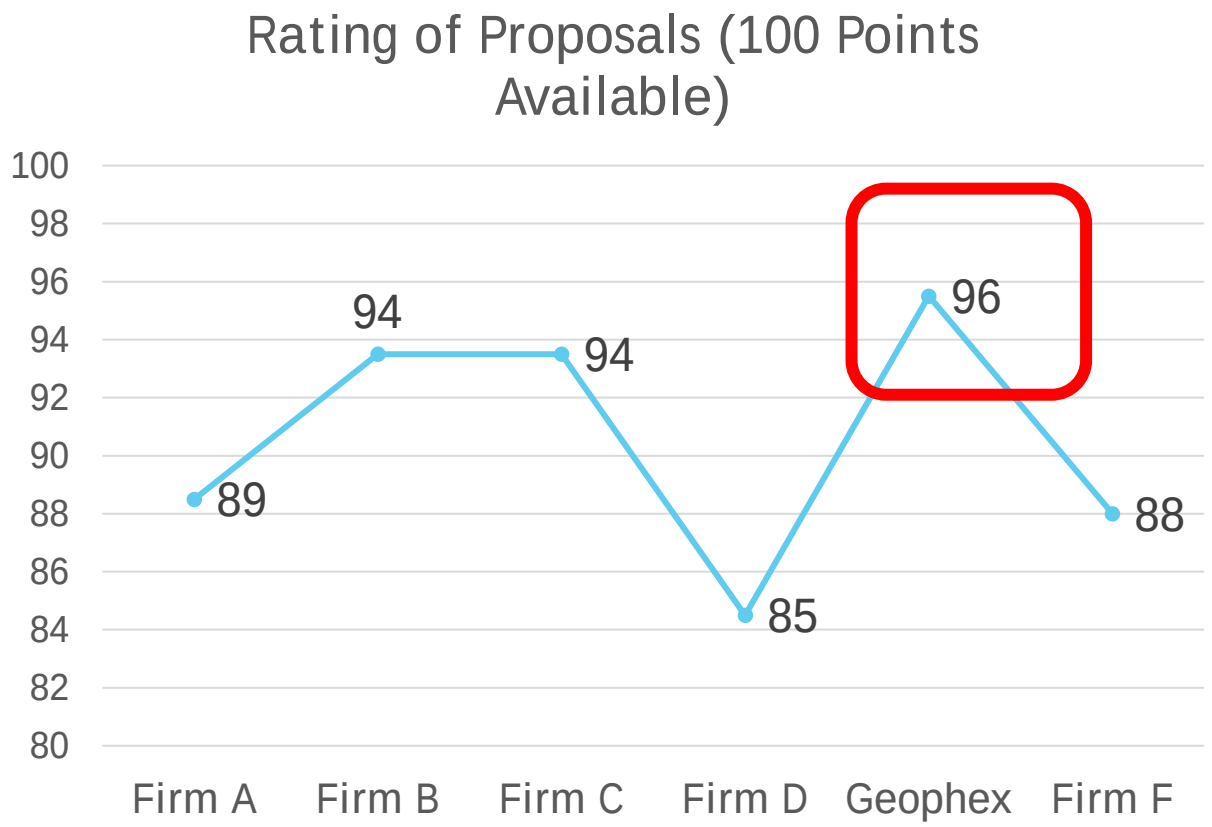
Available via web-portal that member agencies have access too

Major deliverables, used for imagery analysis

Proposals Received

- Eagle View,
- Digital Mapping Inc.,
- Geophex,
- Sanborn,
- Surveying & Mapping LLC, and
- TetraTech.

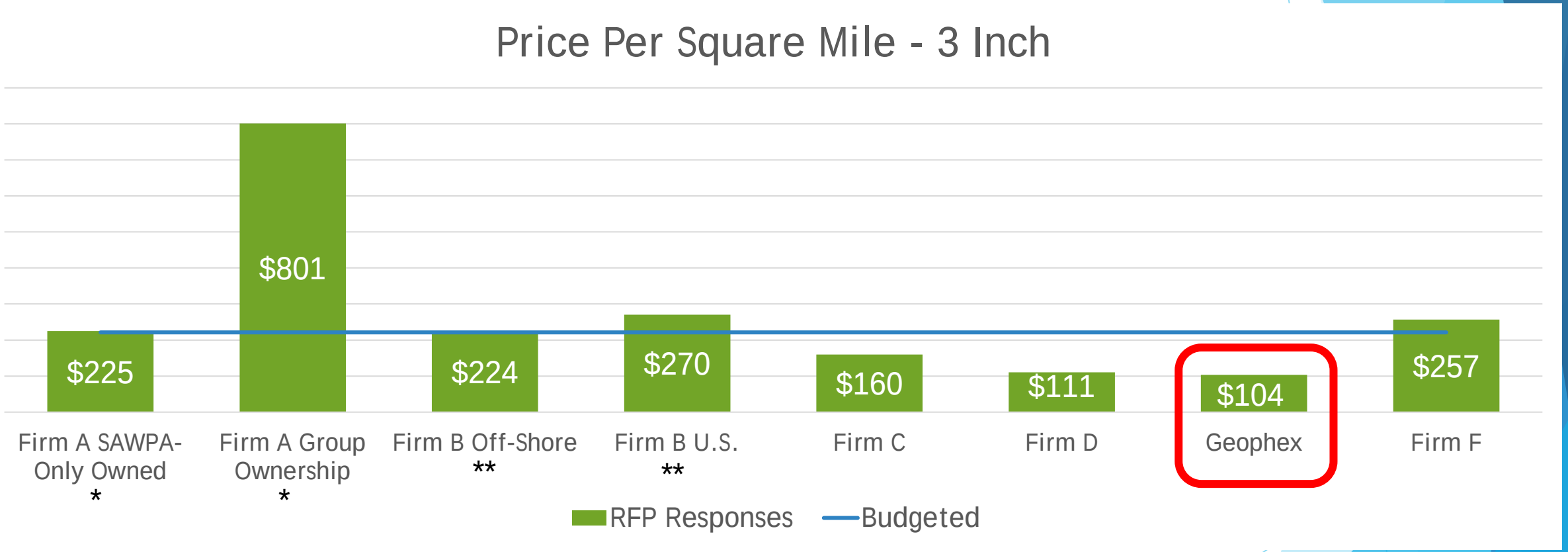
Proposals Ranking



Proposal Criteria Include:

1. Qualifications,
2. Quality of Proposal
3. Price
4. Schedule

Recommend Firm vs. Budget



*SAWPA would only own data (i.e. not transfer it to member agencies without additional fee) unless higher Firm A price is paid.
**Off-Shore vs. U.S. pricing reflects the difference between quality control being performed overseas vs. in the U.S. for Firm B.

Invoicing to SAWPA Member Agencies Using Approved Ratios

Agency*	Proportion Approved by PA 22 Committee	Geophex Contract Costs Using the Proportions
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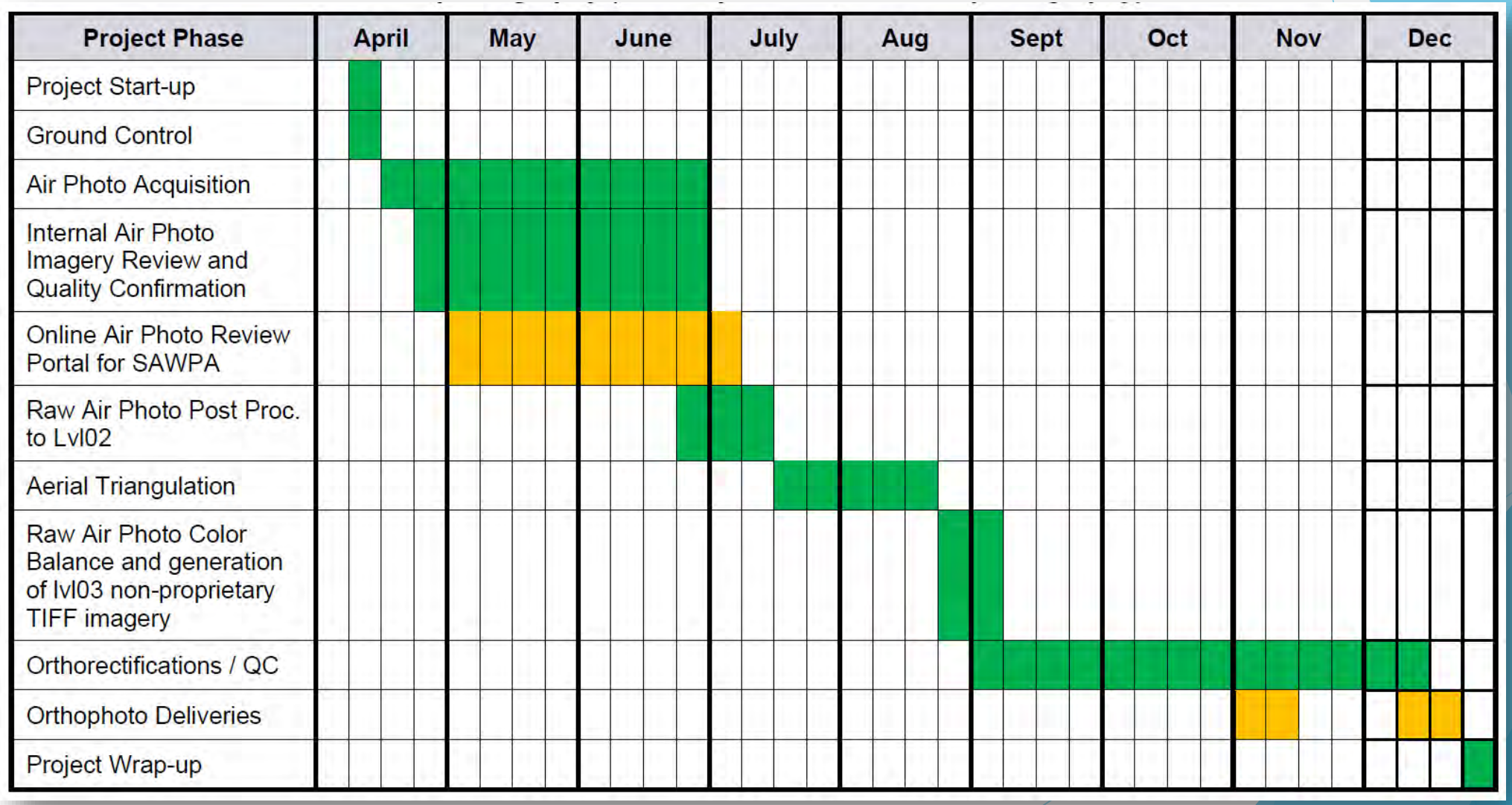
SBVMWD	21%	$43,201
WMWD	29%	$61,460
Total	**100%**	**$210,353**

*OCWD is not shown as they are acquiring imagery through SCAG for Orange County's portion of watershed.

About Geophex

- 28 years of experience in aerial mapping,
- Various California clients including County of Orange, Mojave Water Agency, San Diego Port Authority, and City of Roseville,
- Experience in orthophotography, field surveying, elevation modeling, and LiDAR, and
- Performed similar project for Santa Ana River Watershed in Summer 2015.

Geophex Schedule – 3 Inch Aerial Imagery



Elevation Deliverables

- Not proposing to move forward with elevation deliverables at this time,
- No major interest by SAWPA member agencies and MWDOC currently, and
- Have option to come back later to PA 22 Committee to execute contract.

Recommendation

Authorize the General Manager to execute a contract with Geophex Ltd. in the amount of $210,353 for three-inch resolution aerial imagery.

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Geophex
Surveys

Santa Ana Watershed Project Authority
2021 Imagery Acquisition Project

Submitted to:

Ian Achimore & Peter Vitt
Santa Ana Watershed Project Authority
Email: iachimor@sawpa.org
Email: pvitt@sawpa.org

Due: March 9th, 2021, 5:00pm

Submitted by:

Geophex, Ltd.
605 Mercury Street
Raleigh, North Carolina 27603

Andrew Dawson
President

Email: adawson@geophexsurveys.com
Ph: (919) 578-8857 (ext. 101)
Fax: (919) 578-8849

TABLE OF CONTENTS

A) COVER LETTER

March 9, 2021

To Ian Achimore and Peter Vitt,

Introduction

Geophex Ltd. is pleased to present to Santa Ana Project Watershed Authority (SAWPA) our proposal for the 2021 Imagery Acquisition project. Geophex understands that the primary purpose of this RFP is to obtain 2021 digital color 4-band (RGBIr) imagery that can be used for software vegetation analysis within the area of interest that primarily covers the upper Santa Ana River Watershed. It is also understood that requirements for collections in other parts of Riverside and/or portions of adjacent counties may be requested any time during the term of the contract. Our clear understanding of this project comes from our expert staff and our long history of successfully executing many projects of similar size and scale, including numerous water authority projects requiring quality imagery for image analysis. Geophex Surveys acknowledges any and all RFP revisions, addendums, and any project clarifications provided by the Santa Ana Project Watershed Authority.

Project Understanding

Geophex Surveys understands that the SAWPA 2021 Imagery Project involves the collection of 3-inch, 6-inch or 12-inch resolution aerial photography and delivery of orthophotography, DEM (if any) and contours (if any). The orthophotography will be rectified using imagery collected with the Vexcel UltraCam Eagle, the most recent generation in large format digital camera technology. To control the imagery Geophex Surveys will utilize airborne GPS and IMU data as well as an extensive ground control network that Geophex Surveys has established over the years. The DEM used to rectify the imagery will be generated in-house utilizing a combination of existing and newly collected elevation data. The DTM to support TIN and 2ft contour generation will be photogrammetrically collected from the stereo imagery or collected using a LiDAR sensor.

Qualifications and Experience

Geophex Surveys, by the continual support of government clientele across the United States, is well versed in mapping both large and small regions. In the past ten years, Geophex Surveys has performed over 750,000 mi² of aerial surveying, and within the last few years we have successfully performed projects for several California governments including:

- Santa Ana Watershed Project Authority, CA
- Mojave Water Authority, CA
- Orange County, CA
- California Water District
- San Diego Port Authority, CA
- Santa Clara, CA
- Brentwood, CA
- Roseville, CA

Geophex has successfully completed countless City and County aerial survey and mapping projects throughout California over the past 28 years. Through the submission of this proposal, Geophex Ltd. signals its commitment that if Geophex Ltd. is selected as the successful contractor, it shall bear the sole and complete responsibility for all work as defined in the Santa Ana Project Watershed Authority RFP. This proposal will remain valid for a period of 60 days after the RFP closing date. Geophex Ltd. is looking forward to the opportunity to work with the Santa Ana Project Watershed Authority again. Should you have any questions regarding our proposal, please do not hesitate to contact the undersigned.

Sincerely,

Andrew Dawson, President
Geophex Ltd.
605 Mercury Street
Raleigh, North Carolina 27603
Ph: (919) 578-8857 (ext. 101) / Fax: (919) 578-8849
Email: adawson@geophexsurveys.com

B) INTRODUCTION/COMPANY OVERVIEW

Company name, business address, phone number, fax number and internet address

Name: Geophex Surveys Ltd.

Business Address: Geophex Surveys Ltd
605 Mercury Street
Raleigh, North Carolina
27603

Phone Number: (919) 578-8857 (ext 101)
Fax Number: (919) 578-8849

Internet Address: www.geophexsurveys.com

Year the Firm was Established and any Former Names

Geophex Surveys was established in 1983.

Type of Ownership and Parent Company

Geophex Surveys is a wholly owned subsidiary of Geotech Ltd.

The Location of the Office that will provide the Project Services

605 Mercury Street
Raleigh, North Carolina 27603
Tel: (919) 400-8542
Fax: (919) 839-8528

1214 Austin Ave.
Coquitlam, BC V3K 3P5
Phone: (778) 383-3737
Fax: (604) 931-2026

Location of Subcontractors and Outsourcing Services

The Geophex Surveys team works closely with other professionals who strategically partner with us and assist with production tasks. We have a long-term working relationship with our partners spanning thousands of hours' worth of work, so we can be confident in building a team with the ability to deliver quality results on schedule. In all cases, Geophex acts as the prime contractor for the project and manages our partners carefully to ensure that the project plan is being followed. The members of our team have jointly worked on a number of key projects over the past several years.

Aerial Photography Acquisition Subcontractor

For the air photo acquisition, Geophex Surveys will be teaming with Aero-Graphics Inc. based out of Salt Lake City, Utah. AGI is a privately-owned geospatial services business located in Salt Lake City, Utah. Established in 1965, Aero-Graphics has a nationwide reputation for providing high-quality aerial imaging services on schedule at competitive prices. Aero-Graphics own and operate their own aircraft and equipment which allows for complete control of flight scheduling. The latest digital systems are used to acquire aerial imagery for Federal, State, local, and private clients across many different industries, including flood and geohazard Mitigation, resource management, forestry, environmental and civil engineering, transportation, utilities, and more. In addition, Aero-Graphics is ISO 9001:2015 certified to better service their client needs.

Geophex Surveys and Aero-Graphics have been successfully flying and processing imagery for all of Orange County for the last five (5) years. Our team is very familiar with the terrain, environmental conditions and restricted airspace. This knowledge will minimize flight acquisition risks and ensure a successful air photo capture. See **Appendix C** for more information about Aero-Graphics.

Aero-Graphics Inc.
40 W Oakland Avenue
Salt Lake City, UT 84115
Ph: (801)487-3273
Email: sales@aero-graphics.com

LiDAR Acquisition Subcontractor

For the LiDAR acquisition, Geophex Surveys will be teaming with Keystone Aerial Surveys. Keystone Aerial Surveys, Inc. (Keystone), **established in 1963 and a wholly owned subsidiary of Vexcel Imaging**, specializes in providing high-quality aerial surveys throughout North America. Keystone has flown millions of survey miles throughout the United States and maintains five permanent locations; Philadelphia, PA (headquarters), Tyler, TX, Tucson, AZ, Santa Rosa, CA and Reno, NV. Keystone owns and operates twenty-one aircraft and eight large-format digital sensors.

Geophex and Keystone have successfully flown and processed numerous projects in California, including the 2015 SAWPA program. Keystone's operations in California well positions them to acquire LiDAR for the subset areas as defined in the RFP. For more information about Keystone, see **Appendix C.**

Keystone Aerial Surveys
Northern California Hub
Santa Rosa, California
Phone: (541) 227-8597
Fax: (215) 464-2889
www.kasurveys.com

A Verisk Business KEYSTONE

Geophex, Ltd. Company Background

The Geophex Surveys Division, formerly Mapcon Mapping Inc., has successfully been performing mapping projects for all levels of government throughout California and the United States for more than 30-years. As a supplier of geospatial data products and services, we recognize the crucial role that such information and technology play in key decisions at all levels of an organization. Over the years, Geophex Surveys has achieved a lengthy record of successful projects for numerous government and commercial clients including city, county, state, and federal agencies, as well as many engineering, utility, and resource sector firms. Geophex Surveys has earned an industry reputation for delivering high quality mapping products under demanding schedules.

With each aerial survey project, our philosophy has been to provide the client with superior service to ensure that all stakeholder expectations, such as scope, cost, schedule, and quality are met. Our company's health is directly connected to positive client references. To guarantee these positive client references our approach is to combine cutting-edge technology with a team of key technical personnel backed with impressive career achievements, extensive experience, and solid educational accreditations to ensure successful completion of projects.

Our mapping team members are among the most technically experienced orthophoto and photogrammetric managers and technicians in the business. The people in our photogrammetry group average over 20 years of professional experience, and all the key members of our team have held senior positions for many years with large and respected photogrammetric firms. They bring a wealth of experience in municipal mapping and project management, as well as a high degree of professionalism in building relationships with clients. Our depth of experience and technical ability make Geophex Surveys one of the most highly qualified firms in the mapping industry.

Our services include:

- Aerial Photography Acquisition
- Orthophoto Production
- Planimetric Mapping
- Aerial Triangulation
- Surface Modeling
- LiDAR Mapping
- Satellite Image Acquisition and Processing
- UAV Aerial Surveys
- Ground Surveys
- Engineering Scale Mapping

Statement of Longevity and Financial Security

Geophex has been in the aerial mapping business since 1987. Our parent company, Geotech Ltd, provides the financial stability and strategic leadership required to ensure the implementation of cutting-edge technology teamed with highly qualified staff making. This has made Geophex one of the most successful and competitive mapping companies in the western US.

C) TECHNICAL APPROACH

Geophex Surveys will provide high quality, accurate, and timely orthophotography and related products for the SAWPA acquisition area that covers approximately 2032 mi², as defined in Exhibit D, Flight Area Upper Watershed. Our approach is to capture the imagery utilizing a Vexcel UltraCam Eagle large format digital camera at 3-inch, 6-inch or 12-inch GSD. Aerial Imagery will be controlled using an extensive ground control network and rectified using a combination of existing and new DEM that will exceed the horizontal accuracy requirement of ± 2.5ft. If the Santa Ana Watershed Project Authority opts for the optional DTM, TIN and 2ft contours, Geophex Surveys will either leverage the 2021 3-inch or 6-inch aerial photography or capture new LiDAR elevation data to generate these deliverables. Once the orthophotos/DEM/DTM have been generated, they undergo an extensive QA/QC procedure that checks for positional accuracy as well as aesthetic quality. Project deliverables will meet the requirements as identified in section 4.1 of the RFP.

Geophex Surveys has the experience and expertise required to generate SAWPA's products, and specialize in orthophoto production and the generation of digital elevation models. The tasks required to generate the SAWPA's products can be broken down into the following steps:

1) Ground Control
2) Air Photo Acquisition and Equipment
3) Aerial Triangulation
4) Digital Elevation Model Generation
5) Orthophoto Rectification
6) Optional Products – Photogrammetrically generated Digital Terrain Model or LiDAR Acquisition to generate TIN and 2ft Contours
7) Quality Control

Please refer to the **Responder's Offers** section for a detailed description of how the work will be done in each of these steps.

D) PROJECT TEAM / PROJECT MANAGEMENT APPROACH

Geophex Surveys has a team of highly accredited employees with extensive experience successfully executing many projects of similar size and complexity to the Santa Ana Watershed Project Authority.

Geophex Surveys has assembled the necessary key staff to ensure this project is completed successfully and on schedule, and that it be designated as a priority over other projects booked at a later date. We have assigned seven key Geophex Survey team members to the SAWPA project, and have outlined each team member's defined project role, area of expertise, and experience in the following table. See **Appendix B** for Geophex Surveys' team resumes.

Geophex Surveys Key Personnel Table

Staff Member	Position	Role in Project	Years of Experience	Years w/Geophex Surveys	Qualifications / Experience
Andrew Dawson	President	Backup Project Mgr.	20+	10+	MBA, B.Sc. Environmental Science
Kevin Woolf	Project Manager	Project Manager	20+	10+	M.Sc. in Remote Sensing & Geography
Bill Dawson	Technical Manager	Technical Manager	30+	10+	B.Sc. Geography
Bjorn Norman	Aerial Triang. Mgr.	Aerial Triangulation / QAQC	30+	10+	ASPRS Certified Photogr. #1264
Alexander Gikas	Senior A/T Tech.	Aerial Triang. / QA/QC	25+	1	Degree - Geomatics
Daniel Mani	Photogrammetry Manager	DEM / Photogrammetry	30+	10+	Experience Only
Mark Prenter	Orthophoto Mgr.	Ortho Production / QC	25+	15+	Experience Only
Mike Hogan	Survey Manager	Survey Manager	20+	5+	California Licensed Surveyor PLS 7362

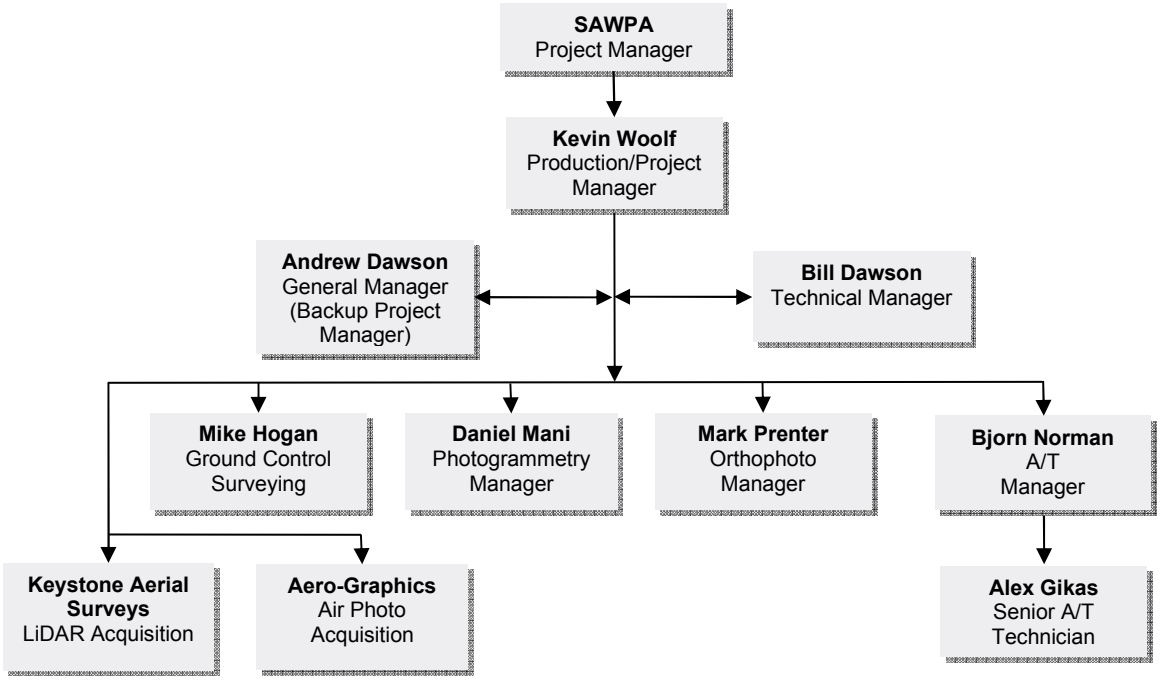
Air Photo Acquisition Subcontractor – Aero-Graphics Key Personnel Table

Staff Member	Position	Experience	Professional Education / Designations
Bernie Doud	Program Mgr. / Contracting	18	Burnaby
Mason Decker	QA/QC Mgr. / GIS Mgr.	6	BS, Geography; GIS Certificate
Emilio Sanchez	Aerial Data Acquisition Mgr.	19	Undergraduate Studies, Aviation Technology FAA Private Pilot / UAS Pilot Certification
Kevin Reid	Photogrammetry Manager	20	Undergraduate Studies, Computer Science ASPRS Certified Photogrammetrist #1557

LiDAR Acquisition Subcontractor - Keystone Aerial Surveys Key Personnel Table

Staff Member	Position	Experience	Professional Education / Designations
Robert Burtoft	Aerial Survey Pilot	15 years	Pierce College North Valley Occ. Center Aviation Maintenance Single and multi-engine commercial rating
James Herrera	Sensor Operator	20 years	Citrus College; Brooks Institute of Photography

Geophex Surveys Organizational Chart



Project Responsibility

The following table identifies the project tasks and responsibilities for the SAWPA project.

SAWPA Project Responsibility Table

Project Responsibilities	Geophex Surveys	Aero-Graphics	Keystone Aerial Surveys	SAWPA
Overall Project Responsibility	✓			
Sole Point of Contact with the SAWPA	✓			
Providing Mapping Boundaries				✓
Aerial Imagery Acquisition		✓		
LiDAR Acquisition and Calibration			✓	
Air Photo QC	✓			
Aerial Triangulation	✓			
Orthophoto DEM	✓			
Orthophotography Processing (optional)	✓			
Photogrammetric DTM/LiDAR Post processing	✓			
TIN and Contour Generation	✓			
Image Processing & QC	✓			
Data Delivery	✓			

Project Management

Geophex Surveys believes that successful projects begin with proactive project management that takes into account our client's needs, project specifications and available resources and implementation of the steps required to achieve this goal. A well-managed project will eliminate many hours of unproductive effort on both the part of Geophex Surveys as well as our client.

At Geophex Surveys, we manage our projects internally through the assignment of a Project Manager who takes responsibility for actively maintaining the project and quality control, and keeping the production processes moving forward smoothly. Our project manager for the SAWPA project will be **Kevin Woolf**. Kevin is a highly experienced project manager and has successfully managed aerial survey projects of all scope and complexity throughout California including:

- SAWPA Orthophoto Program (2015)
- Mojave Water District (2018, 2019, 2020)
- Santa Maria, CA (2015, 16, 18, 19)
- Orange County, CA (2016, 17, 18, 19, 20)
- Roseville, CA (2013, 15, 17, 19)
- Southern Nevada Water Auth. (2016 – 19)
- Brentwood, CA (2015, 18)
- Santa Ana, CA (2017)
- Mountain View, CA (2015, 17)
- Cupertino, CA (2015, 17)

Many of the projects that Kevin has managed over the past 13 years at Geophex Surveys, and is currently managing, include orthophotography, DEM, LiDAR, and topographic data collection. Kevin will act as the prime contact to SAWPA throughout all phases of project execution, and will also ensure that the project schedule is being maintained. He will keep the Geophex Surveys management team informed of project progress and any perceived problems will be resolved immediately, either internally or in consultation with the Agency. Our project management style is based on an open relationship with our clients, where all issues are dealt with efficiently and in an atmosphere of trust and co-operation. See **Appendix B** for Kevin's resume.

Client Communication and Reporting

Open and regular communication between the client and the project manager is vital to ensure that all expectations and project requirements are met and clearly conveyed. In consultation with the client, the project manager arranges meetings and a reporting schedule that meets the specific needs of the client. Often at the beginning of the project, the communication is more frequent as the data and image capture takes place and then usually becomes weekly status updates and progress meetings to report project development. Common communication meetings and reporting schedules include:

Meetings

Meeting Type	Period	Participants
Initiating/Planning meetings	As necessary	Sales Mgr, Geophex Surveys' Project Mgr, MWA's Project Mgr
Project Kick-off meeting	Start	Sales Mgr, Geophex Surveys' Project Mgr, MWAs' Project Mgr
Project Progress meetings	As necessary	Geophex Surveys' Project Mgr, MWA's Project Mgr
Project Status meetings	Monthly As necessary	Geophex Surveys' Project Mgr, MWA's Project Mgr
Closeout meetings	On Phase/Project close	Geophex Surveys' Project Mgr, MWA's Project Mgr

Progress and status reports

Report Type	Period	Recipients	Responsible
Project Plan	Start	MWA's Project Mgr	Geophex Surveys' Project Mgr
Periodic Progress Reports	Bi-weekly	MWA's Project Mgr	Geophex Surveys' Project Mgr

Subcontractor Management

Geophex Survey's approach for all projects is to provide a highly experienced and qualified team of professionals in air photo acquisition, ground control survey, orthophotography, and photogrammetry. Having many years of experience in orthophoto and photogrammetry production are essential in achieving a high quality well executed project. We pride ourselves on our ability to deliver quality work on time and on budget no matter what size of project.

Geophex Surveys acts as the prime contractor for the project and manages all subcontractors carefully to ensure that the project plan is being followed. Our process of subcontractor management begins with an initial meeting with the subcontractor team. In this meeting, the work that is being contracted is described and specific issues or concerns that are unique to each project are discussed. Identifying and communicating concerns to the subcontractor at the outset of the project is critical to the success of a project. We then develop a written Subcontractor Management Plan that documents the following:

- Description of the required tasks including identified concerns
- Identification of key individuals participating in the subcontracted work
- Identification of principal points of contact during project execution
- Description of how periodic and event driven communications will be handled identifying methods to be used such as phone, email etc. and their frequency
- State the frequency of written status reports and to whom and they are to be delivered
- Description of milestones and duration between milestones
- Identification of the individual responsible for managing risks outlined
- Description of how the risk manager will identify, document, analyze, prioritize, mitigate, and monitor risks throughout the project
- Description of how commitments and issues will be documented. Commitments by the subcontractor need to be made explicit and tracked to closure. Issues need to be made visible, resolved and tracked to closure

Once a task has been assigned to one of our prequalified subcontractor partners, a reporting methodology is established. In addition to constant monitoring of project progress through phone calls and emails, a weekly progress report is delivered outlining the progression of the project.

Geophex Surveys performs rigorous QA/QC checks on all data before it is delivered to the client, and **is solely responsible for all deliverables**. We verify that the original project plan and specifications have been adhered to, and then followed up with a more detailed examination of the deliverables.

Project Implementation

Initiation/Administration

Project initiation will begin upon agreement on administrative procedures and the issuance by SAWPA of a written notice to proceed. Conference calls will be scheduled to address project start-up issues, determine the prototype/pilot area, distribute necessary source materials, and to address any other technical or procedural issues.

Following the project initiation meeting(s), Geophex Surveys shall draft a work plan detailing all technical and administrative procedures. The work plan shall include, at a minimum, the following content:

- Narrative description of tasks, subtasks and deliverables
- Schedule with tasks, sub-tasks, dependencies, progress (by task and sub-task), assigned resources and deliverables (to be maintained as a Gantt chart)

SAWPA will review the defined procedures; request any necessary clarifications and changes; and upon agreement, will authorize the commencement of work. The work plan will serve as the project plan and documentation of technical activities throughout the project and will be proactively maintained by Geophex Surveys and re-distributed at least monthly throughout the project. A final report shall be delivered to SAWPA upon project completion.

Production Phase

A full project-wide production phase of the project shall commence upon express written notice to proceed. Geophex Surveys shall propose a delivery schedule for SAWPA's approval after which, they will provide authorization to proceed for each phase of the project. Each delivery will include all products required. Before shipping deliverables, Geophex Surveys will ensure all deficiencies have been identified and corrected using our quality assurance procedures.

Project Wrap-up

Upon the final data delivery, there will be a communication between our project manager and SAWPA to ensure that all data has been received. Once the final data has been accepted, there is to be a closing meeting to communicate any project concerns and ensure that all expectations were met, and the final invoice then presented to the client.

Warranty

Geophex Surveys stands behind all our data deliverables and we back this commitment with long standing warranties. If SAWPA identifies that the data produced does not meet specifications, Geophex Surveys will fix the substandard data at no charge for a period of 1 year. Our commitment to our clients' satisfaction is what has kept Geophex Surveys a consistent leader in the mapping industry.

Contingency Planning and Risk Management

At Geophex Surveys, our project planning and management also includes strategies to eliminate or greatly reduce the effect that unplanned events can have on a project schedule or deliverables. Risk management identifies potential problems before they occur so that contingencies can be planned and executed as needed throughout the life of the project. By doing so, the likelihood of a project finishing successfully is greatly increased. The greatest risks to preventing completion of most aerial survey projects are weather and mechanical difficulties with aerial acquisition.

Aircraft

Keystone Aerial Surveys and Aero-Graphics are proud of their proven mechanical reliability. With a large fleet of aircraft and a strict adherence to aircraft maintenance schedules, they can be relied upon to ensure that the aerial survey is captured according to the required specifications and schedules.

Aerial Camera

The SAWPA project will use the Vexcel UltraCam Eagle format digital aerial camera. This camera system is extremely reliable, and any unlikely maintenance or technical issues can be quickly resolved by Vexcel's maintenance team. In addition, Aero-Graphics a second Vexcel Eagle large format digital aerial cameras, so any technical issues can also be quickly resolved by utilizing an equivalent camera system.

LiDAR Sensor

The SAWPA project will use the Optech Galaxy Prime LiDAR sensor. This LiDAR sensor is one of the top industry LiDAR sensors available and is extremely reliable, and any unlikely maintenance or technical issues can be quickly resolved by Optech's maintenance team. In addition, Keystone Aerial Surveys owns several Optech LiDAR sensors, so any technical issues can also be quickly resolved by utilizing an equivalent camera system.

Resource Management

Resource Management ensures that production resources are available from data acquisition through to delivery. At Geophex Surveys, we have invested in technical infrastructure that allow us to efficiently process complex and large aerial survey projects, and our department managers each have high levels of expertise and many years of production experience. Furthermore, we carefully choose any subcontractors or partners, and only select those that meet our high standards and with whom we can develop and maintain long-term relationships.

Data Redundancy

To protect the acquisition and production data from any technical issues, Geophex Survey ensures that there are redundant copies kept in off-site locations. In the unlikely event that any large technical problem occurs, we could retrieve the data and continue production with minimal impact to the production schedule.

Data Checks

At Geophex Surveys, we apply thorough and stringent data checks at all stages of project production. From the flight and control planning stages, through to aerial acquisition, aerial triangulation, and all deliverable data, we ensure that the product being delivered to our clients is of the highest quality. Utilizing the QC tables stated in the previous Quality Assurance section, in addition to further internal QC production checks, we ensure that our clients receive their data to their complete satisfaction.

E) RESPONDER'S OFFERS

Our project methodology examines in detail the processes required to efficiently and accurately execute and complete the SAWPA project to the defined specifications as per the RFP. As each project is different, our methodology changes to suit the particular needs of each client. The individual steps for this project are as follows:

1) Statement of Understanding
2) Ground Control
3) Air Photo Acquisition
4) Aerial Triangulation
5) Orthophoto Rectification
6) DEM / TIN and Contours
7) Quality Control
8) Project Accuracy

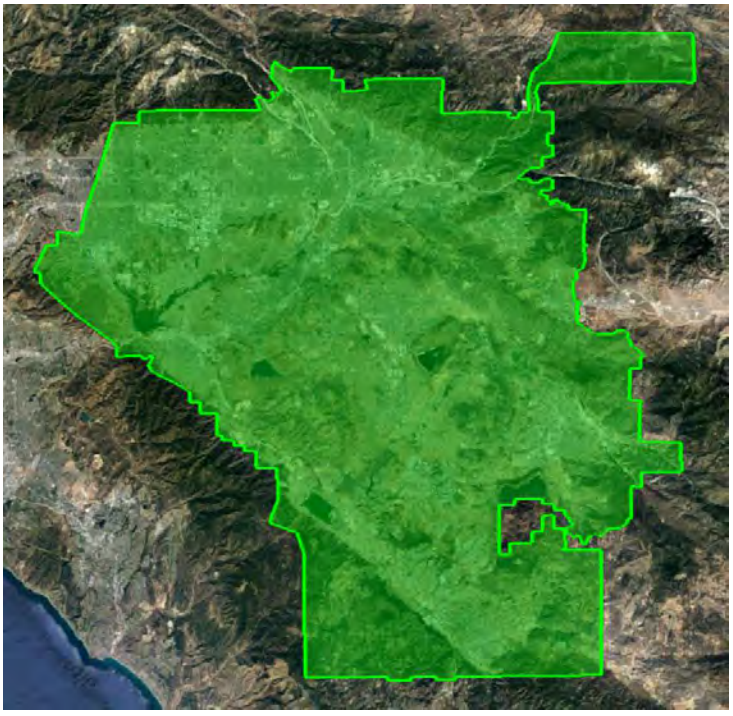
1) Statement of Understanding

Geophex Surveys understand the purpose of this project is to obtain digital four-band color (R,G,B, NIR) aerial photography for the SAWPA Imagery AOI as identified in the RFP, Exhibit B, Page 2/3. The aerial imagery will meet the following requirements:

General Project Requirements

- Image GSD is to be 3-inch, 6-inch , or 12 inch resolution
- Solar Angle >30 degrees or most optimal 4-hour window
- All photography will comply with industry standard tolerances for flight altitude, tip, tilt, side lap, end lap, and crab
- A single camera sensor will used to ensure exact band-to-band registration
- All imagery shall be blur-free imagery
- All imagery and data is to be delivered in California State Plane Coordinates, Zone 6 for Riverside County
- Datums are: Horizontal (NAD 83), Vertical (NAVD 88)
- Project units are to be in feet
- Imagery is to be 4-band (R,G,B,NIr)
- Project Level Metadata

SAWPA Project Area Diagram (approx. 2,032 mi²)



2) Ground Control

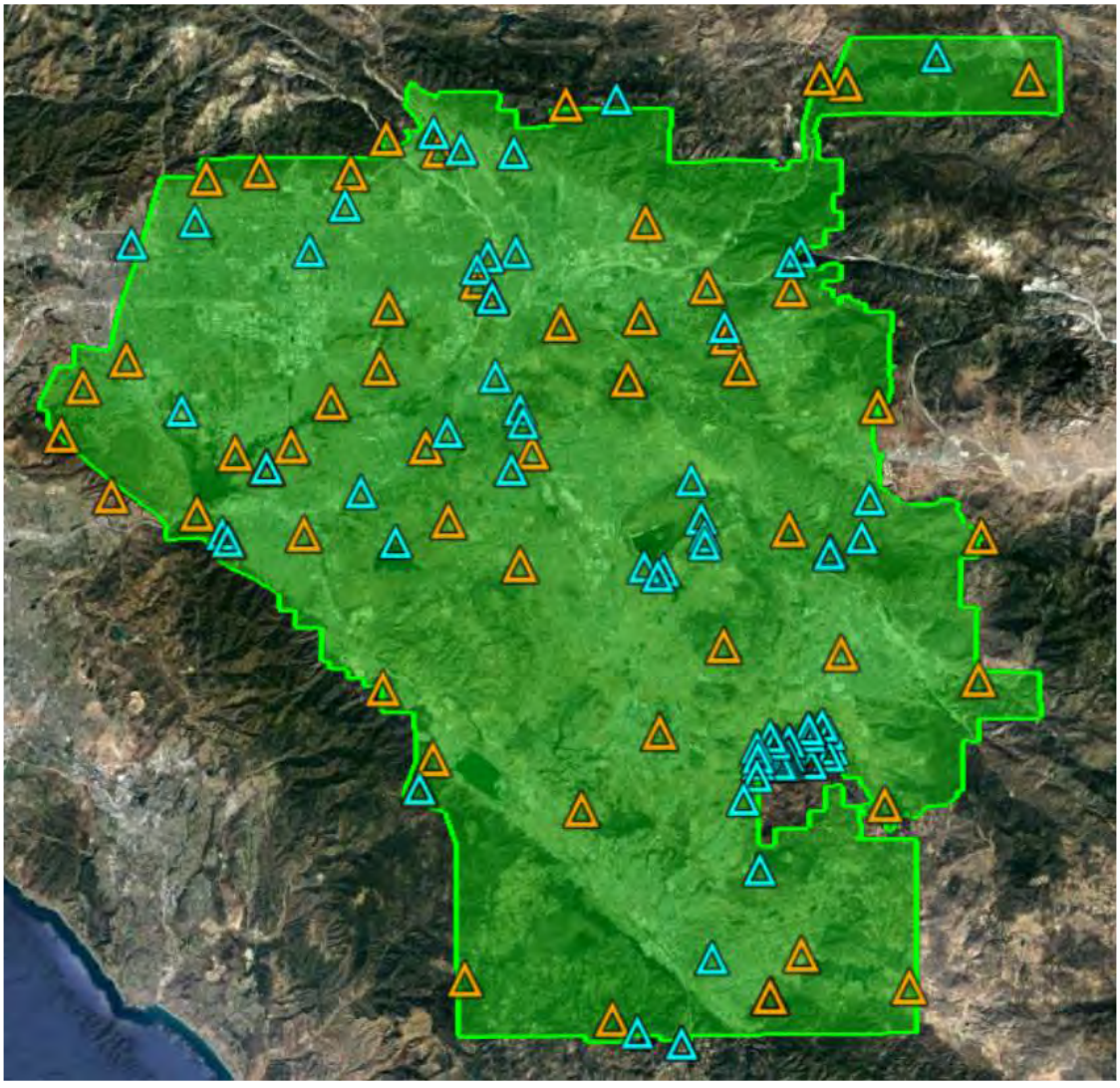
Ground control is fundamental to project accuracy, since accuracy of all subsequent mapping is referenced back to the quality of the original ground control. These control points provide a precise measure of selected positions on the Earth's surface within the project area.

Requirements

To control the SAWPA project, Geophex Surveys will utilize existing photo-id ground control from previous projects. These existing control points are a mixture of both horizontal/vertical and vertical only points as shown below and extend throughout the project area to provide a network that will support final orthophoto accuracy of **2X** the pixel resolution, **exceeding** the required orthophoto accuracy of ±2.5 ft RMSE, as specified in the RFP.

Having a large number of available control points provides a level of redundancy in case some of the control points have become unavailable due to changes in the terrain. No new survey points will have to be established unless there have been significant changes to the ground in specific or multiple control locations.

Available Ground Control Locations



Horizontal/vertical points (orange triangles) / Vertical only points (blue triangles)

3) Air Photo Acquisition

Quality aerial photography begins with a carefully designed flight plan that provides complete coverage and considers terrain variation, location of existing ground control and the configuration of the project area.

For the air photo acquisition, Geophex Surveys will partner with Aero-Graphics which will utilize a Vexcel UltraCam Eagle camera. The Vexcel Eagle is a large format digital aerial mapping camera that offers superb image accuracy, color rendition and dynamic range. Geophex Surveys and Aero-Graphics have been utilizing this camera system for the last two years capturing 3-inch imagery for Orange County with exceptional results.

Prior to any of the acquired imagery being used for processing, it will undergo Quality Control as outlined in the Quality Control section.

Requirements/Preferences

- Geophex Surveys will acquire either 3-inch, 6-inch, or 12-inch, 4-band (RGBIr) imagery
- Imagery is to be cloud-free
- Imagery is to be free from excessive haze, smoke, fog, dust or ground flooding
- Sun angle is to be >30 degrees or most optimal 4-hour window
- Flight plan is to be submitted to and approved by project manager prior to acquisition
- A navigation report is to be delivered
- Geophex Surveys is responsible for obtaining all required air traffic clearances
- The consultant shall capture each of the retail water agencies in the imagery AOI in the same flight day
    - The above has been taken into consideration when planning our flight blocks. Our team will attempt to capture each section of the flight plan in a way that will minimize any radiometric differences between the flight blocks. Our team has recently captured numerous large regions for Water Authorities like SAWPA over multiple days. In all cases our resultant orthophotography is both homogeneous and seamless across the entire project area through the use of the Vexcel UltraMap Integrated work flow that both Aero-Graphics and Geophex utilizes.
- Re-flights are to be performed within 10 days (weather permitting) from notification of image deficiencies
- The Project Manager shall have 15 days to review imagery submitted by the Consultant to identify imagery deficiencies and to notify the Consultant of the deficiencies. The Consultant shall have 15 days to correct the imagery or to recollect imagery and resubmit to the Project Manager.
- Imagery will be reviewed by consultant within 7 days of acquisition
- A camera calibration report less than 3-years old is to be supplied
- The camera is to capture blur-free imagery using a fast shutter speed (>1/500 sec) and a forward motion compensation device.
- The imagery is to be acquired with industry standards for flight altitude, tip, tilt, side lap, end lap, and crab
- The imagery is to be captured with the optical vertical axis <3 degrees
- The tilt between 2 consecutive exposures is not to exceed 4 degrees and the crab angle is not to exceed 3 degrees
- The imagery will be flown and acquired according to the submitted flight plan to meet the project specifications and SAWPA will be notified of any changes to the acquisition parameters
- Deliverables Include:
    - Camera calibration report
    - Flight Plan prior to flight
    - Photo center coordinates post flight in shapefile format
    - Progress Reports
    - Sample Imagery for review
- Imagery that has been captured and not rectified can be made available for review via a web-based portal.

Aerial Imagery Review

Aerial imagery review capability will be made accessible through a dedicated website portal (on aero-graphics.com domain) with an open source back-end via QGIS.

80/30 Image Overlap

Geophex Surveys will be capturing the imagery at 80% forward and 30% side overlap instead of the standard 60% forward and 30% side overlap. The higher forward overlap allows for 3-ray stereo measurements and provides additional imagery required to produce a high accuracy autocorrelated DEM for the orthophotography. Additional benefits of the higher forward overlap imagery include:

- Less building lean and radial displacement from above-ground objects as there are an increased number of photo centers.
- Improved radiometric (color/contrast) balancing resulting from the additional overlap.

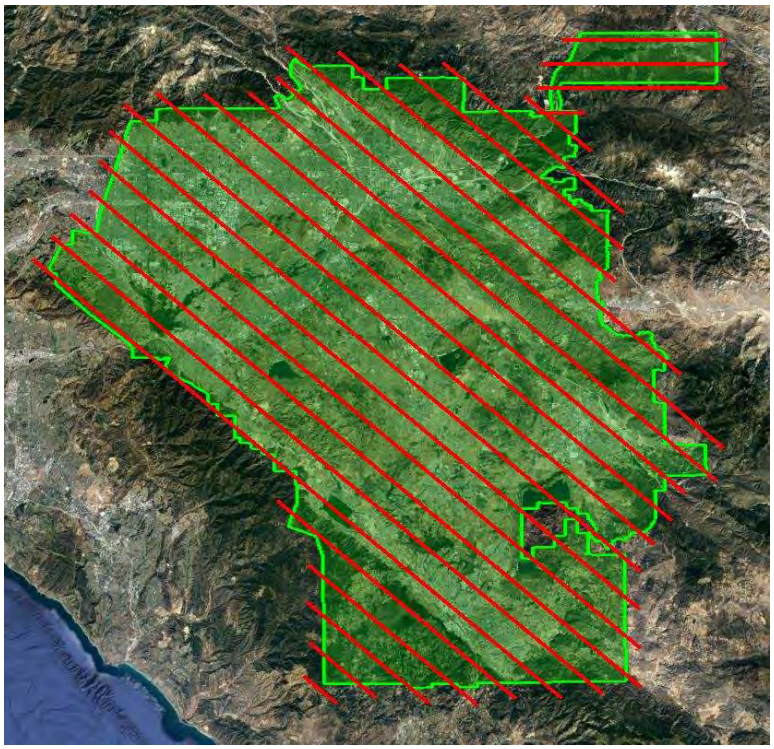
Image Acquisition

The following table shows the image acquisition data for the Santa Ana Watershed Project Authority project.

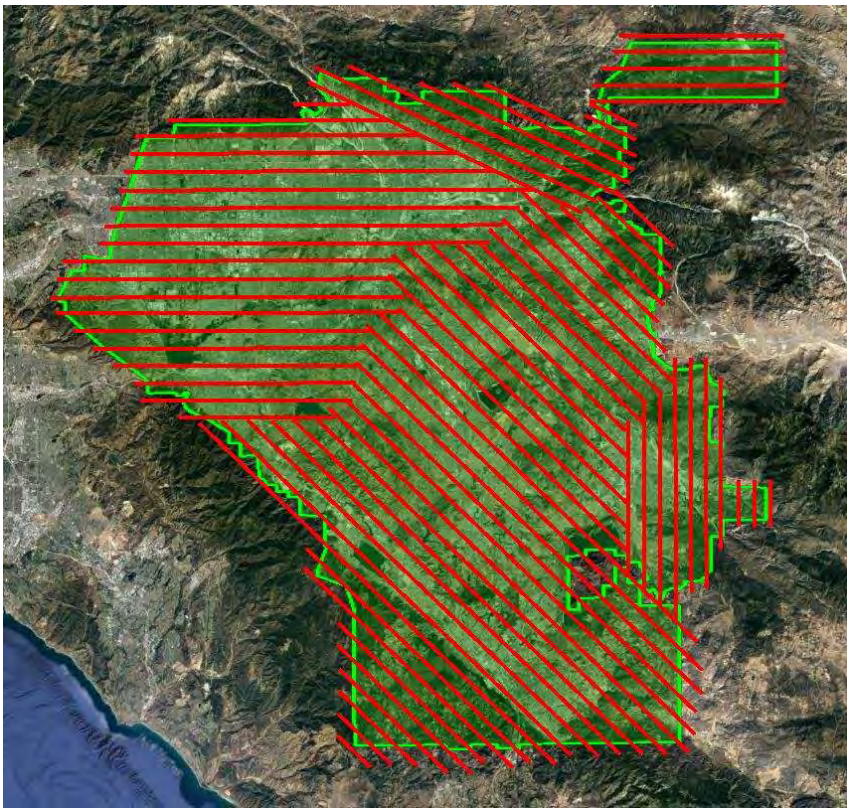
Flight Statistics Table (80/30 overlap)

Avg GSD	Avg Photo Scale	Altitude (ft, AGL)	No. of Flight Lines	No. of Frames
3-inch	1:14,654	4,820	305	28,444
6-inch	1:29,308	9,640	78	7,066
12-inch	1:58,615	19,281	25	1,928

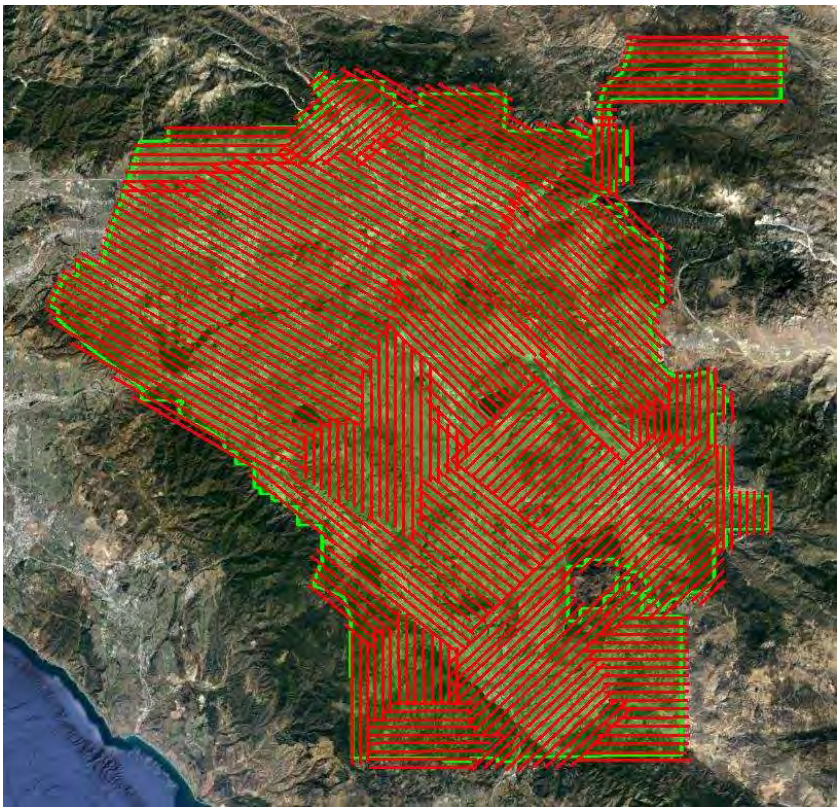
SAWPA 12-inch GSD Flight Diagram



SAWPA 6-inch GSD Flight Diagram



SAWPA 3-inch GSD Flight Diagram



4) Aerial Triangulation

Aerial Triangulation (AT) is one of the most critical phases in the photogrammetric mapping process. It defines the geometric network on which all subsequent mapping is based. Geophex Surveys will design the AT plan to maximize the geometric accuracy of all the required products and ensure that we meet or exceed the project specifications.

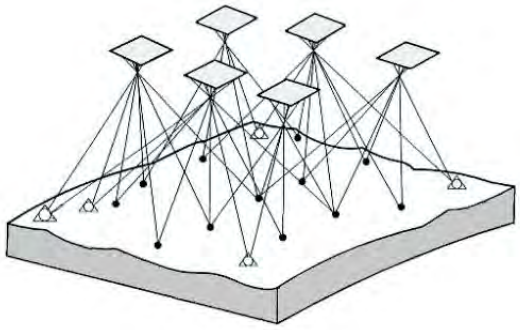
The aerial triangulation process contains five distinct parts:

- AT Block preparation
- Control Point (CP) measurement
- Photogrammetric Point measurement
- AT Block Adjustment / Stereo Models
- AT Report and Deliverables

AT Block Preparation: Contains the most up to date camera calibration report, the captured aerial imagery and the AGPS and IMU data**.**

Control Point Measurement: To support the block adjustment, targeted surveyed ground/photo identifiable control points are measured in stereo softcopy and coded to provide a plate coordinate data file. This file, together with the file containing the ground coordinates of these points becomes part of the input to the AT adjustment software.

Photogrammetric Point Measurement: This creates additional ground photogrammetric points at key locations on the aerial photograph to support setting-up of photogrammetric models and minimizes the expense of extra control from survey points in the field. Additional points are measured on shorelines of hydrographic features to ensure that lake surfaces will be level and that watercourses maintain a correct directional flow. The resulting fit of the points for each model is reported as statistics which are used as guides to determine if points need to be re-read in order to improve their accuracy or if more points are required. This is an important part of the internal quality control process carried out during the AT.



AT Block Adjustment/Stereo Models: The AT adjustment software is run and incorporates a free-net adjustment, support of GPS and IMU data, and advanced graphical display tools allowing block visualization in 3D. The final product of the AT process includes a set of adjusted coordinates and exterior orientations for the photography. This information is used for data collection (compilation) with softcopy stereoplotters and for orthophoto production. The end results of the adjustment process are stereo models that will achieve the highest accuracy results for the SAWPA project.

AT Report and Deliverables: Geophex Surveys will deliver a final report upon completion of the AT process which will provide and executive summary of the AT solution and its results, a description of the adjustment process and QC checks for accuracy, a description of the software used to perform the adjustments and a listing of the final adjusted coordinates in a format agreed upon during contract negotiations.

5) Orthophoto Rectification

Requirements

Geophex Surveys will provide either 3-inch, 6-inch or 12-inch 4-band orthophotograph for the Santa Ana Watershed Project Authority project as defined in the RFP.

Additional requirements include:

- Imagery is to be provided in State Plane Coordinate System, Zone 6, US feet, NAD83 Datum
- Orthophoto accuracy is to meet NSSDA guidelines
- Imagery will be delivered in GeoTIFF format with world (tfw) file
- Project level metadata is to be delivered
- Orthorectified imagery will be radiometrically balanced and seamlessly mosaiced
- Some allowances for high reflection over water will be made
- Rectifications will utilize a DEM of sufficient accuracy and quality to meet the current project specifications
- The final imagery will be without gaps

All imagery shall be seamlessly mosaicked, radiometrically adjusted for color, brightness and contrast and processed to the project requirements. Having successfully processed many city, county and water authory projects throughout North America, including California and for SAWPA, Geophex Surveys understands the orthophoto accuracy and esthetic requirements expected by the Santa Ana Watershed Project Authority.

Orthophoto Production Process

An overview of our orthophoto production process can be summarized in the following steps:

- Aerial photography is received from the acquisition contractor and loaded onto the network
- The aerial photography is inspected for area coverage and overall quality prior to processing
- Aerial Triangulation is performed utilizing the AGPS/IMU data, ground control data and imagery
- A high accuracy autocorrelated DEM is created from high forward overlapping aerial photography
- Every frame of photo is rectified and quality checked for accuracy and quality
- Every rectified frame is color balanced and adjusted for contrast and brightness, and processed in large blocks to maintain project consistency
- All imagery is mosaicked using a software generated best path and then inspected and edited as required
- Image tiles are clipped out and then thoroughly quality checked for any radiometric, mosaic, or smearing issues and fixed
- Images are processed into final delivery formats and delivered to the client

DEM

Geophex Surveys will generate a high accuracy autocorrelated DEM from the high forward overlapping aerial photography. This DEM will provide a project-wide and continuous seamless surface for the ortho rectifications; however it is for internal processing only and not a deliverable product. A separate DEM will be created for the TIN and contour products via LiDAR or photogrammetric collection.

Image Rectification

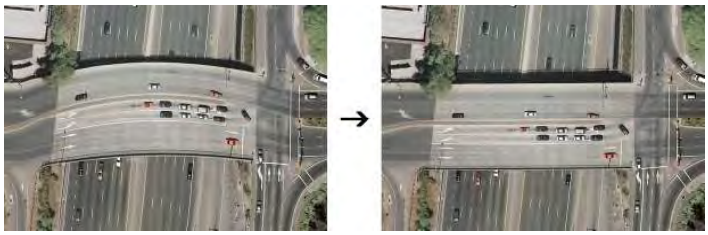
Our orthophoto production process will rectify every frame of the 80% forward overlap photography. Every rectified frame is adjusted for color and contrast to provide project-wide radiometrically balanced imagery. During orthorectification and mosaicking, the imagery is examined for any artifacts resulting from optical and radiometric distortion, including such issues as structure/tree displacement (lean), hot spots, as well as tonal contrast between contiguous features on adjacent frames. The final orthophoto product is comprised of center portions of every rectified frame as required to ensure continuous, seamless imagery across the project area.

Radiometric Balancing

To ensure quality data, the aerial imagery is manually adjusted for radiometric differences to provide natural color and contrast and correct for any areas which exhibit exposure or color variation. These adjusted images are then processed using software which automatically applies any additional corrections for radiometric non-uniformity and color/contrast blending, to provide large radiometrically uniform blocks of rectified imagery. The result is a set of adjusted input images which exhibit consistent contrast and color across the entire project area.

Bridges and Overpasses

When orthorectifying imagery containing bridges, decks and elevated roadways, the DEM will be updated to include these above ground features. This will ensure that the elevated features rectify in their true position and are not subject to "layover" and be incorrectly positioned in the final imagery.



Reduced Lean

Each ortho mosaic is inspected for features such as tall buildings, towers and trees to ensure that the best image available exhibiting the least amount of lean is used. If necessary, the seamline is adjusted to minimize leaning of tall above ground buildings or structures. Due to the **higher forward overlapping** aerial photography, Geophex Surveys will have a greater ability to reduce building and structure lean throughout the project area.

Seamline Edits

Mosaic seamlines are edited to minimize any visible mosaic lines within the image tiles. Seams are examined and revised if necessary to avoid structures and other problem areas which can cause displacement and aesthetic issues. Editing seamlines ensures that our clients receive the best possible seamless orthophotography.

Accuracy checks

Our orthophoto imagery is checked against control points, checkpoints, or other forms of control (provided or generated) to ensure that delivered data meets project accuracy specifications.

Quality Checks and Corrections

At Geophex Surveys, imagery is checked following each processing stage to ensure that the inputs for the next step are correct. This methodology greatly reduces errors that are carried through all the production stages and leads to a more error-free final product. Any errors that are found by our senior technicians are either fixed by them, or returned back to production for repair, before being quality checked again. Our multiple quality assurance steps along with Geophex Surveys' data warranty, ensures that our clients receive high quality data to their satisfaction.

6) DEM / TIN and Contours

Geophex Surveys will provide a DEM surface and 2ft contours for client specified areas in order that slope analysis can be performed. The DEM surface will be produced from new LiDAR acquisition or photogrammetric collection depending on the selected DEM resolution and area. The DEM collection options include:

Table Showing DEM Generation Methodology

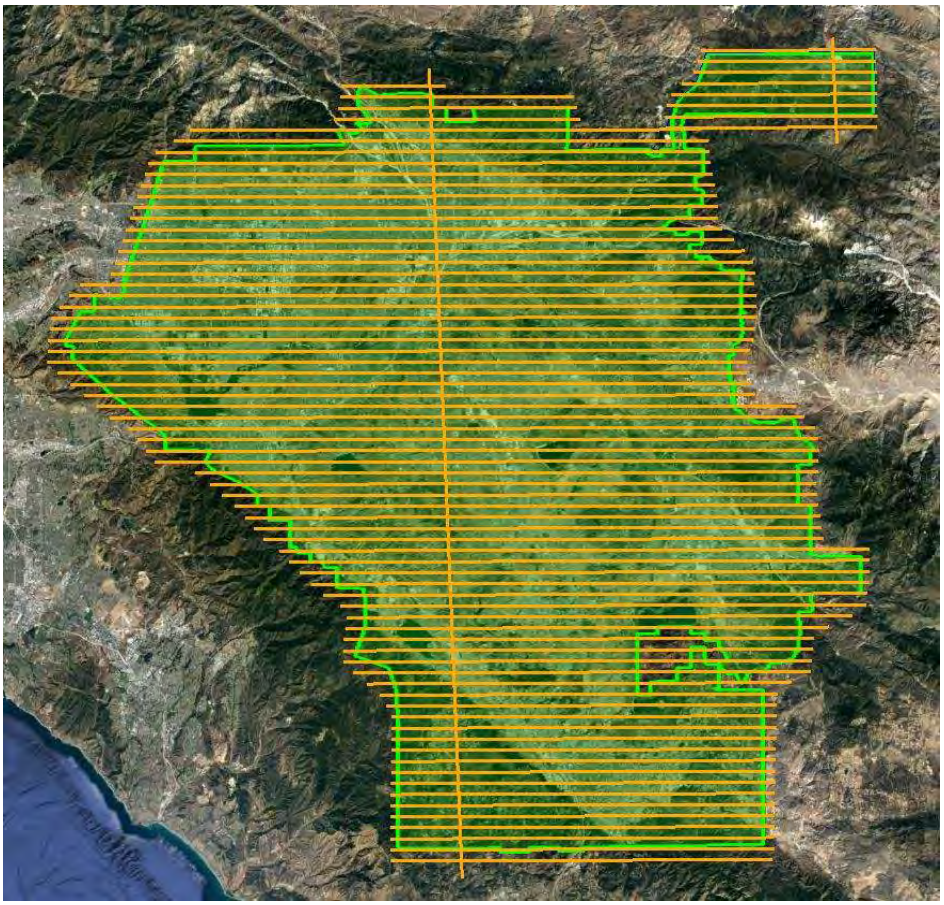
Area (mi²)	5m resolution	≤2m resolution	1m resolution	<1m resolution
<50	Photogrammetric	LiDAR	LiDAR	LiDAR
50-250	Photogrammetric	LiDAR	LiDAR	LiDAR
250-500	LiDAR	LiDAR	LiDAR	LiDAR
>500	LiDAR	LiDAR	LiDAR	LiDAR

LiDAR Acquisition

The LiDAR will be acquired using a Teledyne Optech Galaxy Prime. This LiDAR unit is a high performance LiDAR sensor designed for wide-area mapping, urban mapping and natural resource management. The acquisition specifications are as follows:

Project Area	Point Density	Side Overlap	Altitude	Speed	Flight Distance
2,032mi²	2ppm²	25%	2,400m AGL	125kts	6,265km

LiDAR Flight Plan



LiDAR Data Calibration

Following the flight mission, the preliminary calibrated point clouds are compared to ensure the relative data accuracy. Both horizontal and vertical values are checked for alignment against appropriate ground features such as buildings or other well defined objects. If any calibration values (angles between the sensor and IMU) are found to have changed from the previous mission, corrective measures are taken. The absolute accuracy is then evaluated and compared to several data sources including:

- known ground coordinates within the project area
- calibration passes and surveyed ground truth near the airport
- adjacent point cloud for vertical comparison

Classification

The raw LiDAR data is processed into calibrated point cloud strips corresponding to flight lines. For ease of data manipulation, the strips are combined and saved in tiles of approximately 1 km by 1 km. The tiled point cloud is then processed with a series of algorithms to separate the “most-likely” ground returns from other returns. The points will be classified to ground, non-ground and noise.

The angles and distances between the points are measured to determine the appropriate classification (ground, noise, etc.). The measurement parameters can be adjusted to fine tune the classification. Ground points can be improved by generating viewable TIN and grid surfaces and performing visual inspections for areas that appear rough, artificially flattened, or have no data or other errors. Areas showing errors are corrected and checked again to validate the correct classification category (non-ground, ground, noise). The classified LiDAR will have a vertical accuracy of approximately ±10cm on flat open ground.

Photogrammetric Collection

For a project area less than 250mi² and for the lower DEM density of approximately 5m, Geophex Surveys will be generating the DEM surface photogrammetrically from either the new 3-inch or 6-inch stereo imagery as those resolutions will support 2ft contours. Photogrammetric collection will be performed in 3D stereo from the new aerial photography and will include the appropriate breaklines and mass points to meet the project accuracy requirements.

Contours

Geophex Surveys will provide 2ft contours from either the LiDAR or photogrammetric data for the defined project area. Contours are lines of constant elevation created from a bare earth model and show the elevation differences within the project area. Contours can provide information on the steepness of slopes, drainage and any other elevation changes.

7) Quality Control

Geophex Surveys performs rigorous QA/QC checks on all data before it is delivered to the client, and is solely responsible for all deliverables. We verify that the original project plan and specifications have been adhered to, and then follow up with more detailed checking of deliverables. The following section describes in detail the checks that are performed for the aerial photography, aerial triangulation, DEM and orthophoto rectification.

AIR PHOTO QUALITY CONTROL

Overall Impression	Frame contrast and brightness properly balanced and consistent.
Forelap/Sidelap matches specification	Measurement of forward lap/side lap on various flight lines
Digital Artifacts	Rating of the level of internal light reflection/refractions in imagery
Bit Depth/Band Assignment	Rating of adherence to specification
Raw Pixel Size Assessment	Rating of the estimated raw resolution of the imagery's GSD
Color Rendition	Rating of the color rendition/consistency throughout the flight block
Vignetting	Rating of the amount of vignette visible in the imagery.

AERIAL TRIANGULATION QUALITY CONTROL

Ground Sample Distance	Does photo scale meet expected GSD
Project Coverage	Is flight plan coverage complete
Control Coverage	Does flight plan cover ground control points
Ground Control data	Is source ground control in correct datum, projection and units
Vertical Measurement Values	Ensure Z values of ground control is that of ground, not monument
GPS Data Check	Is supplied airborne GPS in correct datum, projection and units
IMU Rotations	Check airborne IMU for large rotations (>5º)
GPS PDOP	Is airborne GPS PDOP between 1.5 and 3.0
GPS Line break check	Does airborne GPS have at least two photo overlap in line breaks
Smoke/Haze	Check images for smoke/haze
Coverage	Check images for snow/leaf coverage
ISAT Point Density	Check and fix ISAT results for tie/pass point density
ISAT Shadow Points	Check and fix ISAT shadow points
ISAT Water/Moving Object Points	Check and fix ISAT points correlated on water or moving objects
Result Clean/Check	Check and clean adj. results to meet specs
Final Model Check	QC final model setups for horiz. and vert. errors using check points

DIGITAL ELEVATION MODEL (DEM) QUALITY CONTROL

Complete Coverage	Is the project area coverage complete
Accuracy: Spot Checks	Do randomly selected points accurately fit the ground
Accuracy: Regional Checks	Are sample generated contours accurate in different terrain types
Accuracy: Project-wide Checks	Does the TIN and Shaded Relief Map reflect the terrain surface
Data continuity	Is the data seamless across the project area
Data Density	Does the data collection meet the project specifications
Geometric Accuracy	Does the data meet positional accuracy using check points
Ties between tiles	Is there a data mismatch between tiles

ORTHOPHOTO QUALITY CONTROL

Pixel Resolution	Raw image pixel resolution is ≤ to the output orthophoto pixel
Image Accuracy	Orthophoto accuracy is verified against control points
Image Bit Depth	The imagery bit depth meets the defined specifications
Edge Matching	No visible discontinuities in ground features within tiles
Color Balance	Uniform color within each tile and throughout project
Radiometric Differences	No or minimal radiometric differences for groups of tiles
Seam line geometry	Geometric seam line mismatch should not be visible
Warping of Streets/linear Ground Features	Alignment of streets/linear ground features true to real condition.
Blurred or Smeared Imagery	No visible blurring or smeared imagery
Shadows and highlights	Extremely light or dark areas should be minimized to retain details
Format - TIFF, ECW, JPG, Mr Sid, etc	Files must be in the format as required in the project specifications
Correct Data	Verify projection and names for all delivered data.

CONTOUR QUALITY CONTROL

Elevations	Final DEM check for elevation errors
Smoothing	Check and manually smooth contours if required
Isolations	All isolations deleted
Intersecting Contours	Intersecting contours corrected
Other Contour Errors	correct contours that loop, have gaps or broken segments
Contour Labeling	Contours are labeled as required
Spot Heights	Add spot heights at peaks, valleys, bridges, water levels, dam, top and bottom of vertical walls
Spot Heights (other)	Add spot heights in areas where contours do not adequately represent the terrain (mainly in flat areas)
Contour Clipping	Clip contours to map sheet/project boundaries
Text Positioning	Move to produce a more aesthetically pleasing map.
Text Editing	Are all text and symbols are correct and correctly scaled

LiDAR QUALITY CONTROL

File Check	Are LAS files consistent between headers and file contents
Location Check	Is the delivery coordinate system correct
Gross Void Check	Are there voids in the data where there shouldn't be
Gross Returns Check	Do returns contain excess noise
Network/Absolute Accuracy Check	Compare checkpoint accuracy to the project specifications
Relative Accuracy Check	Compare LiDAR strips alignment to project specifications
Pits, Spikes and Undulations	Do random sample areas contain pits, spikes, or undulations
Overall Density Check	Do any areas contain insufficient data density
Density by Class Check	Does the density for different classes meet specifications
Classification Quality Check	Are features correctly classified
Breakline Check	Do breaklines ensure water bodies are correctly represented
Metadata Check	Is the metadata correctly formatted and complete

8) Project Accuracy

Utilizing our extensive experience in processing orthophoto projects, we have designed the SAWPA project to meet the highest accuracy standards, and to most effectively carry out the work using our efficient and proven methodology.

Overall project accuracy is affected by several factors including flying height, pixel resolution, ground control, DEM, and the terrain of the project area. The following table shows the achievable accuracy of the various data components.

SAWPA Project Accuracy Table (RMSE)

Avg GSD	Ground Control	Aerial Triangulation	Internal Ortho DEM	Orthophotography
3-inch	<2-inches	3-inch	6-inch	±6-inches
6-inch	<2-inches	6-inch	12-inch	±12-inches
12-inch	<2-inches	12-inch	24-inch	±24-inches

Avg GSD

The Average Ground Sample Distance is the average pixel resolution during photo acquisition. Geophex Surveys has planned the average resolution to be either 3-inches, 6-inches or 12-inches for the entire project area. Flight lines have been planned to align with the general shape of the project area for acquisition efficiency.

Ground Control

The required ground control accuracy is largely determined by the orthophoto accuracy requirements. For the SAWPA project, the existing ground control accuracy is approximately <2-inches.

Aerial Triangulation

The aerial triangulation accuracy is in part determined by the ground control accuracy and distribution throughout the project area. Geophex Surveys has utilized the ground control from previous projects and has determined an effective point distribution for aerial triangulation processing. Adequate ground control, in addition to the airborne GPS and IMU data and the 80/30 photo overlap ensures that the aerial triangulation results will meet the project accuracy requirements.

DEM

Geophex Surveys will utilize an autocorrelated DEM for generating the orthophotography which will have an accuracy of approximately 2x the source image pixel resolution.

Orthophotography

The orthophotography for the SAWPA project will be approximately 2x the final orthophoto pixel (RMSE) resolution which meets and exceeds the project accuracy of ± 2.5ft.

F) CONTRACT PROVISIONS EXCEPTIONS / RECOMMENDATIONS

1. Scope of Work Exceptions / Recommendations

Supplemental / Alternative Imagery

As supplemental or alternative imagery to the 2021 aerial photography, Geophex Surveys is offering SAWPA licensed off the shelf orthophotography that was flown during the spring and summer months of 2020. This imagery may be used as a comparison to the 2021 imagery, or as low cost alternative to the 2021 imagery for parts of, or the entire project area. Pricing for these options has been included in Exhibit A – Pricing.

2020 Imagery Specifications

Photo Dates: April to August 2020 (specific dates for areas of interest can be provided)

Projection: UTM Zone 11, NAD83 (2011)

Format: GeoTIFF

Deliverable: 4-band (RGBi)

Accuracy Specifications

15cm (6-inch) GSD	30cm (12-inch) GSD
RMSE XY: 0.50m	RMSE XY: 1.2m
RMSEr: 0.71m	RMSEr: 1.7m
CE90: 1.07m	CE90: 2.6m
CE95: 1.22m	CE95: 3.0m

2. Contract Provisions Exceptions / Recommendation

Geophex Surveys has included the following license agreement that allows Geophex Surveys to resell the SAWPA 2021 Imagery Acquisition project data. See below for the Shared Master License and License Agreement which was utilized as part of the 2015 SAWPA Ortho project.

SHARED MASTER LICENSE:

Geophex and SAWPA are under a shared master license to use the Licensed Imagery under the terms set forth herein.

SAWPA, the below listed water agencies, and other water related agencies (the "Eligible Agencies"), shall have the right to use and/or sublicense the Licensed Imagery to: 1) SAWPA; 2) the Eligible Agencies and 3) any contractors who are doing specified work for SAWPA or the Eligible Agencies, only with respect to, and during the duration, of such work. (collectively, the "Permitted Use"). The Permitted Use, with respect to the Eligible Agencies, shall permit use of the Licensed Imagery ONLY in connection with water resource management and conservation activities and not in connection with any other activity, including, without limitation, other municipal activities, such as public works, engineering, non-water-related GIS, emergency response or the like. As a condition to its receipt and use of the Licensed Imagery, each of the Eligible Agencies shall execute an Eligible Agency License Agreement in the form attached hereto.

Except for the Permitted Use as stated herein, SAWPA shall have no right to assign, transfer, share, sublicense, sell, lend or otherwise use, any aspect of the Licensed Imagery. SAWPA shall fully reimburse and indemnify, defend and hold harmless Geophex for any loss, liability, claim or damage to its economic interests or intellectual property rights arising from any violation by SAWPA or its member agencies of the terms of the license granted hereunder.

Geophex, and appointed resellers, shall have the exclusive right to sell or sublicense the imagery to any agency, contractor or enterprise not listed on the attached water agency list. Any such approved contractor/enterprise/agency shall execute a sub-license agreement in such form as shall reasonably be requested by Geophex. Geophex shall fully reimburse and indemnify, defend and hold harmless SAWPA for any for any loss, liability, claim or damage to its economic interests or intellectual property rights arising from any violation by Geophex and/or its sublicenses of the terms of the license granted hereunder.

Agency Name ***(2015 List, which will need updating)***	**Region**	**Type**	**Wholesaler layer**	**Retailer layer**
Metropolitan Water District of Southern California	So Cal	Wholesaler	x	
Orange County Water District	Orange County	Wholesaler	x	
Municipal Water District of Orange County	Orange County	Wholesaler	x	
Anaheim City	Orange County	Water Utility		x
Brea City	Orange County	Water Utility		x
Buena Park City	Orange County	Water Utility		x
East Orange County Water District	Orange County	Water Retailer		x
El Toro Water District	Orange County	Water Retailer		x
Fountain Valley City	Orange County	Water Utility		x
Fullerton City	Orange County	Water Utility		x
Garden Grove City	Orange County	Water Utility		x
Golden State Water Company - Cowan Heights	Orange County	Water Retailer		x
Golden State Water Company - Placentia	Orange County	Water Retailer		x
Golden State Water Company - West Orange	Orange County	Water Retailer		x
Huntington Beach City	Orange County	Water Utility		x
Irvine Ranch Water District	Orange County	Water Retailer		x
La Habra City	Orange County	Water Utility		x

La Palma City	Orange County	Water Utility		x
Mesa Consolidated Water Distict	Orange County	Water Retailer		x
Newport Beach City	Orange County	Water Utility		x
Orange City	Orange County	Water Utility		x
Santa Ana City	Orange County	Water Utility		x
Seal Beach City	Orange County	Water Utility		x
Serrano Water District	Orange County	Water Retailer		x
Tustin City	Orange County	Water Utility		x
Westminster City	Orange County	Water Utility		x
Yorba Linda Water District	Orange County	Water Retailer		x
Western Municipal Water District	WMWD	Water Retailer	x	x
Corona City	WMWD	Water Utility		x
Eagle Valley Mutual Water Company	WMWD	Water Retailer		x
Elsinore Valley Municipal Water District	WMWD	Water Retailer		x
Home Gardens County Water District	WMWD	Water Retailer		x
Jurupa Community Services District	WMWD	Water Retailer		x
Lee Lake Water District	WMWD	Water Retailer		x
Norco City	WMWD	Water Utility		x
Riverside City	WMWD	Water Utility		x
Riverside Highland Water Company	WMWD	Water Retailer		x
Rubidoux Community Services District	WMWD	Water Retailer		x
Santa Ana River Water Company	WMWD	Water Retailer		x
Eastern Municipal Water District	EMWD	Water Retailer	x	x
Box Springs Mutual Water Company	EMWD	Water Retailer		x
Hemet City Water Department	EMWD	Water Utility		x
Lake Hemet Water District	EMWD	Water Retailer		x
Perris City Water Department	EMWD	Water Utility		x
San Jacinto City	EMWD	Water Utility		x
Nuevo Water Company	EMWD	Water Retailer		x
Idyllwild Municipal Water District	SJ Mountain Area	Water Retailer		x
Pine Cove Water District	SJ Mountain Area	Water Retailer		x
Fern Valley Water District	SJ Mountain Area	Water Retailer		x
Inland Empire Utilities Agency	IEUA	Wholesaler	x	
Chino Basin Desalter Authority	IEUA	Wholesaler	x	
Water Facilities Authority	IEUA	Wholesaler	x	
Chino City	IEUA	Water Utility		x
Chino Hills City	IEUA	Water Utility		x
Cucamonga Valley Water District	IEUA	Water Retailer		x
Fontana Water Company	IEUA	Water Retailer		x
Monte Vista Water District	IEUA	Water Retailer		x
Ontario City	IEUA	Water Utility		x
San Antonio Water Company	IEUA	Water Retailer		x

Upland City	IEUA	Water Utility		x
Golden State Water Company - Claremont	IEUA	Water Retailer		x
Pomona City	IEUA	Water Utility		x
San Bernardino Valley Municipal Water District	SBVMWD	Wholesaler	x	
Colton City	SBVMWD	Water Utility		x
East Valley Water District	SBVMWD	Water Retailer		x
Loma Linda City	SBVMWD	Water Utility		x
Marigold Mutual Water Company	SBVMWD	Water Retailer		x
Muscoy Mutual Water Company	SBVMWD	Water Retailer		x
Redlands City	SBVMWD	Water Utility		x
Rialto City	SBVMWD	Water Utility		x
San Bernardino City	SBVMWD	Water Utility		x
South Mesa Water Company	SBVMWD	Water Retailer		x
Terrace Water Company	SBVMWD	Water Retailer		x
West Valley Water District	SBVMWD	Water Retailer		x
Western Heights Water Company	SBVMWD	Water Retailer		x
Yucaipa Valley Water District	SBVMWD	Water Retailer		x
San Gorgonio Pass Water Agency	SGWPA	Wholesaler	x	
Banning City	SGWPA	Water Utility		x
Beaumont Cherry Valley Water District	SGWPA	Water Retailer		x
Big Bear Lake City	SB Mountain Area	Water Retailer		x
Big Bear City Community Services District	SB Mountain Area	Water Retailer		x
Running Springs Water District	SB Mountain Area	Water Retailer		x
Rancho California Water District	USMW	Water Retailer		x
Eastern Municipal Water District	USMW	Wholesaler	x	x
Western Municipal Water District	USMW	Wholesaler	x	x
Elsinore Valley Municipal Water District	USMW	Water Retailer		x

SAWPA— Eligible Agency Imagery License Agreement

between

Geophex, Ltd. & _____
605 Mercury Street _____
Raleigh, North Carolina _____
27603 _____

Date of This License Agreement: _____

ALL DATA DELIVERED TO YOU UNDER THIS AGREEMENT IS COPYRIGHT PROTECTED

License Agreement for digital aerial photography

This License Agreement ("License Agreement") is a legal and binding agreement between the water agency listed above ("Licensee") and Geophex, Ltd. ("Geophex"). This License applies to the digital aerial photography being delivered to Licensee herewith and any additional data delivered therewith (collectively, the "Licensed Imagery"). The Licensed Imagery delivered under this License Agreement is licensed by Geophex for use only under the terms and conditions set forth herein. Accessing the Licensed Imagery or related data provided to you by Geophex indicates that you accept, and agree to, and will abide by the terms and conditions of this License Agreement.

1. Grant of License

Geophex grants Licensee a non-exclusive, non-transferable license to use the Licensed Imagery under the terms set forth herein. Licensee shall have the right to use the Licensed Imagery for internal operations by employees of Licensee only and any contractors who are doing specified work for Licensee and only with respect to such work (the "Permitted Use"). If Licensee is a municipal entity, the Permitted Use shall permit use of the Licensed Imagery ONLY in connection with water resource management and conservation activities and not in connection with any other activity, including, without limitation, other municipal activities, such as public works, engineering, non-water-related GIS, emergency response or the like. If Licensee wished to obtain and expanded license to permit the use of the Licensed Imagery beyond the Permitted Use, it shall make arrangements to do so with either Geophex, or Geophex's authorized distributor, Eagle Aerial Solutions. Licensee shall fully reimburse and indemnify, defend and hold harmless Geophex, for any loss, liability, claim or damage to either of their economic interests or intellectual property rights arising from any violation of the terms of this License Agreement. The terms of the preceding sentence shall survive the termination of this License Agreement.

2. **General**

This License Agreement shall be governed by the laws of the State of California. No failure or delay by either party in exercising any right, power or remedy with respect to any of the provisions of this License Agreement shall operate as a waiver thereof. This Agreement sets forth the entire agreement between the parties. There are no other understandings, terms or agreements expressed or implied, oral or written. No alteration, change or modification of the terms of the Agreement will be valid unless made in writing, signed by all parties. If any dispute should arise with respect to the subject matter of this License Agreement, the prevailing party shall be entitled to recover from the other party all attorneys' fees and costs incurred in connection with such dispute, whether or not such dispute shall be brought to final judgment.

IN WITNESS WHEREOF the parties hereto have executed this License Agreement as of the date first hereinabove written.

Licensee	**Geophex**
_____	
By: _____	**By:** _____
Title: _____	**Title:** _____

G) PROJECT RESOURCES AND SCHEDULE

Hardware and Software

Geophex Surveys has not only assembled one of the top teams in the mapping industry, but also invested in the latest technology to produce the highest quality data products possible for our clients. Our modern workstations have the latest hardware and industry standard software for processing projects of all sizes.

Hard drive storage: 1+ PB

Processing: 20 dedicated image processing servers (100 cores)

Production Software

Orthophoto Department	
• Intergraph/Hexagon OrthoPro	• Global Mapper
• Vexcel Ultramap	• LizardTech GeoExpress MrSID Image Encoder
• Orthovista Radiometric Balancing and Mosaicking	• Bentley MicroStation v8
• Intergraph/Hexagon GeoMedia Pro GIS	• Pix4Dmapper Pro
• Intergraph/Hexagon IRAS-C Image Processing	• nFrames Sure Aerial Pro
• Intergraph/Hexagon Terrain Analyst Surface Modeling	• PCI Geomatica
• Adobe PhotoShop Image Processing	• OrthoPro DTMQue, PixelQue, Digital Image Analyst

LiDAR Processing Department	
• Terrasolid – Terra Model, Terra Scan	• LAS Tools

Photogrammetry Department	
• Intergraph/Hexagon Stereo Softcopy Kit (SSK)	• Intergraph/Hexagon Feature Collection (ISFC)
• Intergraph/Hexagon Cadmap DGN	• Datem Summit Evolution
• Intergraph/Hexagon DTM collection (ISDC)	• Bentley MicroStation v8
• Intergraph/Hexagon Auto-DEM Extraction (ISAE)	• LAS Tools
• Intergraph/Hexagon Stereo Display (ISSD)	• nFrames Sure Aerial Pro

Aerial Triangulation Department	
• Intergraph/Hexagon Image Stn. Aerial Triang. (ISAT)	• Delorme Flight Planner
• Intergraph/Hexagon Image Stn. Project Mgr. (ISPM)	• Bentley MicroStation v8
• Inpho InBlock Bundle Block Adjustment	• Erdas Imagine – Photogrammetry
• BINGO Bundle Block Adjustment	• PCI Geomatica
• Topoflight Flight Planner (ArcGIS)	

GIS Data Editing Department	
• ESRI ArcMap 10.X	• AutoCAD Civil 2013 (with Land Desktop and Survey)
• Bentley MicroStation v8	• Cardinal Systems Vr-One
• Datem Map Edit	• Axiom Spec Checker
• Safe Software FME Workbench with ESRI Suite and Universal Translator	• PCI Geomatica

In addition to the software listed above, Geophex Surveys also develops our own proprietary software tools to provide us with production solutions and increase our technical abilities and efficiencies.

Subcontractor Equipment

Aerial Photography Acquisition Subcontractor

For the LiDAR acquisition, Geophex Surveys will be teaming with Aero-Graphics Inc. based out of Salt Lake City, Utah. AGI is a privately-owned geospatial services business established in 1965. They have a nationwide reputation for providing high-quality aerial imaging services and own and operate their own aircraft and equipment which allows for complete control of flight scheduling. The latest digital systems are used to acquire aerial imagery for Federal, State, Local, and private clients across many different industries. In addition, Aero-Graphics is ISO 9001:2015 certified to better service their client needs.

Aero-Graphics Inc.
40 W Oakland Avenue
Salt Lake City, UT 84115
Ph: (801)487-3273
Email: sales@aero-graphics.com

aero-graphics

Aircraft

Aero-Graphics operates several aircraft which have all been modified specifically for aerial photography and data acquisition. These aircraft include:

Model	Single/Dual Engine	Number of planes	Owned/Leased
Cessna T310	Dual	2	Owned
Piper Aztec	Dual	1	Leased
Cessna T206	Single	3	Owned
Cessna T210	Single	1	Leased

Aircraft Maintenance

Aero-Graphics has extensive experience in reliably and consistently capturing aerial imagery throughout the United States and is proud of their proven reliability. Having multiple aircraft and strictly adhering to the aircraft maintenance schedule allows Aero-Graphics to offer high reliability and minimum aircraft downtime.

Camera

VEXCEL IMAGING

The SAWPA aerial imagery will be captured using a high performance Vexcel UltraCam Eagle. With a large footprint size of 20,010 x 13,080 pixels and Forward Motion Compensation, this 262MP camera lends excellent efficiency in addition to superior radiometric quality and image sharpness to almost any aerial mapping project. To ensure correct image geometry and accuracy, the camera undergoes regular calibration testing, and the current camera calibration report is available in **Appendix D**.

PAN image size	20,010 x 13,080 pixels	Imaging sensor	CCD
PAN pixel size	5.2 µm	Shutter (Prontor Magnetic 0 - Vexcel)	1/500 to 1/32
Color channels	4 ch. - R, G, B & NIR	Forward-motion comp. (FMC)	TDI controlled
Color image size	6,670 x 4,360 pixels	Maximum FMC capacity	50 pixels
Color pixel size	5.2 µm	Frame rate (min. inter-image interval)	1 frame per 1.8 secs
Pan-sharpen ratio	1:3	CCD Signal to Noise	72 db
Camera Focal Length	100mm	Analog-to-digital-conversion at	14 bits

Precision Airborne GPS and Inertial Measurement Sensors

To aid in project accuracy, all aerial photography is captured in conjunction with onboard Airborne GPS (AGPS) and Inertial Measurement Unit (IMU) sensors. AGPS utilizes satellite positioning to provide an accurate, cost effective and rapid method of providing control and ensuring accuracy of photo center positions, and IMU uses extremely sensitive motion-sensing technology to record any change in aircraft orientation (roll, pitch, yaw). AGPS data together with IMU data can reconstruct the exact position of the aircraft during image exposure and use this information as part of the aerial triangulation solution.

LiDAR Acquisition Subcontractor

For the LiDAR acquisition, Geophex Surveys will be teaming with Keystone Aerial Surveys. Keystone Aerial Surveys, Inc. (Keystone), **established in 1963 and a wholly owned subsidiary of Vexcel Imaging**, specializes in providing high-quality aerial surveys throughout North America. Keystone has flown millions of survey miles throughout the United States and maintains five permanent locations; Philadelphia, PA (headquarters), Tyler, TX, Tucson, AZ, Santa Rosa, CA and Reno, NV. Keystone owns and operates twenty-one aircraft and eight large-format digital sensors. For more information, see **Appendix C.**

Keystone Aerial Surveys
Northern California Hub
Santa Rosa, California
Phone: (541) 227-8597
Fax: (215) 464-2889
www.kasurveys.com

KEYSTONE

Aircraft

Keystone operates a large fleet of aircraft which have all been modified specifically for aerial photography and LiDAR acquisition. These aircraft are based at five permanent locations throughout the country in Philadelphia PA, Tyler TX, Tucson AZ, Santa Rosa CA and Reno NV.

The aircraft include:

Model	Number of Planes	Ceiling (ft)
Piper Navajo PA-31	1	24,000
Cessna Skynight C-320	3	28,000
Cessna T310Q	1	28,000

Model	Number of Planes	Ceiling (ft)
Cessna T310R	7	28,000
Piper Aztec PA-23-250	1	24,000
Cessna 210	3	26,000

Equipment and Acquisition

The LiDAR acquisition will utilize the Teledyne Optech Galaxy Prime. This LiDAR unit is a high performance LiDAR sensor designed for wide-area mapping, urban mapping and natural resource management.

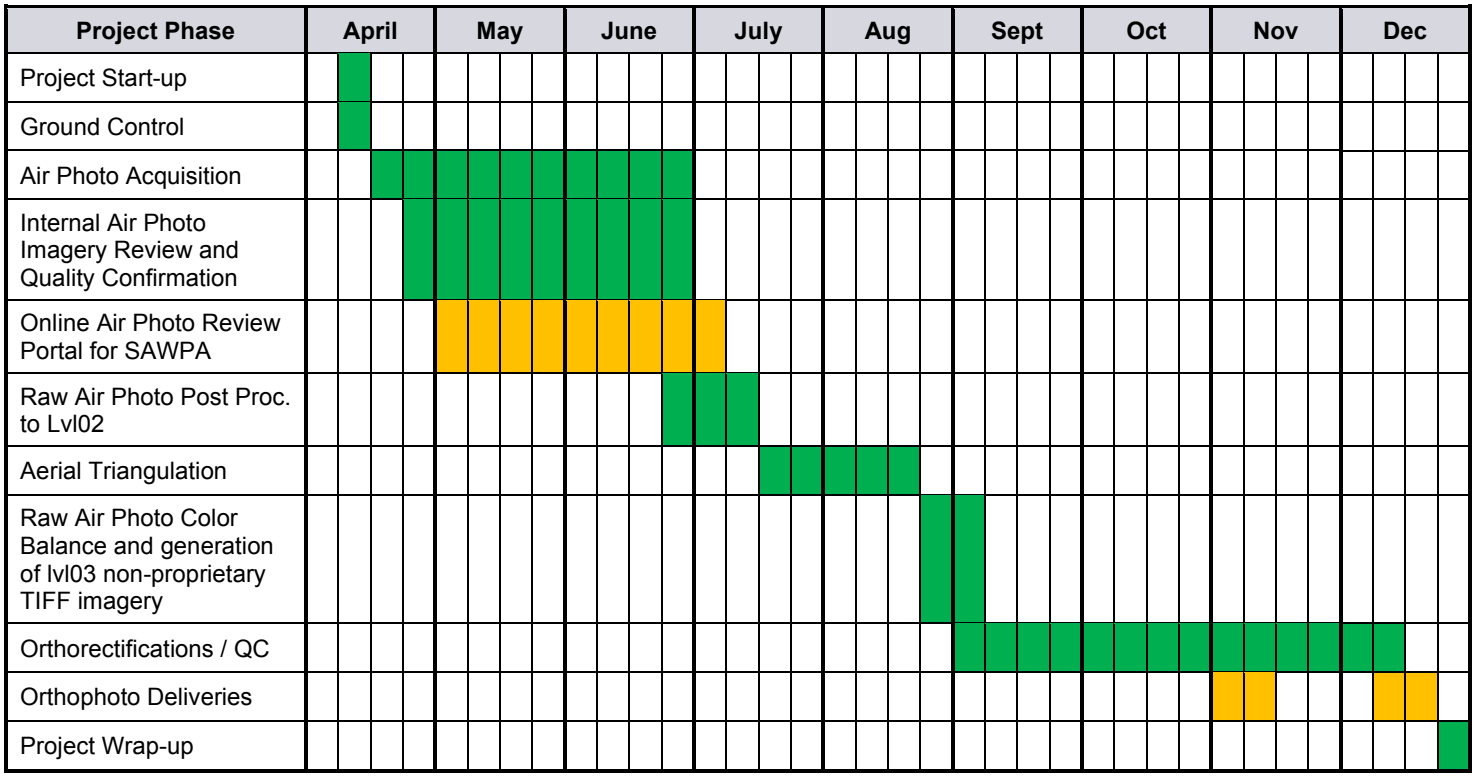
Galaxy Prime Specifications

Absolute Elevation Accuracy:	< 0.03-0.25 m RMSE from 150-6000m AGL
Topographic laser:	1064-nm near-infrared
Beam divergence:	0.25 mrad (1/e)
Scan angle (FOV):	10-60°
Swath width:	10-115% of altitude AGL
Flight management system:	Optech FMS (Airborne Mission Manager and Nav) with operator console
Pulse repetition frequency (effective):	Programmable, 50-1000 kHz

Schedule

It is anticipated that the SAWPA project will occupy approximately 20% of the personnel resources we have identified at any given time. Also, our production resources are scalable as necessary to complete the project within schedule. The following project schedule is based on flying and generating 3-inch orthophotography for the entire area of interest (2,032 square miles).

Orthophotography (2,032 sq. mi of 3 Inch Orthophotography)



Schedule Notes:

- The schedule above is based on past performance and the time required to process and QC final deliverables.
- If Aerial Photography is delayed, subsequent project milestones will be delayed the same amount.
- If DEM/TIN/Contours products are selected, datasets will be generated in concert with orthophotography. Depending on volume of elevation work, additional time may be required.

H) PROJECT EXPERIENCE

Client Name	Southern Nevada Water Authority
Address	100 City Parkway, Suite 700 Las Vegas, NV 89106
Contact Name	Craig Hale
Contact Position	Spatial Technologies Manager
Contact Tel	702-862-3730
Contact Email	craig.hale@snwa.com
Contract Period	2016, 17, 19, 20
Project Description	In 2016, 2017, 2019 and 2020 Geophex Surveys was contracted by the Southern Nevada Water Authority, NV to provide 6-inch resolution orthophotos, and a mix of 3-inch and 6-inch ortho respectively for the Las Vegas Valley Water District over an area of approximately 1,500mi².

Client Name	Eagle Aerial Surveys (Orange County, CA)
Contact Name	Wayne Tate
Contact Position	Project Manager
Contact Tel	714-754-7670 Ext #707
Contact Email	wtate@eagleaerial.com
Contract Period	2015, 16, 17, 18, 19, 20
Project Description	In 2015–2020, Geophex Surveys was contracted to provide 3-inch, 4-band orthophotography for approximately 811mi². The project consisted of approximately 5600 frames. Geophex Surveys established ground control and also utilized existing points to provide a project accuracy of approximately 6”.

Client Name	Mojave Water Agency, CA
Contact Name	Richard Schulman
Contact Position	Project Manager
Contact Tel	858-735-7424
Contact Email	resourcestrategies@usa.net
Contract Period	2018, 19, 20
Project Description	In 2018 – 20, Geophex Surveys was contracted to provide 12-inch 4-band orthophotography for approximately 3,475mi². Part of the delivery included CIR prints and imagery according to a specific tiling scheme.

I) FEE NARRATIVE

- Please refer to the proposed fees as shown in Exhibit A (Proposal Cost).
- With regards to the shared Master License Agreement please refer to Contract Provisions Exceptions / Recommendation.
- Prices provided in Exhibit A (Proposal Cost) do not include applicable taxes
- Invoicing will be per milestone as follows:
    - Successful air photo acquisition
    - Final deliverables

J) SCHEDULE

- See Project Resources and Schedule Section

APPENDIX A – SAMPLE IMAGERY

Geophex Surveys is including sample 3-inch, 6-inch and 12-inch orthophoto imagery from within the last 5-years using the same technology as proposed for the 2021 SAWPA project. The full resolution TIFF imagery can be downloaded via FTP.

FTP: ftp://184.68.179.204 **User Name**: SalesSamples **Password**: $s@P3G **Path**: /SAWPA

Orange County, 3-inch, 4-band

Southern Nevada Water Authority, 6-inch, 4-band

Mojave Water Agency, 12-inch, 4-band

APPENDIX B – GEOPHEX SURVEYS RESUMES

Andrew Dawson

General Manager

Education / Training

- MBA: Management of Technology, 2009
- Graduate Diploma in Business Administration, 2006
- B.Sc: Env. Science, Physical Geography & GIS, 2002

Experience

- Geophex Ltd. 10+ years
- Other firms, 9 years

Experience Summary

Andrew Dawson has been involved in the photogrammetric and GIS industry since 1994. Over the years he has held several positions including CAD specialist, GIS specialist, QA/QC specialist, Map Finisher, Project Lead, Project Manager, and now General Manager. Andrew's diverse experience in the mapping industry enables him to contribute to projects in a variety of capacities. Andrew is trained in MicroStation, ArcGIS, FME and several other photogrammetric and mapping software platforms.

Primary Job Duties

- Responsible for planning all aspects of project specifications, including the development of project plans
- Assist Project Managers and ensure the required information is available to successfully execute projects
- Provide technical support for proposal and productions teams
- Manage staff and company operations

Kevin Woolf

Project Manager

Education / Training

- Master of Science Remote Sensing, 1994
- Bachelor of Science, 1988

Experience

- Geophex Ltd. 10+ years
- Other firms, 8 years

Experience Summary

Kevin has worked in the mapping industry working with satellite and aerial imagery since 1996. Kevin has worked in orthophoto production before becoming the orthophoto department manager and the moving onto a project manager position. He is responsible for liaison with other departments on production issues, and with training and supervising new employees. Kevin has successfully managed many aerial survey projects involving color and near infrared imagery, planimetric data collection, DEM generation etc., with the majority of these projects operating under tight scheduling and to rigid quality standards.

Primary Job Duties

- Provides complete technical, financial, administrative, scheduling, and client liaison oversight and management.
- Responsible to the Director of Operations for the execution of all assigned projects to meet budgets, scope, schedules, quality and technical specifications as laid out in approved project plans.
- In charge of the assembly and guidance of project teams in order to efficiently and effectively execute their assigned projects.

William (Bill) Dawson

Sales / Technical Manager

Education / Training

- B.Sc. Geography
- Photogrammetry and Field Survey Dipl.

Experience

- Geophex Surveys 10+ years
- Other firms, 20+ years

Experience Summary

Bill Dawson is a professional geographer with over 30 years of experience in Resource and Municipal GIS mapping applications. His past experience also includes being the owner-operator of a mapping firm (Digital Geographics), and working 17 years as a photogrammetrist in the forestry industry in a production and supervisory position. Bill is extremely dedicated to his clients, and takes a role in ensuring that work being performed for his clients meets all the project requirements.

Primary Job Duties

- Promote Company profile
- Generate new business opportunities
- Meet sales revenue targets
- Provide front line Customer support
- Business development
- Job estimating
- Create and maintain client marketing reports and database
- Develop and maintain client relationships
- Company Representation at seminars and tradeshows
- Participates in industry associations

Michael Hogan

Vice President of Survey Operations

Education / Training

- Professional Licensed Surveyor, California #7362
- ACSM - American Congress of Surveying and Mapping
- ASCE - American Society of Civil Engineers
- AOPA - Aircraft Owners and Pilots Association
- Rotary - Santa Rosa East, Santa Rosa , California

Experience

- Geophex Ltd. 5 years
- Other firms, 16 years

Experience Summary:

Michael Hogan was licensed as a professional Land Surveyor in 1997 after working in the field for 14 years. His apprenticeship included working with some of the most experienced surveyors in Sonoma County. His education consists of taking courses in Engineering and Surveying at Santa Rosa Junior College, and short courses from the Geomatics Engineering Program at Fresno State University.

In 1997, after receiving his professional license, and with several years of experience, Michael opened his first Land Surveying Business in Kenwood, California. As a partner in Hogan-Ford Land Surveying, Inc. he served over 500 clients and completed over 900 different projects in a span of 5 years. In 2003, Michael opened his own company, Hogan Land Services, Inc., offering a wide range of land development services, including Civil Engineering, Septic and Permit Processing. He opened his office in downtown Santa Rosa at 541 Farmers Lane. Hogan Land Services employs a staff of 10, with over 1,140 clients served. Michael has performed surveying as a subcontractor for Geophex Surveys for many years before joining Geophex in 2012 as Vice President of Survey Operations.

Primary Job Duties:

- Performs ground control survey acquisition
- In Responsible Charge on projects
- Performs QAQC on final mapping project

Bjorn Norman

Aerial Triangulation Manager

Education / Training

- B.A. Geography/Archaeology, 1982
- Surveying and Photogrammetry Diploma
- ASPRS Certified Photogrammetrist (Certificate no. R1264).

Experience

- Geophex Ltd. 10+ years
- Other firms, 16 years

Experience Summary

Björn Norman is formally trained as an aerial triangulation specialist and has worked in the photogrammetry industry since 1986. He has been involved in all aspects in photogrammetry and has specialized in aerial triangulation since 1995. Björn is a recognized authority in both fully automated and conventional techniques of aerial triangulation, including AT adjustment with imagery from digital mapping cameras.

Primary Job Duties

- Planning and execution of all aspects of project aerial triangulation, including point mensuration and block adjustments.
- Provides instructions and locations to surveyors to establish ground control points.
- Provides technical support for proposal team. Coordinates quality procedures, naming conventions, trouble-shooting, and quality checks.

Alex Gikas

Aerial Triangulation and Photogrammetry Senior Technician

Education / Training

- Degree – Geomatics, Surveying and Mapping Engineering
- ASPRS Certified Photogrammetrist (Certificate No. R1279)

Experience

- Geophex Ltd. 1 year
- Other firms, 25 years

Experience Summary

Alex Gikas is formally trained as a photogrammetry and aerial triangulation specialist, and has worked in the photogrammetry industry since 1995. He has been involved in all aspects in photogrammetry and is an expert user of the Intergraph ImageStation hardware/software suite as well as MicroStation software.

Primary Job Duties

- Responsible for planning and organizing aspects of the AT and photogrammetry component of projects, including point mensuration and block adjustment.
- Assists Project Managers during the sales-PM handover and makes sure the necessary information is available to produce maps that meet project specifications.
- Provides technical support for proposal team. Coordinates quality procedures, naming conventions, trouble-shooting, and quality checks.
- Provides instructions to surveyors to establish ground control.
- Responsible for the assembly and guidance of Project Teams to efficiently and effectively execute their assigned projects.

Daniel Mani

Photogrammetry Manager

Experience

- Geophex Ltd. 10+ years
- Other firms, 22 years

Experience Summary

Daniel has been in working in the photogrammetry industry since 1982 and is an expert user of the Intergraph ImageStation hardware/software suite as well as MicroStation software. He is ideally suited to oversee our photogrammetric staff and subcontractors in working with these applications and brings an ideal combination of technical knowledge with business experience to our company. His excellent communication skills, as well as his attention to detail, are critical tools in the successful execution of our projects.

Primary Job Duties

- Provides complete technical, financial, administrative scheduling and client liaison oversight and management for one or multiple projects being executed within single or multiple offices.
- Responsible to the Project Manager for the execution of all assigned projects to meet budget, scope, schedule, quality and technical specifications as laid out in approved project plans.
- Responsible for the assembly and guidance of project teams to efficiently and effectively execute their assigned projects.

Mark Prenter

Orthophoto Manager

Experience

- Geophex Ltd. 10+ years
- Other firms, 15 years

Experience Summary

Mark Prenter has been directly involved in orthophoto production since 1987. During his professional career, he has successfully acted as Orthophotography Project Leader for hundreds of projects and provided departmental technical support to a team of over 14 technicians. He is extremely familiar with most orthophotography and media writing software tools and he has written software to allow for batch processing of rectification jobs and automated color balancing routines to assist in the color correction of ortho imagery.

Primary Job Duties

- Responsible for preparation of large batches of data for orthophoto rectification, quality control of orthophoto batch runs by analytical testing techniques, review of image radiometry and adjustment to project specific standards, and review of image geometry and verification to project specific standards.
- In charge of application of corrections using industry standard software (ZI Imaging, Leica, Adobe, etc) and setup of Microstation seed files with correct projection and datum parameters
- Assists Project Managers during the sales-PM handover and makes sure the necessary information is available to produce a map that will meet specifications.

APPENDIX C - SUBCONTRACTOR INFORMATION

Keystone Aerial Surveys - LiDAR Acquisition

KEYSTONE

Keystone Aerial Surveys, Inc specializes in providing quality aerial surveys. Keystone has flown millions of survey miles throughout the United States on projects with varied specifications. We have five locations; Philadelphia PA (headquarters), Tyler TX, Reno NV, Tucson AZ and Los Angeles CA. The Flight Department has considerable experience collecting airborne imagery at high and low altitudes in several formats including digital, film and LiDAR. Keystone also collects and processes both Airborne GPS (ABGPS) and Inertial Measurement Unit (IMU) data.

Its history of success uniquely qualifies Keystone to fly large statewide, and multiple county projects in one season. Keystone is expert in the execution of projects in all types of terrain and weather conditions as well as in restricted airspace. Keystone has extensive experience in contract management of large, complicated projects where quality control and communication are paramount. On the Federal level, Keystone has worked for the USDA (NRI, WRP and NAIP, Forests), USGS, BLM, FEMA, Corp of Engineers and NOAA.

Keystone operates one of the largest private fleets of aircraft, suite of large format digital sensors and multiple Optech LiDAR systems; employs flight crews consisting of pilots, camera operators, four full time licensed aircraft mechanics and a fully equipped and staffed photo lab and IT Department for extensive post processing support. Two of Keystone's employees are ASPRS Certified Photogrammetrists.

In 2011, Keystone became part of the PASCO Group of companies. The PASCO Group of companies is one of the largest geospatial firms in the world, providing services in five continents: Asia, Europe, Africa and North and South America. With the power of the PASCO Group behind Keystone, there is no project too large or distant for Keystone to accomplish. Feel free to contact the Sales team if you wish to work with the international group or if you have interest in exploring what services Keystone can offer through the group.

Keystone is an Affirmative Action / Equal Opportunity Employer.

Headquarters:
Keystone Aerial Surveys, Inc.
Northeast Philadelphia Airport
Grant Ave & Ashton Road
Philadelphia, PA 19114
Phone: (215) 677-3119
Fax: (215) 464-2889

Keystone Aerial Surveys - Resumes

KEYSTONE AERIAL SURVEYS INC. PHILADELPHIA, PA

KEYSTONE AERIAL SURVEYS a VEXCEL company

ROBERT BURTOFT

Aerial Survey Pilot

JOINED KEYSTONE:

- October 2011

YEARS OF EXPERIENCE:

- 15 years

EDUCATION/ CERTIFICATIONS:

- 2 years: Pierce College
- 2 years: North Valley Occ. Center Aviation Maintenance
- Single and Multi-Engine Commercial Rating

SUMMARY:

More than 7500 Hours total time PIC. Rob has both single- and multi-engine commercial rating, Instrument Pilot, he is also an experienced Airframe and Powerplant mechanic and has had training in welding and sensor installation. Robb has gained experience operating the Leica RC 30 Analog sensor as well as the UltraCam Falcon Prime and Eagle.

In addition to serving as an Aerial Survey Pilot for Keystone, Rob assumed Aircraft mechanical responsibilities in 2009. He has experience conducting survey flights in numerous operational environments including over mountainous terrain, open ocean, and within congested or highly-restricted airspace.

PROJECT EXPERIENCE:

PROJECT	STATES FLOWN	NUMBER OF MILES OR NUMBER OF SITES
DOT	WV, CA, NV, TX, AZ,	Greater than 5,5000 miles
NRI	OR, WA, UT, ID, PA, NJ, VT	Greater than 14,500 miles
TOPO	OR, WA, UT, ID, PA, NJ, WI, NV, NM, CO, TX, AZ, ID, MS, NC, SC, WY,	More than 26,500 miles
Digital	CA, IL, NV, NV, CO, FL, KS, MO, IA, TN,	Greater than 14,500 miles

KEYSTONE AERIAL SURVEYS INC. PHILADELPHIA, PA

KEYSTONE AERIAL SURVEYS a VEXCEL company

JAMES HERRERA

Sensor Operator / Photographer

JOINED KEYSTONE:

- 2012

YEARS OF EXPERIENCE:

- 20 years

EDUCATION/ CERTIFICATIONS:

- Cirtus College 1994-1996
- BROOKS INSTITUTE OF PHOTOGRAPHY 1996-1999

SUMMARY:

James Herrera began his career with I.K.Curtis Services (now Keystone Aerial) as a camera operator/photographer in 2001. James has flown over 2500 hours of survey missions. In 2002-2005 James flew over 80% of California highways for CALTRANS. Presently, James is collecting hundreds of line miles of LiDAR data in California for various customers.

PROJECT EXPERIENCE:

PROJECT	STATES FLOWN	MILEAGE / SITES/ EXPOSURES
NRI/SLI	5 US STATES	5,000+total NRI/SLI sites
TOPO/ DOT	10 US STATES	Hundreds of sites throughout CONUS
Digital	5 US STATES	2,000+ miles
LiDAR	5 US STATES	2,000+ miles

Aero-Graphics Inc. – Aerial Photography Acquisition

AGI is a privately-owned small geospatial services business located in the heart of Salt Lake City, Utah. Established in 1965, we have a nationwide reputation for providing high-quality aerial LiDAR, mapping, and imaging services on schedule at competitive prices. We own and operate a full-time aerial acquisition service, which allows for complete control of our flight schedule.

The latest digital systems are used to acquire and produce classified LiDAR datasets, digital topographic maps, orthorectified imagery, and dynamic GIS analyses and workflows for Federal, State, Local, and private clients across many different industries, including Flood and Geohazard Mitigation, Resource Management, Forestry, Environmental and Civil Engineering, Transportation, Mining, Utilities, and more.

AGI's extensive acquisition experience throughout the continental United States dates back to our founding in 1965 and includes thousands of LiDAR and imagery collections from El Paso to Washington DC, Minneapolis to San Diego. We routinely range throughout the nation, flying LiDAR and imagery projects up to 18,000 square miles in size from Mobile, Alabama to Seattle, Washington. This extensive experience gives us familiarity that helps us more accurately anticipate and respond to weather patterns, as well as design projects tailored to the specific terrain that we will encounter. AGI has performed LiDAR acquisition and processing since 2009, aerial photography since 1985, and photogrammetric production since 1965.

AGI prides itself on employing and maintaining relationships with the most intelligent and skilled people in the geospatial industry, including (internally) eight (8) Certified Photogrammetrists, one (1) Project Management Professional, two (2) Certified GIS Professionals, and two (2) Professional Land Surveyors. These professionals supervise acquisition and production tasks and ensure that quality standards are met and exceeded. In addition, we employ 16 flight operations managers, pilots, and sensor operators that provide data acquisition and 14 additional technical and administrative staff members. All work performed by AGI will be completed in our Salt Lake City, Utah office.

Key benefits for working with Aero-Graphics Inc. include:

- **Quick Response & Turnaround**

  We understand that time is of the essence. Aero-Graphics maintains full control of its flight schedule, yet isn't constrained by large company red tape and long queues. If you need a project completed quickly, we have the flexibility and availability to make it happen.

- **High Quality & Accuracy**

  We understand that the proper level of accuracy and quality is critical to project success. Our professional experience and acute awareness of industry standards ensures we get it right the first time, every time.

- **Certified & Licensed Employees**

  Aero-Graphics employs a talented staff of ASPRS Certified Professionals, Certified GIS Professionals, Professional Land Surveyors, aerial photographers and pilots to ensure accurate and reliable data.

- **Proven Experience**

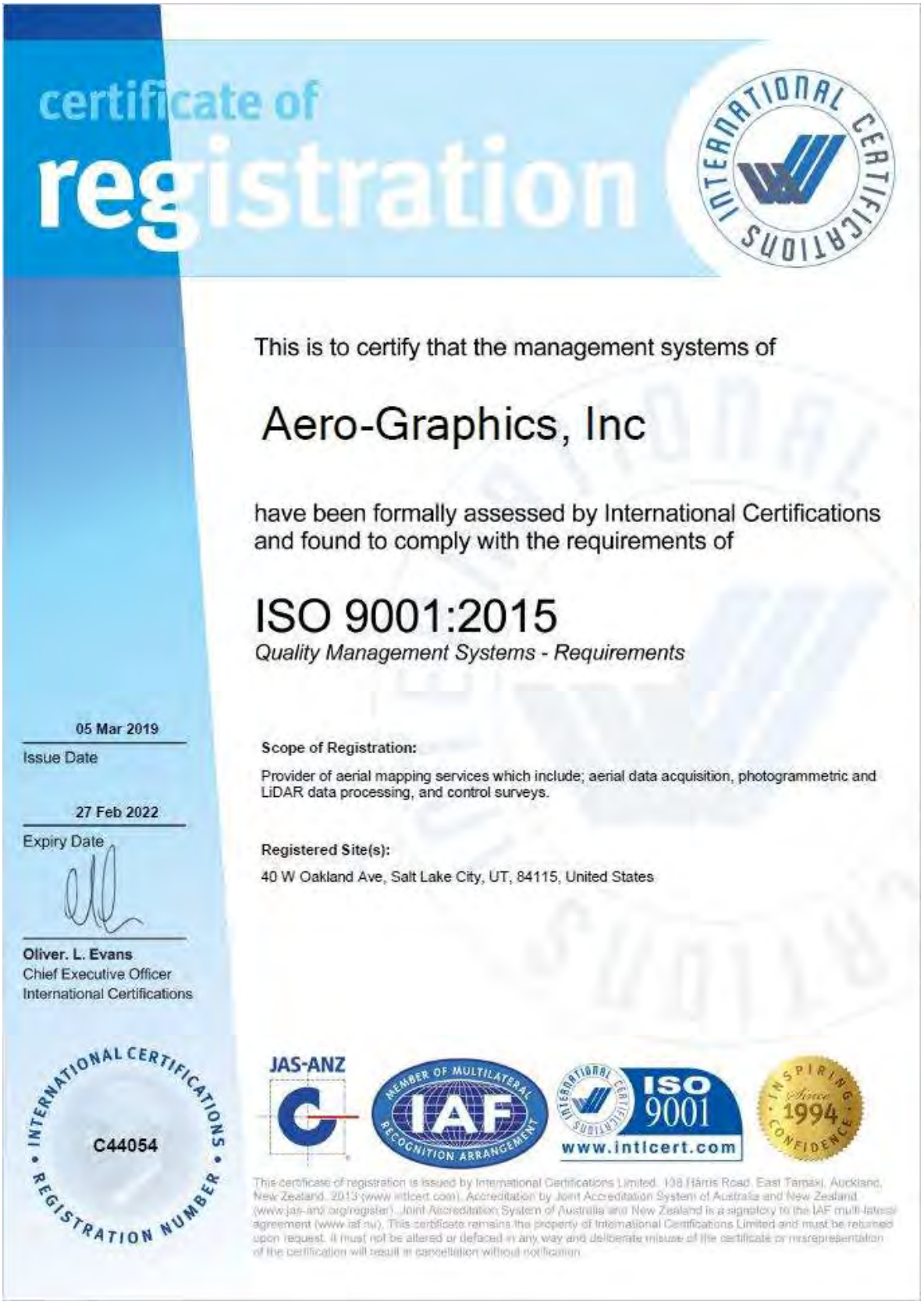
  Since 1965, Aero-Graphics has been meeting the expectations of our clients across a diverse spectrum of industries. Whether your project is located in San Diego or Quantico, we have the equipment, staff and experience to guarantee a successful outcome.

- **ISO 9001:2015 Certification**

  We are pleased to announce our new ISO 9001:2015 certification to better service our clients' needs. Process accountability, continuous documented improvement, and procedural document control will lend increased confidence in our services and end products.

Aero-Graphics Inc.
40 W Oakland Avenue
Salt Lake City, UT 84115
Ph: (801)487-3273
Email: sales@aero-graphics.com

Aero-Graphics Inc. – ISO 9001:2015 Certification



certificate of registration

INTERNATIONAL CERTIFICATIONS

This is to certify that the management systems of

Aero-Graphics, Inc

have been formally assessed by International Certifications and found to comply with the requirements of

ISO 9001:2015

Quality Management Systems - Requirements

Scope of Registration:

Provider of aerial mapping services which include; aerial data acquisition, photogrammetric and LiDAR data processing, and control surveys.

Registered Site(s):

40 W Oakland Ave, Salt Lake City, UT, 84115, United States

05 Mar 2019
Issue Date

27 Feb 2022
Expiry Date

Oliver. L. Evans
Chief Executive Officer
International Certifications

INTERNATIONAL CERTIFICATIONS • REGISTRATION NUMBER • C44054

JAS-ANZ

MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT IAF

ISO 9001 www.inticert.com

INSPIRING CONFIDENCE Since 1994

This certificate of registration is issued by International Certifications Limited. 138 Harris Road, East Tamaki, Auckland, New Zealand. 2013 (www.inticert.com). Accreditation by Joint Accreditation System of Australia and New Zealand (www.jas-anz.org/register). Joint Accreditation System of Australia and New Zealand is a signatory to the IAF multi-lateral agreement (www.iaf.nu). This certificate remains the property of International Certifications Limited and must be returned upon request. It must not be altered or defaced in any way and deliberate misuse of the certificate or misrepresentation of the certification will result in cancellation without notification.

Aero-Graphics Inc. – Resumes

BERNIE DOUD, CP, GISP | Position: Program Manager / Contracting

YEARS EXPERIENCE	
TOTAL	WITH CURRENT FIRM
18	12

EDUCATION

MBA: Project Management
BS: Geographic Information Systems

CURRENT PROFESSIONAL REGISTRATION

ASPRS Certified Photogrammetrist (#R1449, exp 6/2020)
GISCI Certified GIS Professional (#52260, exp 4/2021)

OTHER PROFESSIONAL QUALIFICATIONS

Bernie Doud has undertaken progressively more responsible geospatial roles throughout his career, including client relationships; project management; contracting; proposal creation; corporate strategy; quality management system implementation; GIS management; airborne GPS/IMU data refinement; analytical aerotriangulation; LiDAR data calibration; and photogrammetric compilation and editing.

RELEVANT PROJECTS

State of Utah LiDAR Acquisition Project – State of Utah AGRC (2018)

Scope and Size: As part of a cooperative agreement between the State of Utah and USGS' 3DEP program, AGI was awarded a contract to provide high resolution LiDAR acquisition for 13,109mi² of rugged terrain in Utah. Among the deliverables were: ground control & NVA/VVA checkpoint survey & classified LiDAR data adhering to NDEP/ASPRS vertical accuracy standards, as well as USGS LBS 1.2 and 1.3. The data acquired will be serving the needs of federal, state, and local agencies, as well as many private industry users for many years. **Fee:** $2.1M. **Role:** As Assistant Program Manager, Bernie assisted in everything from proposal creation to final deliveries. He closely monitored weather and provided location guidance to ensure the project was completed in one season.

Nat'l Res. Inventory Aerial Imagery – USDA-FPAC for NRCS: AZ,CA,CO,ID,KS,MO,NE,NM,OK,UT,WY (2011-19)

Scope and Size: Scope and Size: In 2019 AGI provided film acquisition and negative scanning for 16,675 single-photo sites throughout the above-mentioned states. Program included acquisition, film titling, scanning, QA and delivery of digital and film products to the NRCS. **2019 Fee:** $1.7M. **Role:** As Assistant Program Manager, Bernie tracked acquisition progress, provided QC guidance to staff, implemented and improved reporting procedures, and acted as technical liaison with the client.

2018 Air Photo Services & Supplies - Stewardship Lands – USDA-FPAC for NRCS: AZ,CA,CO,ID,KS,MN,MS, MO,NM,UT,WY (2014-18)

Scope and Size: For the 5th consecutive season AGI was awarded a Prime contract by FPAC/NRCS to acquire and process 3,964 easements across 11 states (listed above). Specifications were for 4-band spectral, 16-bit radiometric resolution imagery, analytical aerial triangulation, and digital orthorectification delivered as georeferenced TIFF image sets. **2018 Fee:** $977,406. **Role:** As Assistant Program Manager, Bernie was instrumental in the success of this initiative from project inception and proposal through final delivery.

Laramie County Contract – Cheyenne Laramie County GIS Cooperative | Laramie County, Wyoming (2019)

Scope and Size: The Laramie County project was awarded to Aero-Graphics in 2019 for digital imagery and LiDAR acquisition of 2,686mi² in Wyoming. Specifications included ground classified LiDAR data, 4-band orthorectified imagery in LZW compressed TIF/TFW tile and mosaic SID/SDW formats at a 0.5' pixel resolution. This data is being used for land study and development planning in Laramie County. **Fee:** $130,000. **Role:** Mr. Doud as Project Manager was responsible for cost and time management of the initiative as well as client liaison and final QC and delivery to the client.

MASON DECKER Position: QA/QC Manager, GIS Manager

YEARS EXPERIENCE	
TOTAL	WITH CURRENT FIRM
6	5

EDUCATION

BS, Geography; GIS Certificate

OTHER PROFESSIONAL QUALIFICATIONS

Mason Decker is responsible for the development, implementation, training, compliance, maintenance, and internal auditing of Aero-Graphics' ISO 9001:2015 certified Quality Management System. This includes the maintenance and monitoring of the company CAPA Log and Document Control SOPs, and the creation and oversight of quality workflows for all elements of a project. Mr. Decker's responsibilities also cover the development of software solutions to further automate and improve the quality of final deliverables.

RELEVANT PROJECTS

Historical Aerial Film Scanning and Orthorectification – USDA-FPAC for NRCS: South Dakota (2015-19)

Scope and Size: The Historical Aerial Film Scanning and Orthorectification project was awarded to AGI in 2015 and task orders extended through 2019. Two task orders included full orthorectification of 70,620 black and white scans from the years 1958-1978. NRCS uses this imagery to detect land use and perform change analyses. **Fee:** $1,439,488. **Role:** Performed the role QA/QC Manager and ensured all processes followed ISO procedure. He supervised progress reporting and contributed to the development of GIS automation that combines softcopy aerial triangulation, surface modeling, and orthorectification into a single process.

State of Utah LiDAR Acquisition Project – State of Utah AGRC: Utah (2018)

Scope and Size: As part of a cooperative agreement between the State of Utah and USGS' 3DEP program, AGI was awarded a contract to provide high resolution LiDAR acquisition for 13,109 square miles of rugged terrain in UT. Deliverables included: ground control and NVA/VVA checkpoint survey and classified LiDAR data adhering to NDEP/ASPRS vertical accuracy standards, and USGS LBS 1.2 and 1.3. The data acquired will serve the needs of federal, state, and local agencies, and private industry users for years. **Fee:** $2.1M. **Role:** QA/QC manager-provided QC guidance to staff, ensuring the data met NDEP/ASPRS accuracy standards and contributed to the creation of GIS software used for gap detection and quality assurance, metadata, and progress reporting.

The NHAP Historical Orthorectification Program – USDA-NRCS: FL, PA, NJ, DE, MI, MD (2019 – present)

Scope and Size: The NHAP Historical Orthorectification program was awarded to AGI in 2019. AGI was provided with historical film imagery from 1980-1987 covering the extent of the above-mentioned states to produce approximately 3,625 orthorectified DOQs in GeoTIFF format. Specifications required FGDC-compliant metadata, horizontal accuracy of 10m at 95% confidence, and detailed bi-weekly progress reports. **Fee:** $269,772 **Role:** Worked closely with both Bohannan Huston and the client to derive a suite of tools specifically designed to meet the quality and accuracy standards of the client. He also provided project management and oversight.

2018 Aerial Photography Services and Supplies – Stewardship Lands – USDA-FPAC for NRCS | AZ, CA, CO, ID, KS, MN, MS, MO, NM, UT, WY (2014 - 18)

Scope and Size: For the 5th consecutive season AGI was awarded a Prime contract by FPAC/NRCS to acquire and process 3,964 easements across 11 states (listed above). Specifications were for 4-band spectral, 16-bit radiometric resolution imagery, analytical aerial triangulation, and digital orthorectification delivered as georeferenced TIFF image sets. **2018 Fee:** $977,406. **Role:** Performed quality assessments on the imagery and data to ensure adherence to project requirements. He also monitored adherence to ISO processes throughout the project and performed quality checks on the imagery pre-delivery.

EMILIO SANCHEZ | Position: Aerial Data Acquisition Manager

YEARS EXPERIENCE	
TOTAL	WITH CURRENT FIRM
19	3

EDUCATION

Undergraduate Studies,
Aviation Technology

CURRENT PROFESSIONAL REGISTRATION

FAA Private Pilot (No. 3024934)
UAS Pilot Certification (No. 3965868)

OTHER PROFESSIONAL QUALIFICATIONS

Emilio Sanchez, as manager of AGI's Flight Department, is responsible for the daily oversight and management of flight crews, aircraft maintenance and the support and maintenance of our LiDAR and digital camera equipment. He has gained a broad knowledge of the issues involved with managing a multi-aircraft / sensor flight department that proves invaluable when dealing with weather, access restrictions, Class Bravo, temporary flight restriction and personnel. Mr. Sanchez is also responsible for the continued education and orientation of new pilots and operators.

RELEVANT PROJECTS

2019 Orthoimagery Updates – San Bernardino County: San Bernardino County, California (2011 – present)

Scope and Size: Annually, since 2011, AGI acquires and processes approximately 4,735mi² of digital imagery for San Bernardino Cty. at 1' GSD. Acquisition requires access into Twentynine Palms R-2501 and Edwards R-2515 restricted airspaces, as well as two mobilizations for winter and summer photography. **Fee:** $299,985 for current 3-year option period. **Role:** Responsible for daily flight oversight and high-altitude crew training. Manages restricted airspace access at Edwards AFB.

State of Utah LiDAR Acquisition Project – State of Utah AGRC: Utah (2018)

Scope and Size: As part of a cooperative agreement between the State of Utah and USGS' 3DEP program, AGI was awarded a contract to provide high resolution LiDAR acquisition for 13,109mi² of rugged terrain in UT. Deliverables included: ground control and NVA/VVA checkpoint survey and classified LiDAR data adhering to NDEP/ASPRS vertical accuracy standards, and USGS LBS 1.2 and 1.3. **Fee:** $2.1M. **Role:** Managed multiple crews, aircraft, and sensors for the project to complete acquisition before snow fell. Coordinated access into class Bravo airspaces, scheduled aircraft maintenance during bad weather windows and ensured crews had a balanced work / life schedule.

2018 Aerial Photography Services and Supplies – Stewardship Lands – USDA-FPAC for NRCS: AZ, CA, CO, ID, KS, MN, MS, MO, NM, UT and WY (2014-18)

Scope and Size: For the 5th consecutive season AGI was awarded a Prime contract by FPAC/NRCS to acquire and process 3,964 easements across 11 states. Specifications were for 4-band, 16-bit imagery, analytical aerotriangulation, and orthorectification delivered as georeferenced TIFF images. **2018 Fee:** $977,406. **Role:** Coordinated crews, sensors, and aircraft to ensure efficient and timely acquisition of each state. Monitored adverse weather conditions and ensured acquisition was completed in bad-weather areas as opportunities arose.

2019 National Resources Inventory Aerial Imagery – USDA-FPAC for NRCS | AZ, CA, CO, ID, KS, MO, NE, NM, OK, UT, WY (2011-19)

Scope and Size: In 2019 AGI provided film acquisition for approximately 16,675 single-photo sites throughout the above-mentioned states. The NRI program included acquisition, film titling, scanning, QA and delivery of digital and film products to the NRCS. **2019 Fee:** $1.7M. **Role:** Trained operators on film cameras. Coordinated access into restricted and class Bravo airspaces, made mobilization assignments based on the best weather forecasts, and ensured crews overnighted in locations with aircraft maintenance readily available. He managed multiple aircraft, sensors, and crew for the entirety of the acquisition period.

KEVIN REID, CP | Position: Photogrammetry Manager | YEARS EXPERIENCE: TOTAL 20, WITH CURRENT FIRM 14

EDUCATION
Undergraduate Studies, Computer Science

CURRENT PROFESSIONAL REGISTRATION
ASPRS Certified Photogrammetrist #1557

OTHER PROFESSIONAL QUALIFICATIONS

Mr. Reid is an ASPRS Certified Photogrammetrist with 20 years of experience as a geospatial Engineer. His expertise includes a wide array of skills required to efficiently manage and lead a large team of GIS professionals in the development of LiDAR and imagery datasets. He has been with AGI for over 14 years and currently serves as Vice President of Operations & Production, as such, he is responsible for the strategic direction, staffing and production of GIS, LiDAR and Ortho deliverables. As a former subcontractor to ESRI, he has a very deep knowledge of ESRI's suite of GIS and Geospatial analytical tools as well as AutoCAD and other leading GIS products.

RELEVANT PROJECTS

District 6 and Keams Canyon Contract – Hopi Utilities Corporation | Navajo County, Arizona (2018)

Scope and Size: AGI acquired both LiDAR and digital imagery across approximately 490mi² in Arizona. Processing specifications included analytical aerial triangulation, image radiometry, bare earth classified LiDAR and DEM surface data, and orthoimagery in TIFF and SID formats at a 1' pixel resolution. This data is being used for engineering projects in order to improve the infrastructure of the Hopi Nation **Fee:** $167,290. **Role:** His team was responsible for the project's production while he undertook QA/QC to ensure deliverables and horizontal and vertical accuracy met ASPRS 2014 standards for both the mapping and orthorectified imagery.

Cortez Mine Mapping Contract – Nevada Gold Mines: Crescent Valley, Nevada (1998, 2000, 2005-19)

Scope and Size: Each year AGI provides an updated aerial survey dataset for the Cortez Mine. Specifications in 2019 included two separate flights for imagery and LiDAR covering a total of 256 square miles, ground classified LiDAR, 5' contours and planimetry at 1" = 200' map scale, and ortho imagery mosaics at 0.5', 1', 5', 10', 15', & 20' resolutions. Cortez Mine uses this data to plan for future work and the environmental department is able to use this data when submitting permits to regulatory agencies. **2016-2019 Fee:** $725,080. **Role:** Oversaw the production of deliverables and supervised the final delivery in 3 different projections according to client specifications.

Indian Canyon Contract - Jones & DeMille Engineering: Duchesne County, Utah (2019)

Scope and Size: Aero-Graphics provided high-resolution LiDAR and 3-band stereo imagery acquisition for a total of 59 linear miles in Duchesne County, Utah. Specifications included bare earth classified point cloud data, 0.1' resolution ortho imagery, DTM files of break lines, and 1' contours and planimetry. The mapping is being used to plan and engineer a new railway corridor for oil transportation, which will greatly reduce road congestion and safety concerns with oil trucking through dangerous terrain along the Wasatch Back en route to refineries near Salt Lake City. **Fee:** $245,704. **Role:** Provides preparations and oversight for all imagery processing and performed a final QC on both the digital imagery and LiDAR data prior to delivery.

2018 Aerial Photography Services and Supplies – Stewardship Lands – USDA-FPAC for NRCS: AZ, CA, CO, ID, KS, MN, MS, MO, NM, UT, WY (2014-18)

Scope and Size: For the 5th consecutive season AGI was awarded a Prime contract by FPAC/NRCS to acquire and process 3,964 easements across 11 states. Specifications were for 4-band spectral, 16-bit radiometric resolution imagery, analytical aerotriangulation, and digital orthorectification delivered as georeferenced TIFF image sets. **2018 Fee:** $977,406. **Role:** Supervised all imagery processing, scheduled due dates, provided QC, kept project managers up to date on the technicians' progress throughout the project.

APPENDIX D - CAMERA CALIBRATION REPORT

VEXCEL IMAGING

ULTRACAM

Calibration Report

www.vexcel-imaging.com

ULTRACAM

Geometric Calibration

Camera:	**UltraCam Eagle**
Serial:	**UC-E-1-70012378-f100**
Panchromatic Camera:	**ck = 100.500 mm**
Multispectral Camera:	**ck = 100.500 mm**
PPA Information:	**X: 0.000 mm**
	Y: 0.000 mm
Calibration Date:	**Jan-02-2019**
Date of Report:	**Jan-17-2019**
Camera Revision:	**Rev06.1**
Version of Report:	**V06**

Panchromatic Camera

Large Format Panchromatic Output Image

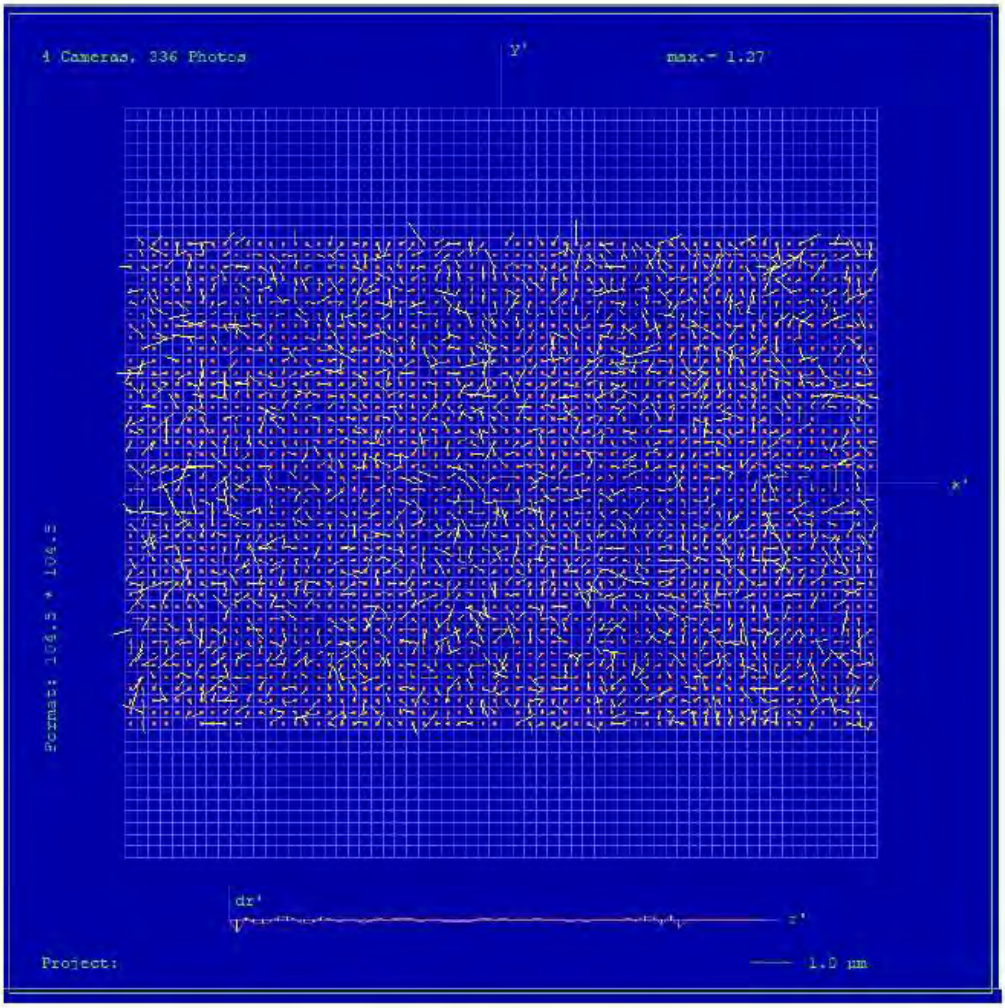
Image Format	long track cross track	68.016mm 104.052mm	13080pixel 20010pixel
Image Extent		(-34.008, -52.026)mm	(34.008, 52.026)mm
Pixel Size		5.200µm*5.200µm	
Focal Length	ck	100.500mm	± 0.002mm
Principal Point (Level 2)	X_ppa	0.000mm	± 0.002mm
	Y_ppa	0.000mm	± 0.002mm
Lens Distortion		Remaining Distortion less than 0.002mm	

Multispectral Camera

Medium Format Multispectral Output Image
(Upscaled to panchromatic image format)

Image Format	long track cross track	68.016mm 104.052mm	4360pixel 6670pixel
Image Extent		(-34.008, -52.026)mm	(34.008, 52.026)mm
Pixel Size		15.600µm*15.600µm	
Focal Length	ck	100.500mm	± 0.002mm
Principal Point (Level 2)	X_ppa	0.000mm	± 0.002mm
	Y_ppa	0.000mm	± 0.002mm
Lens Distortion		Remaining Distortion less than 0.002mm	

Full Panchromatic Image, Residual Error Diagram

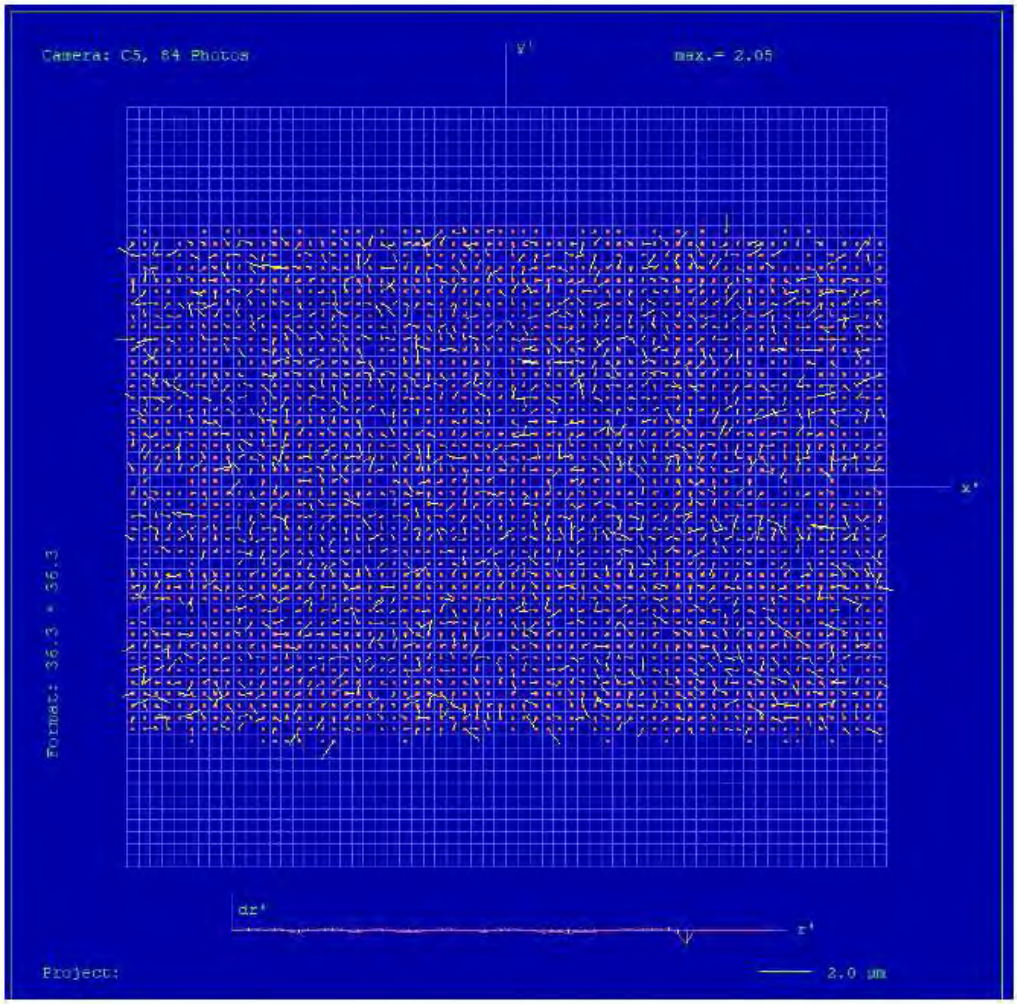


Residual Error (RMS): **0.49 µm**

ULTRACAM

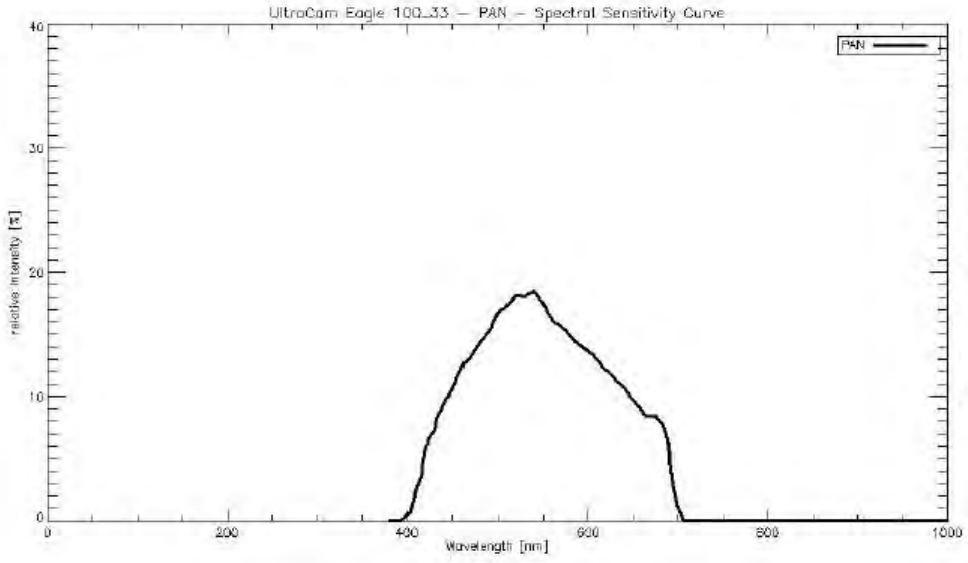
Green Cone (Cone 5), Residual Error Diagram

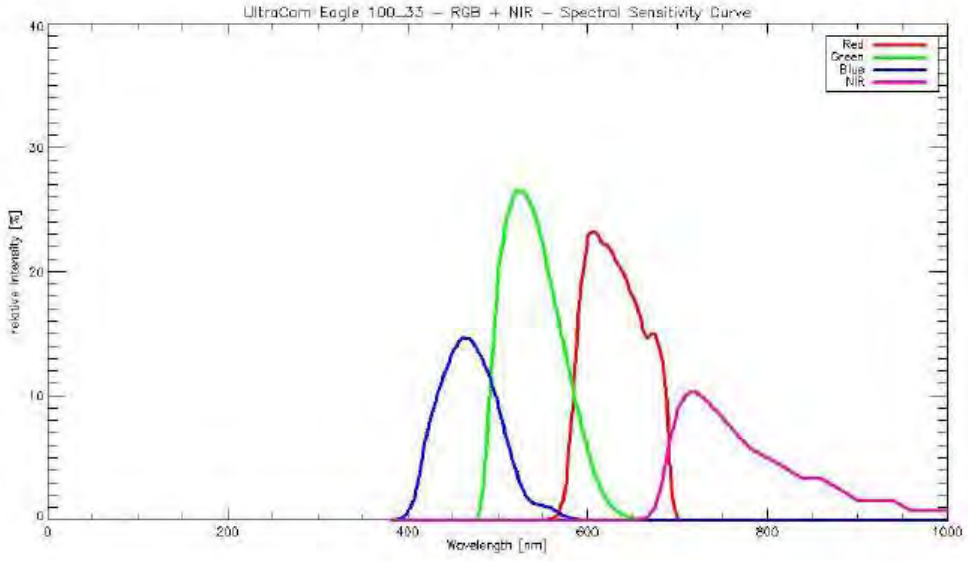
Residual Error (RMS): **0.50 µm**



SN: UC-E-1-70012378-f100 6

Spectral Sensitivity





ULTRACAM

Radiometric Calibration

Camera: UltraCam Eagle
Serial: UC-E-1-70012378-f100

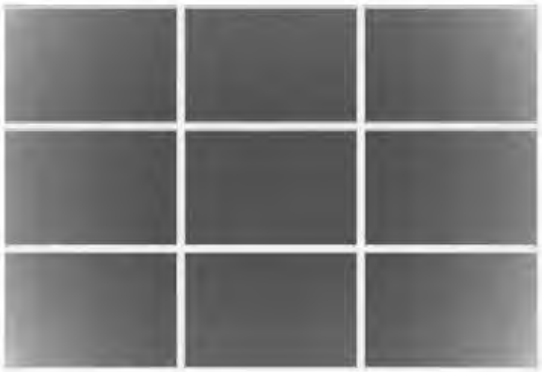
	PAN	R, G, NIR	B
Used Apertures	F5.6	F4.8	F4.8
	F6.7	F5.6	F4.8
	F8	F6.7	F4.8
	F9.5	F8	F5.6
	F11	F9.5	F6.7
	F13	F11	F8
	F16	F13	F9.5
	F22	F19	F13

Calibration Date: Jan-02-2019
Date of Report: Jan-17-2019
Camera Revision: Rev06.1
Version of Report: V06

Calibration of Vignetting for working Aperture F6.7

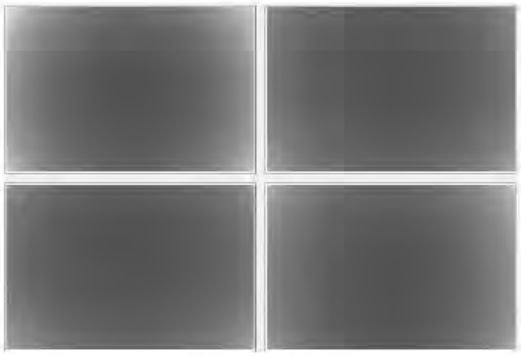
	PAN	R, G, NIR	B
Aperture	F6.7	F5.6	F4.8

Graphical Overview of Pan Sensors:



00_00	01_00	00_01
02_00	03_00	02_01
00_02	01_01	00_03

Graphical Overview of Multispectral Sensors:



04_00 (RED)	06_00 (BLUE)
05_00 (GREEN)	07_00 (NIR)

ULTRACAM

Shutter Calibration

Camera:	**UltraCam Eagle**
Serial:	**UC-E-1-70012378-f100**
Panchromatic Camera:	**4 * Prontor Magnetic 0** **Prontor-Werk Alfred Gauthier GmbH, Germany**
Multispectral Camera:	**4 * Prontor Magnetic 0** **Prontor-Werk Alfred Gauthier GmbH, Germany**
Calibration Date:	**Jan-02-2019**
Date of Report:	**Jan-17-2019**
Camera Revision:	**Rev06.1**
Version of Report:	**V06**

Calibration of Shutter Release Times:

The shutter release times measured during the calibration describe the time from the moment when the electrical current through the shutter is turned off by the electronics, until the shutter is mechanically closed.

This time is relevant for the exposure control and needs to be known before image recording can take place.

Cone Number	Lens Serial Number	SRT F5.6 [ms]	SRT F6.7 [ms]	SRT F8 [ms]	SRT F9.5 [ms]	SRT F11 [ms]	SRT F13 [ms]	SRT F16 [ms]	SRT F22 [ms]	Measurement Tolerance [ms]
C0 (Pan)	12 13 49 57	10.05	10.46	11.06	11.43	11.85	12.02	12.28	12.80	+/- 0.2
C1 (Pan)	12 13 49 45	10.49	11.00	11.45	11.88	12.29	12.52	12.67	13.11	+/- 0.2
C2 (Pan)	12 13 49 56	10.98	11.49	12.03	12.47	12.80	13.21	13.27	13.77	+/- 0.2
C3 (Pan)	12 13 49 56	9.76	10.19	10.71	11.11	11.42	11.70	11.92	12.38	+/- 0.2
C4 (Red)	12 14 79 10	11.87	12.05	12.34	12.53	12.77	12.92	13.00	13.11	+/- 0.2
C5 (Green)	12 14 79 11	11.96	12.24	12.50	12.75	13.02	13.10	13.26	13.52	+/- 0.2
C6 (Blue)	12 14 79 05	10.99	10.99	11.01	11.30	11.58	11.80	12.01	12.26	+/- 0.2
C7 (NIR)	12 14 79 08	11.89	12.20	12.20	12.71	12.74	13.03	13.07	13.07	+/- 0.2

ULTRACAM

Electronics and Sensor Calibration

Camera:	**UltraCam Eagle**
Serial:	**UC-E-1-70012378-f100**
Panchromatic Camera:	**9 * FTF7046-M Area CCD Sensor by DALSA**
Multispectral Camera:	**4 * FTF7046-M Area CCD Sensor by DALSA**
Calibration Date:	**Jan-02-2019**
Date of Report:	**Jan-17-2019**
Camera Revision:	**Rev06.1**
Version of Report:	**V06**

Calibration of Negative Substrate Voltage (VNS):

For optimum performance of the DALSA CCD sensors, the negative substrate voltage is adjusted to a value specified by DALSA.

This voltage value is measured to achieve the best anti-blooming performance possible for each particular sensor.

Cone_Sensor	Sensor Type	Sensor Serial Number	VNS Voltage [V]
00_00	FTF7046-M	15 7349/032	23.80
00_01	FTF7046-M	15 7349/043	24.20
00_02	FTF7046-M	15 7349/047	24.40
00_03	FTF7046-M	15 7349/034	24.00
01_00	FTF7046-M	15 7349/026	24.00
01_01	FTF7046-M	15 7349/044	24.20
02_00	FTF7046-M	15 7349/024	24.00
02_01	FTF7046-M	15 7349/025	24.40
03_00	FTF7046-M	15 7349/020	24.00
04_00 (red)	FTF7046-M	15 7349/031	24.20
05_00 (green)	FTF7046-M	15 7349/035	24.00
06_00 (blue)	FTF7046-M	14 9219/043	23.80
07_00 (NIR)	FTF7046-M	14 9219/042	24.00

Calibration of Intensity Threshold for Exposure Control:

Each CCD sensor and electronics module varies slightly in global sensitivity and intensity scale.

Therefore the maximum possible intensity of each sensor needs to be measured to evaluate the sensitivity behavior of the CCD and electronics.

This value is used as a threshold for the exposure control dialogue shown in the in-flight user interface of the Eagle.

Cone_Sensor	Sensor Type	Sensor Serial Number	Intensity Threshold [DN]
00_00	FTF7046-M	15 7349/032	13450
00_01	FTF7046-M	15 7349/043	13590
00_02	FTF7046-M	15 7349/047	13650
00_03	FTF7046-M	15 7349/034	13200
01_00	FTF7046-M	15 7349/026	13690
01_01	FTF7046-M	15 7349/044	14020
02_00	FTF7046-M	15 7349/024	13900
02_01	FTF7046-M	15 7349/025	14010
03_00	FTF7046-M	15 7349/020	13860
04_00 (red)	FTF7046-M	15 7349/031	13980
05_00 (green)	FTF7046-M	15 7349/035	13680
06_00 (blue)	FTF7046-M	14 9219/043	13860
07_00 (NIR)	FTF7046-M	14 9219/042	13790

ULTRACAM

Summary

Camera:	**UltraCam Eagle**
Serial:	**UC-E-1-70012378-f100**
Calibration Date:	**Jan-02-2019**
Date of Report:	**Jan-17-2019**
Camera Revision:	**Rev06.1**
Version of Report:	**V06**

The following calibrations have been performed for the above mentioned digital aerial mapping camera:

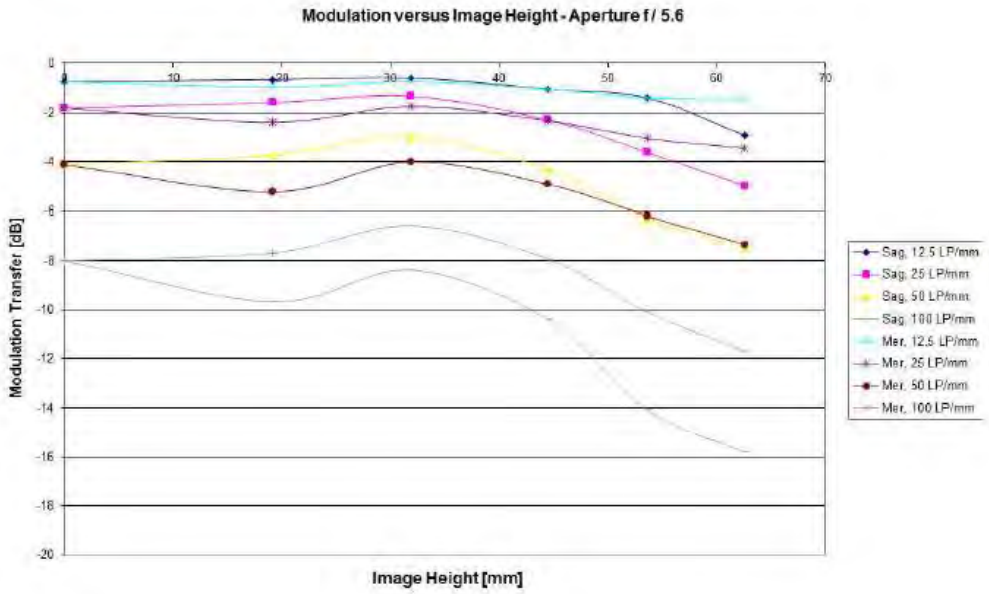
- Geometric Calibration
- Radiometric Calibration
- Shutter Calibration
- Sensor and Electronics Calibration

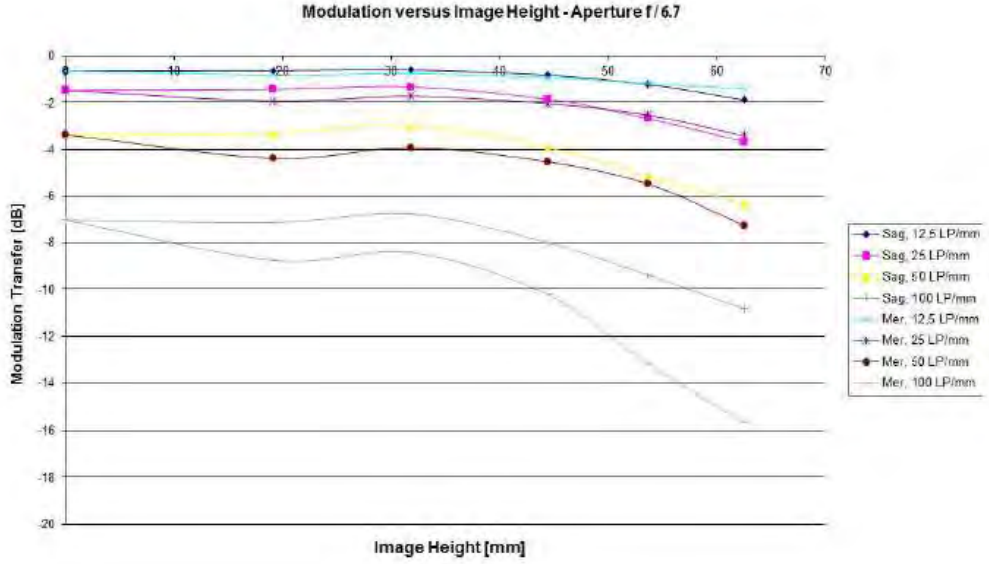
This equipment is operating fully within specification as defined by Vexcel Imaging GmbH.

Dr. Michael Gruber
Chief Scientist, Photogrammetry
Vexcel Imaging GmbH

Dipl. Ing. (FH) Helmut Jauk
Senior Project Engineer R&D
Vexcel Imaging GmbH

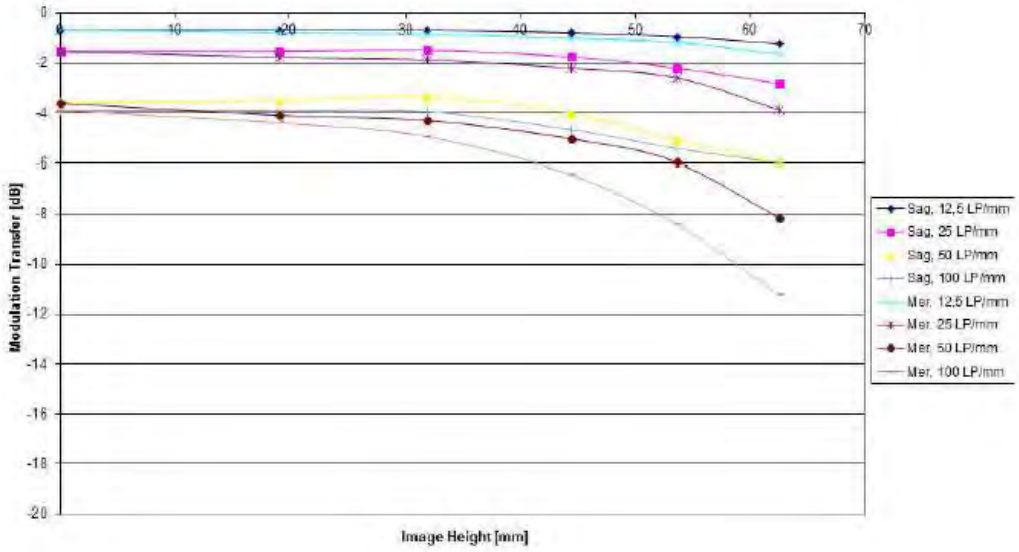
APPENDIX E – CAMERA MTF FUNCTIONS



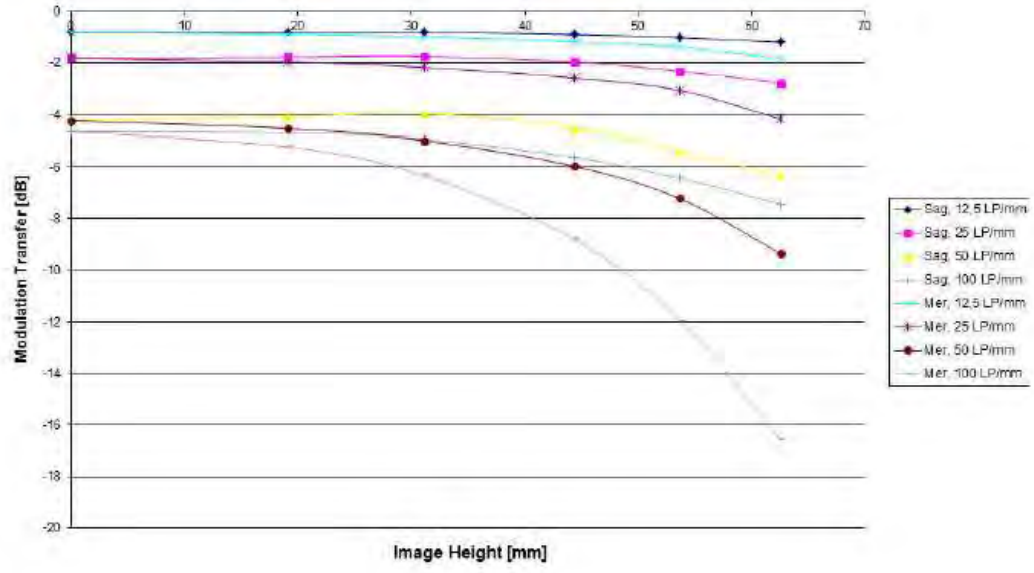


SN: UC-E-1-70012378-f100 11

Modulation versus Image Height - Aperture f / 8



Modulation versus Image Height - Aperture f / 9.5



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SANTA ANA WATERSHED PROJECT AUTHORITY
GENERAL SERVICES AGREEMENT FOR SERVICES BY INDEPENDENT CONSULTANT

This Agreement is made this **13th day of April, 2021** by and between the Santa Ana Watershed Project Authority ("SAWPA") located at 11615 Sterling Avenue, Riverside, CA, 92503 and Geophex, Ltd. ("Consultant") whose address is 605 Mercury Street, Raleigh, NC 27603.

RECITALS

This Agreement is entered into on the basis of the following facts, understandings, and intentions of the parties to this Agreement:

- SAWPA desires to engage the professional services of Consultant to perform such professional consulting services as may be assigned, from time to time, by SAWPA in writing;
- Consultant agrees to provide such services pursuant to, and in accordance with, the terms and conditions of this Agreement and has represented and warrants to SAWPA that Consultant possesses the necessary skills, qualifications, personnel, and equipment to provide such services; and
- The services to be performed by Consultant shall be specifically described in one or more written Task Orders issued by SAWPA to Consultant pursuant to this Agreement.

AGREEMENT

Now, therefore, in consideration of the foregoing Recitals and mutual covenants contained herein, SAWPA and Consultant agree to the following:

ARTICLE I
TERM OF AGREEMENT

1.01 This agreement shall become effective on the date first above written and shall continue until **December 31, 2023**, unless extended or sooner terminated as provided for herein.

ARTICLE II
SERVICES TO BE PERFORMED

2.01 Consultant agrees to provide such professional consulting services as may be assigned, from time to time, in writing by the Commission and the General Manager of SAWPA. Each assignment shall be made in the form of a written Task Order. Each such Task Order shall include, but shall not be limited to, a description of the nature and scope of the services to be performed by Consultant, the amount of compensation to be paid, and the expected time of completion.

2.02 Consultant may at Consultant's sole cost and expense, employ such competent and qualified independent professional associates, subcontractors, and consultants as Consultant deems necessary to perform each assignment; provided that Consultant shall not subcontract any work to be performed without the prior written consent of SAWPA.

ARTICLE III
COMPENSATION

3.01 In consideration for the services to be performed by Consultant, SAWPA agrees to pay Consultant as provided for in each Task Order.

3.02 Each Task Order shall specify a total not-to-exceed sum of money and shall be based upon the regular hourly rates customarily charged by Consultant to its clients.

3.03 Consultant shall not be compensated for any services rendered nor reimbursed for any expenses incurred in excess of those authorized in any Task Order unless approved in advance by the Commission and General Manager of SAWPA, in writing.

3.04 Unless otherwise provided for in any Task Order issued pursuant to this Agreement, payment of compensation earned shall be made in monthly installments after receipt from Consultant of a timely, detailed, corrected, written invoice by SAWPA's Project Manager, describing, without limitation, the services performed, when such services were performed, the time spent performing such services, the hourly rate charged therefore, and the identity of individuals performing such services for the benefit of SAWPA. Such invoices shall also include a detailed itemization of expenses incurred. Upon approval by an authorized SAWPA employee, SAWPA will pay within 30 days after receipt of a valid invoice from Consultant.

ARTICLE IV
CONSULTANT OBLIGATIONS

4.01 Consultant agrees to perform all assigned services in accordance with the terms and conditions of this Agreement including those specified in each Task Order. In performing the services required by this Agreement and any related Task Order Consultant shall comply with all local, state and federal laws, rules and regulations. Consultant shall also obtain and pay for any permits required for the services it performs under this Agreement and any related Task Order.

4.02 Except as otherwise provided for in each Task Order, Consultant will supply all personnel and equipment required to perform the assigned services.

4.03 Consultant shall be solely responsible for the health and safety of its employees, agents and subcontractors in performing the services assigned by SAWPA.

4.04 Insurance Coverage: Consultant shall procure and maintain for the duration of this Agreement insurance against claims for injuries or death to persons or damages to property which may arise from or in connection with the performance of the work hereunder and the results of that work by the Consultant, its agents, representatives, employees or sub-contractors.

4.04(a) **Coverage -** Coverage shall be at least as broad as the following:

1. **Commercial General Liability (CGL) -** Insurance Services Office (ISO) Commercial General Liability Coverage (Occurrence Form CG 00 01) including products and completed operations, property damage, bodily injury, personal and advertising injury with limit of at least two million dollars ($2,000,000) per occurrence or the full per occurrence limits of the policies available, whichever is greater. If a general aggregate limit applies, either the general aggregate limit shall apply separately to this project/location (coverage as broad as the ISO CG 25 03, or ISO CG 25 04 endorsement provided to SAWPA) or the general aggregate limit shall be twice the required occurrence limit.

2. **Automobile Liability –** (if necessary) Insurance Services Office (ISO) Business Auto Coverage (Form CA 00 01), covering Symbol 1 (any auto) or if Consultant has no owned autos, Symbol 8 (hired) and 9 (non-owned) with limit of one million dollars ($1,000,000) for bodily injury and property damage each accident.

3. **Workers' Compensation Insurance -** as required by the State of California, with Statutory Limits, and Employer's Liability Insurance with limit of no less than $1,000,000 per accident for bodily injury or disease.

4. **Professional Liability** - (Also known as Errors & Omission) Insurance appropriates to the Consultant profession, with limits no less than $1,000,000 per occurrence or claim, and $2,000,000 policy aggregate.

5. **Cyber Liability Insurance (Technology Professional Liability – Errors and Omissions) –** If Consultant will be providing technology services, limits not less than $2,000,000 per occurrence or claim, and $2,000,000 aggregate or the full per occurrence limits of the policies available, whichever is greater. Coverage shall be sufficiently broad to respond to the duties and obligations as is undertaken by Consultant in this Agreement and shall include, but not be limited to, claims involving infringement of intellectual property, including but not limited to infringement of copyright, trademark, trade dress,

invasion of privacy violations, information theft, damage to or destruction of electronic information, release of private information, alteration of electronic information, extortion and network security. The policy shall provide coverage for breach response costs as well as regulatory fines and penalties as well as credit monitoring expenses with limits sufficient to respond to these obligations.

If the Consultant maintains broader coverage and/or higher limits than the minimums shown above, SAWPA requires and shall be entitled to the broader coverage and/or higher limits maintained by the Consultant. Any available insurance proceeds in excess of the specified minimum limits of insurance and coverage shall be available to SAWPA.

4.04(b) If Claims Made Policies:

1. The Retroactive Date must be shown and must be before the date of the contract or the beginning of contract work.
2. Insurance must be maintained and evidence of insurance must be provided for at least five (5) years after completion of the contract of work.
3. If coverage is canceled or non-renewed, and not replaced with another claims-made policy form with a Retroactive Date prior to the contract effective date, the Consultant must purchase "extended reporting" coverage for a minimum of five (5) years after completion of contract work.

4.04(c) Waiver of Subrogation: The insurer(s) named above agree to waive all rights of subrogation against SAWPA, its elected or appointed officers, officials, agents, authorized volunteers and employees for losses paid under the terms of this policy which arise from work performed by the Named Insured for the Agency; but this provision applies regardless of whether or not SAWPA has received a waiver of subrogation from the insurer.

4.04(d) **Other Required Provisions -** The general liability policy must contain, or be endorsed to contain, the following provisions:

1. **Additional Insured Status:** SAWPA, its directors, officers, employees, and authorized volunteers are to be given insured status (at least as broad as ISO Form CG 20 10 10 01), with respect to liability arising out of work or operations performed by or on behalf of the Consultant including materials, parts, or equipment furnished in connection with such work or operations.

2. **Primary Coverage:** For any claims related to this project, the Consultant's insurance coverage shall be primary at least as broad as ISO CG 20 01 04 13 as respects to SAWPA, its directors, officers, employees and authorized volunteers. Any insurance or self-insurance maintained by the Member Water Agency its directors, officers, employees and authorized volunteers shall be excess of the Consultant's insurance and shall not contribute with it.

4.04(e) **Notice of Cancellation:** Each insurance policy required above shall provide that coverage shall not be canceled, except with notice to SAWPA.

4.04(f) Self-Insured Retentions - Self-insured retentions must be declared to and approved by SAWPA. SAWPA may require the Consultant to provide proof of ability to pay losses and related investigations, claim administration, and defense expenses within the retention. The policy language shall provide, or be endorsed to provide, that the self-insured retention may be satisfied by either the named insured or SAWPA.

4.04(g) Acceptability of Insurers - Insurance is to be placed with insurers having a current A.M. Best rating of no less than A: VII or as otherwise approved by SAWPA.

4.04(h) Verification of Coverage – Consultant shall furnish SAWPA with certificates and amendatory endorsements or copies of the applicable policy language effecting coverage required by this clause. All certificates and endorsements are to be received and approved by SAWPA before work commences. However, failure to obtain the required documents prior to the work beginning shall not waive the Consultant's obligation to provide them. SAWPA reserves the right to require complete, certified copies of all required insurance policies, including policy Declaration pages and Endorsement pages.

4.04(i) **Subcontractors -** Consultant shall require and verify that all subcontractors maintain insurance meeting all the requirements stated herein, and Consultant shall ensure that SAWPA, its directors, officers, employees and authorized volunteers are additional insureds on Commercial General Liability Coverage.

4.05 Consultant hereby covenants and agrees that SAWPA, its officers, employees, and agents shall not be liable for any claims, liabilities, penalties, fines or any damage to property, whether real or personal, nor for any personal injury or death caused by, or resulting from, or claimed to have been caused by or resulting from, any negligence, recklessness, or willful misconduct of Consultant. To the extent permitted by law, Consultant shall hold harmless, defend at its own expense, and indemnify SAWPA, its directors, officers, employees, and authorized volunteers, against any and all liability, claims, losses, damages, or expenses, including reasonable attorney's fees and costs, arising from all acts or omissions of Consultant or its officers, agents, or employees in rendering services under this Agreement and any Task Order issued hereunder; excluding, however, such liability, claims, losses, damages or expenses arising from SAWPA's sole negligence or willful acts.

4.06 In the event that SAWPA requests that specific employees or agents of Consultant supervise or otherwise perform the services specified in each Task Order, Consultant shall ensure that such individual(s) shall be appointed and assigned the responsibility of performing the services.

4.07 In the event Consultant is required to prepare plans, drawings, specifications and/or estimates, the same shall be furnished with a registered professional engineer's number and shall conform to local, state and federal laws, rules and regulations. Consultant shall obtain all necessary permits and approvals in connection with this Agreement, any Task Order or Change Order. However, in the event SAWPA is required to obtain such an approval or permit from another governmental entity, Consultant shall provide all necessary supporting documents to be filed with such entity, and shall facilitate the acquisition of such approval or permit.

4.08 Consultant shall comply with all local, state and federal laws, rules and regulations including those regarding nondiscrimination and the payment of prevailing wages, if required by law.

ARTICLE V
SAWPA OBLIGATIONS

5.01 SAWPA shall:

5.01a Furnish all existing studies, reports and other available data pertinent to each Task Order that are in SAWPA's possession;

5.01b Designate a person to act as liaison between Consultant and the General Manager and Commission of SAWPA.

ARTICLE VI
ADDITIONAL SERVICES, CHANGES AND DELETIONS

6.01 During the term of this Agreement, the Commission of SAWPA may, from time to time and without affecting the validity of this Agreement or any Task Order issued pursuant thereto, order changes, deletions, and additional services by the issuance of written Change Orders authorized and approved by the Commission of SAWPA.

6.02 In the event Consultant performs additional or different services than those described in any Task Order or authorized Change Order without the prior written approval of the Commission of SAWPA, Consultant shall not be compensated for such services.

6.03 Consultant shall promptly advise SAWPA as soon as reasonably practicable upon gaining knowledge of a condition, event, or accumulation of events, which may affect the scope and/or cost of services to be provided pursuant to this Agreement. All proposed changes, modifications, deletions, and/or requests for additional services shall be reduced to writing for review and approval or rejection by the Commission of SAWPA.

6.04 In the event that SAWPA orders services deleted or reduced, compensation shall be deleted or reduced by a comparable amount as determined by SAWPA and Consultant shall only be compensated for services actually performed. In the event additional services are properly authorized, payment for the same shall be made as provided in Article III above.

ARTICLE VII
CONSTRUCTION PROJECTS: CONSULTANT CHANGE ORDERS

7.01 In the event SAWPA authorizes Consultant to perform construction management services for SAWPA, Consultant may determine, in the course of providing such services, that a Change Order should be issued to the construction contractor, or Consultant may receive a request for a Change Order from the construction contractor. Consultant shall, upon receipt of any requested Change Order or upon gaining knowledge of any condition, event, or accumulation of events, which may necessitate issuing a Change Order to the construction contractor, promptly consult with the liaison, General Manager and Commission of SAWPA. No Change Order shall be issued or executed without the prior approval of the Commission of SAWPA.

ARTICLE VIII
TERMINATION OF AGREEMENT

8.01 In the event the time specified for completion of an assigned task in a Task Order exceeds the term of this Agreement, the term of this Agreement shall be automatically extended for such additional time as is necessary to complete such Task Order and thereupon this Agreement shall automatically terminate without further notice.

8.02 Notwithstanding any other provision of this Agreement, SAWPA, at its sole option, may terminate this Agreement at any time by giving 10 day written notice to Consultant, whether or not a Task Order has been issued to Consultant.

8.03 In the event of termination, the payment of monies due Consultant for work performed prior to the effective date of such termination shall be paid after receipt of an invoice as provided in this Agreement.

ARTICLE IX
CONSULTANT STATUS

9.01 Consultant shall perform the services assigned by SAWPA in Consultant's own way as an independent contractor, in pursuit of Consultant's independent calling and not as an employee of SAWPA. Consultant shall be under the control of SAWPA only as to the result to be accomplished and the personnel assigned to perform services. However, Consultant shall regularly confer with SAWPA's liaison, General Manager, and Commission as provided for in this Agreement.

9.02 Consultant hereby specifically represents and warrants to SAWPA that the services to be rendered pursuant to this Agreement shall be performed in accordance with the standards customarily applicable to an experienced and competent professional consulting organization rendering the same or similar services. Furthermore, Consultant represents and warrants that the individual signing this Agreement on behalf of Consultant has the full authority to bind Consultant to this Agreement.

ARTICLE X
AUDIT AND OWNERSHIP OF DOCUMENTS

10.01 All draft and final reports, plans, drawings, specifications, data, notes, and all other documents of any kind or nature prepared or developed by Consultant in connection with the performance of services assigned to it by SAWPA are the sole property of SAWPA, and Consultant shall promptly deliver all such materials to SAWPA. Consultant may retain copies of the original documents, at its option and expense. Use of such documents by SAWPA for project(s) not the subject of this Agreement shall be at SAWPA's sole risk without legal liability or exposure to Consultant. SAWPA agrees to not release any software "code" without prior written approval from the Consultant.

10.02 Consultant shall retain and maintain, for a period not less than four years following termination of this Agreement, all time records, accounting records, and vouchers and all other records with respect to all matters concerning services performed, compensation paid and expenses reimbursed. At any time during normal business hours and as often as SAWPA may deem necessary, Consultant shall make available to SAWPA's agents for examination of all such records and will permit SAWPA's agents to audit, examine and reproduce such records.

ARTICLE XI
MISCELLANEOUS PROVISIONS

11.01 This Agreement supersedes any and all previous agreements, either oral or written, between the parties hereto with respect to the rendering of services by Consultant for SAWPA and contains all of the covenants and agreements between the parties with respect to the rendering of such services in any manner whatsoever. Any modification of this Agreement will be effective only if it is in writing signed by both parties.

11.02 Consultant shall not assign or otherwise transfer any rights or interest in this Agreement without the prior written consent of SAWPA. Unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under this Agreement.

11.03 In the event Consultant is an individual person and dies prior to completion of this Agreement or any Task Order issued hereunder, any monies earned that may be due Consultant from SAWPA as of the date of death will be paid to Consultant's estate.

11.04 Time is of the essence in the performance of services required hereunder. Extensions of time within which to perform services may be granted by SAWPA if requested by Consultant and agreed to in writing by SAWPA. All such requests must be documented and substantiated and will only be granted as the result of unforeseeable and unavoidable delays not caused by the lack of foresight on the part of Consultant.

11.05 SAWPA expects that Consultant will devote its full energies, interest, abilities and productive time to the performance of its duties and obligations under this Agreement, and shall not engage in any other consulting activity that would interfere with the performance of Consultant's duties under this Agreement or create any conflicts of interest. If required by law, Consultant shall file a Conflict of Interest Statement with SAWPA.

11.06 Any dispute which may arise by and between SAWPA and the Consultant, including the Consultants, its employees, agents and subcontractors, shall be submitted to binding arbitration. Arbitration shall be conducted by a neutral, impartial arbitration service that the parties mutually agree upon, in accordance with its rules and procedures. The arbitrator must decide each and every dispute in accordance with the laws of the State of California, and all other applicable laws. Unless the parties stipulate to the contrary prior to the appointment of the arbitrator, all disputes shall first be submitted to non-binding mediation conducted by a neutral, impartial mediation service that the parties mutually agree upon, in accordance with its rules and procedures.

11.07 During the performance of the Agreement, Consultant and its subcontractors shall not unlawfully discriminate, harass, or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, physical disability (including HIV and AIDS), mental disability, medical condition (cancer), age (over 40), marital status and denial of family care leave. Consultant and its subcontractors shall insure that the evaluation and treatment of their employees and applicants for employment are free from such discrimination and harassment. Consultant and its subcontractors shall comply with the provisions of the Fair Employment and Housing Act (Government Code, Section 12290 et seq.) and the applicable regulations promulgated there under (California Code of Regulations, Title 2, Section 7285 et seq.). The applicable regulations of the Fair Employment and Housing Commission implementing Government Code Section 12990 et seq., set forth in Chapter 5 of Division 4 of Title 2 of the California Code of Regulations, are incorporated into this Agreement by reference and made a part hereof as if set forth in full. Consultant and its subcontractors shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement. Consultant shall include the

non-discrimination and compliance provisions of this clause in all subcontracts to perform work under the Agreement.

11.08 Contractor's employees, agents and subcontractors shall adhere to, and comply with, the California Drug Free Workplace Act at Government Code, Sections 8350 through 8357.

In witness whereof, the parties hereby have made and executed this Agreement as of the day and year first above-written.

SANTA ANA WATERSHED PROJECT AUTHORITY

_____

Jeffrey J. Mosher, General Manager Date

GEOPHEX, LTD.

_____ _____

(Signature) Date Typed/Printed Name

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SANTA ANA WATERSHED PROJECT AUTHORITY
TASK ORDER NO. GEO505-01

CONSULTANT: Geophex, Ltd. **VENDOR NO.:** 2065
605 Mercury Street
Raleigh, NC 27603

COST: **$210,353.00**

PAYMENT: Upon Receipt of Proper Invoice

REQUESTED BY: Ian Achimore, Senior Watershed Manager April 13, 2021

FINANCE: _____
Karen Williams, Deputy GM/CFO Date

FINANCING SOURCE: Acct. Coding: 505-00ADMIN
Acct. Description: General Consulting

COMMISSION AUTHORIZATION REQUIRED FOR THIS TASK ORDER: YES (X) NO ( )
Authorization: April 13, 2021; PA22#2021.4

This Task Order is issued upon approval and acceptance by the Santa Ana Watershed Project Authority (SAWPA) and Geophex, Ltd. (Consultant) pursuant to the General Agreement for Services between SAWPA and Consultant, entered into on April 13, 2021, expiring December 31, 2024.

I. PROJECT NAME OR DESCRIPTION
2021 Imagery Acquisition Project

II. SCOPE OF WORK / TASKS TO BE PERFORMED
Consultant shall provide all labor, materials, and equipment for the services to implement the Project scope of work (Attached). Invoicing will be per milestone as follows: Successful air photo acquisition of the entire AOI; Final deliverables of the entire batch of GeoTIFF files and related files.

*Please also refer to Appendix X for acceptable formats***.**

III. PERFORMANCE TIME FRAME
Consultant shall begin work **April 13, 2021** and shall complete performance of such services by **April 15, 2022.**

IV. SAWPA LIAISON
Ian Achimore shall serve as liaison between SAWPA and Consultant.

V. COMPENSATION
For all services rendered by Consultant pursuant to this Task Order, Consultant shall receive a not-to-exceed sum of **$210,353.00**. Funding for the services, provided by the State through a reimbursable grant with SAWPA, will be provided to the Consultant when SAWPA is provided payment by the State after the calendar year's quarter. Each invoice from the Consultant shall be provided to SAWPA within 15 days after the end of the calendar year's quarter in which the services were performed. The Consultant's invoice will bill for the Project per the Fee Table attached [Exhibit A in RFP] for the portion of work that was completed in the past calendar year quarter. Note that a retention withholding of 10% will be withheld on each quarterly invoice.

VI. CONTRACT DOCUMENTS PRECEDENCE

In the event of a conflict in terms between and among the contract documents herein, the document item highest in precedence shall control. The precedence shall be:

A. The Agreement for Services by Independent Consultant/Contractor.
B. The Task Order or Orders issued pursuant to the Agreement, in numerical order.
C. Exhibits attached to each Task Order, which may describe, among other things, the Scope of Work and compensation therefore.
D. Fee tables.
E. Specifications incorporated by reference.
F. Drawings incorporated by reference.

In witness whereof, the parties have executed this Task Order on the date indicated below.

SANTA ANA WATERSHED PROJECT AUTHORITY

Jeffrey J. Mosher, General Manager Date

GEOPHEX, LTD.

(Signature) Date Print/Type Name and Title

Scope of Work

Project Description: Obtain 2021 digital color four-band (R, G, B, and NIR[1]) imagery that can be used for software vegetation analysis within the Area of Interest (AOI) shown in Figure 1 below. The orthorectified imagery will be at a resolution of three inches per pixel.

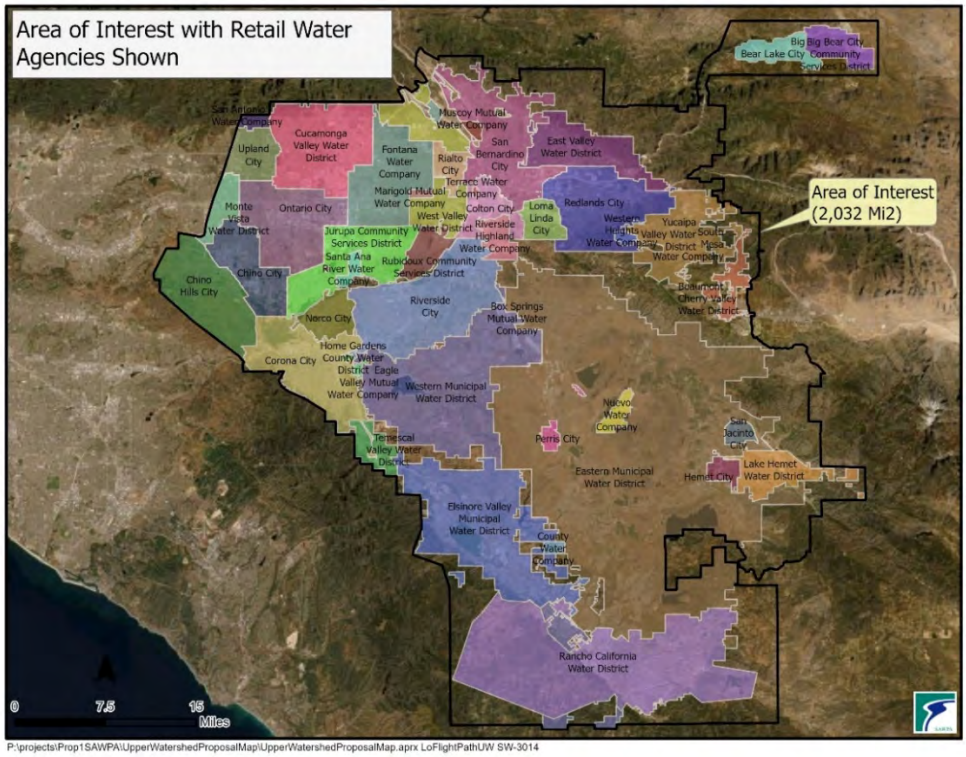
PROJECT OVERVIEW

1.1 Geographic Extents

The geographic area is primarily the upper Santa Ana River Watershed which extends from San Bernardino County in the north, through west Riverside County and the portions of the Santa Margarita Watershed covering west Riverside County down to the San Diego County border. The Orange County portion of the watershed is not included in the geographic extents for the imagery portion of this Project. There are 45 retail water agencies in the flight area.

However, requirements for collections in other parts of Riverside and/or portions of adjacent counties may be requested any time during the term of the contract. A shapefile in State Plane Zone 6 NAD83 Feet is provided as apart of Exhibit D to define the extents of the AOI.

Figure 1: Area of Interest for Project



[1] Near Infrared Reflectance.

1.2 Professional Standards and Practices

Employees or agents of Consultant shall perform all services hereunder in accordance with the standards of the profession. Consultant's findings, recommendations, and professional advice shall be based on practices and procedures customary to the Consultant's profession. Consultant must employ the current industry practice in performing its services and shall provide additional services, if needed, to correct its deficiencies at no cost to watershed agencies members.

A flight line index map in reproducible Adobe Portable Document Format (PDF) at a scale not greater than 1:100,000, showing topography and major features, is required. The center point of each photo shall be shown and labeled for each frame on the index, and the edge of one frame shall be shown as an example of the extent of coverage for each frame. A flight line and frame number shall be shown for each photo. The index shall contain a legend indicating photography scale, date of flight, and a depiction of the mechanics of the numbering sequence. After the AOI is completed, Consultant will provide a shapefile with metadata which includes the acquisition data of the frame, the frame extents and any other relevant information. The Consultant will also provide a shapefile showing the extents of each tile within the final deliverable AOI.

1.3 Ground Control

The Consultant shall be responsible for establishing sufficient ground control to perform the required digital orthophoto mapping. While ground control is typically established using survey methods, Bidders may propose alternative approaches to traditional survey methods as long as each approach is fully described and justified relative to the deliverable specification for each offer. Horizontal accuracy for the delivered ortho product shall be +/- 2.5 feet or better. The deliverable should include the expected horizontal accuracy. Table 1 below shows the accuracy of the Project's data components.

Table 1: Project Accuracy Table RMSE

Average Ground Sample Distance (GSD)	**Ground Control**	**Aerial Triangulation**	**Internal Ortho DEM**	**Orthophotography**
3 inches	<2 inches	3-inch	6-inch	6 inches to less than 2.5 feet

All surveying shall be performed under the direction of a land surveyor licensed to practice in and by the State of California. The control survey shall be completed in accordance with accepted industry practice and the applicable provision of the California Land Surveyor's Act. The setting of control by airborne GPS methods is permissible as long as the Consultant describes the process for achieving the required accuracy for the final orthophotography.

1.4. Coordinates

SAWPA requires that all ground control coordinates, and data products derived therefrom, be furnished in California State Plane Coordinates, Zone 6 for Riverside County; Horizontal Datum

shall be NAD 83; Vertical Datum, if applicable, shall be NAVD 88. Working units shall be in feet. Bidders may submit a proposed flight and control plan as part of their response. Some Watershed Agencies members may provide their own ground control and/or an alternative specification for the survey standard. These alternatives, if any, shall be provided to the Consultant in writing in a timely manner before imagery acquisition commences.

PROJECT SPECIFICATIONS

2.1 Collection Requirements

The imagery flight should not occur before award of a contract and issuance of a Contract. Consultant should mobilize adequate resources to insure timely capture of the various extents and flight heights. Since cloud-free imagery is required, an extension of the flight collection end-date is possible if no cloud-free days occur during the proposed collection period. The imagery shall not be captured when the ground is obscured by other factors such as flooding, excessive haze, smoke, or other obscuring atmospheric conditions.

Collection shall occur in calendar year 2021 when solar elevation > 30 degrees or most optimal 4-hour window. Consultant shall capture imagery at 80% forward and 30% side overlap.

2.2 Flight Plan

2.2.1 Flight Plan

The Consultant shall submit to the Project Manager the proposed flight plan and shall not obtain imagery until the Project Manager approves this flight plan. The Consultant shall capture each of the retail water agencies in the imagery AOI in the same agreed upon flight window with similar environmental conditions to support the production of a radiometrically balanced orthophoto product on a water agency by water agency basis. Flight blocks will be agreed upon and generally follow the boundaries of adjacent water agencies, similar terrain, and weather.

The boundaries of the retail water agencies are included as part of the shapefiles associated with Figure 1. The Consultant should discuss with the Project Manager availability and type of aircraft to perform the image acquisition.

The Consultant shall provide to the Project Manager a report (often called a Navigation Report) showing post-processing results and photo capture points. The photo points shall be in a shape file with date, time, photo location/elevation in attribute tables.

The Consultant shall obtain all necessary clearances, including military and government (Air Route Traffic Control Center) clearances to conduct the flights.

Re-flights shall be performed within 10 days (weather permitting) once feedback is received by SAWPA of deficiencies per Section 3.3 for the purpose of securing replacement images for all which fail to meet the minimum specifications set forth in the Contract. The Consultant will conduct a review within 7 days after the original flight to ensure that the imagery meets contract and Contract specifications. The Project Manager shall have 15 days to review imagery submitted by the Consultant to identify imagery deficiencies and to notify the Consultant of the deficiencies. The Consultant shall have 15 days to correct the imagery or to recollect imagery and resubmit to the Project Manager.

The Project Manager shall be the sole judge as to what constitutes "imagery deficiencies." There shall be no additional charge for re-flights and/or imagery correction. Additional quality review will be conducted by the Project Manager.

2.3 Sensor Specification and Calibration

2.3.1 Digital

The primary imagery to be acquired shall be four-band color (R,G,B, NIR) GEOTIFFs. SAWPA expects the sensor used by the Consultant to be able to delineate sharp edges and have high spatial resolution. Forward motion compensation is helpful but not mandatory. A copy of the most recent (less than 3 years old) calibration certificate must be supplied. The sensor should be able to acquire blur-free imagery at the proposed resolutions through use of a very fast shutter speed (greater than 1/500th second) or through use of a motion-compensation device.

Consultant shall be liable for ensuring that all photography complies with industry standard tolerances for flight altitude, tip, tilt, side lap, end lap, and crab. In particular, the imagery shall be done with the optical axis of the camera as nearly vertical as possible, always kept below 3 degrees. The tilt between two consecutive exposures shall not exceed 4 degrees. The crab angle shall not exceed 3 degrees. The imagery is to be captured with the optical vertical axis <3 degrees.

2.3.2 Digital Sensor

For each digital camera proposed, SAWPA prefers that a single camera sensor be used to ensure exact band-to-band registration. If a multi-camera sensor is proposed, the proposal should provide specifications regarding the band-to-band registration or discuss how a highly accurate band-to-band registration will be ensured. For each digital sensor proposed, the Modulation Transfer Function (MTF) of the sensor should be provided.

2.4 Image Production Process

The Project Manager and Consultant will coordinate on the tiling scheme during approval of the Flight Plan.

2.5 Photo Specifications – General Requirements

SAWPA requests the following specifications:

a) Four band imagery (R, G, B, NIR): 24 bit (3 bands x 8 bits/band) digital camera collections will include collection of multi-spectral imagery so that the required Color Infrared Imagery (CIR) can also be produced. b) Spatial Resolution: 3 inch GSD.

b) Spatial Accuracy: The National Standard for Spatial Data Accuracy (NSSDA) provides criteria for specifying accuracy at any photo scale. Consultant shall follow the NSSDA guidelines with regard to spatial accuracy.

c) Projection: State Plane Coordinate System, Zone VI, US feet, Datum NAD83.

d) Image Format ESRI compatible GEOTIFF files are required for each tile; addition of a supplemental world file (.tfw) is required.

e) Metadata: Complete documentation on image acquisition, spatial accuracy, and other technical specifications related to image acquisition and processing is required.

f) Image Quality: Images must be free of significant defects or inconsistencies in tone, contrast or color within an individual tile and/or between adjacent image tiles; color and contrast shall be natural – no bias towards a single shade or color; samples from the same sensor proposed for this project shall be provided; image shall be free of striping, banding, washouts, and hot spots. Some allowance for high reflection over water will be made. Some feature extraction should be possible in lightly shaded areas.

g) AOI for 2021 Imagery Acquisition: The shapefiles for the Project's AOI as shown in Figure 1 for the imagery acquisition are attached in an electronic format.

h) A shapefile showing the photo collection points including the date and time of photo collection, camera elevation, and corresponding image name.

The GEOTIFF file naming convention shall correspond to SAWPA's required tiling schema; the Consultant may offer their version of a traditional aerial tiling system.

2.6 Digital Elevation Model (DEM)

In order to ensure proper orthorectification, unless ground control is provided, the Consultant will be responsible for developing a professional, industry standard DEM. Consultant shall perform the necessary Ground Survey and other steps necessary to meet the horizontal accuracy and quality of the delivered imagery. Deviations from industry standard procedures must be discussed with the Project Manager in advance and Consultant must receive written SAWPA approval for such variations.

2.7 Project Reporting, Quality Assurance and Quality Control

The Consultant shall provide brief weekly email progress reports to the Project Manager summarizing the overall status of the project and providing details of the project accomplishments and actions taken for the subject period. Consultant shall indicate which project milestones have been met and what the next or remaining steps to be taken are.

Imagery will be reviewed by consultant within 7 days of acquisition

The Consultant shall provide two mid-project updates during Project implementation (one to its staff-level workgroup and one to its governing body), and then two final project updates once the Project is complete (one to its staff-level workgroup and one to its governing body). The staff-level updates will each be two-hours long, and the governing body updates will be one-hour long. The Consultant can attend these meetings virtually.

2.8 Document and Product Ownership

The imagery will be provided under a "Shared Master License" agreement. (Paragraph 2.8.2.)

2.8.1 Watershed Agencies Ownership

All data, designs, files, forms, graphics, images, information, photographs, plans, procedures, renderings, reports, studies, statistics, systems and any other materials produced pursuant to this project shall be the property of SAWPA and the Watershed Agencies under the Shared Master License agreement. Consultant shall deliver all final data, information, and any other materials produced under this agreement to SAWPA and the Watershed Agencies.

2.8.2 Shared Master License

As described above, the Contract shall be issued on a “Shared Master License” basis. The deliverables of this Project may be used without any licensing fees for purposes of implementing the OWOW Plan Update 2018 (and its updates), or by SAWPA, or their consultants and contractors, for any purpose, and how Consultant may charge a license fee for other entities to use the deliverables of this Project for purposes unrelated to OWOW.

SAWPA shall not convey the Project deliverables to any entity other than the Watershed Agencies. However, Consultant shall, upon written notification from SAWPA, grant a license without fee to any entity for use in implementing the OWOW Plan Update 2018 (and its updates), such license not being further transferable.

3.1 Project Deliverables

1. **Work Plan**: Following the project initiation meeting(s), the Consultant shall draft a work plan detailing all technical and administrative procedures. The work plan shall include, at a minimum, the following content:

- Narrative description of tasks, subtasks and deliverables, and
- Schedule with tasks, sub-tasks, dependencies, progress (by task and sub-task), assigned resources and deliverables (to be maintained as a Gantt chart).

2. A **flight plan**.

3. A **project control report** shall be submitted documenting all controls used for orienting the captured imagery for the project. This will include:

- Flight Line;
- Camera Calibration Report;
- CD-ROM or DVD with Final Post Processed AGPS Photo Center Point Coverage;

- Statement Specifying the Location and Storage Criteria for the Master Digital Files;

- All horizontal and vertical control points used for orienting the captured imagery submitted as part of an ESRI point feature shapefile(s).

For each digital sensor proposed, the Modulation Transfer Function (MTF) of the sensor should be provided as well as any other parameters unique to the digital sensor.

4. **Metadata Report:** FGDC compliant metadata is desirable. As a minimum, the Consultant's metadata report shall contain the following information:

- Date(s) of image collection;

- Spatial and spectral resolutions;

- Spatial accuracy of image (typically stated in circular error, RMS error or in NMAS format or NSSDA format);

- Projection and datum of imagery;

- Filters used (if any);

- Collection consultant and contact information;

- DEM (if any) and contours (if any) in conformance with NAVD88 or equivalent standard.

5. **Initial raster imagery** that has not been orthorectified and a web-based portal that allows SAWPA to QA/QC review the imagery as it is captured. Portal login shall be available to SAWPA and the other Watershed Agencies.

6. An **Index Map**, which is a post-award and pre-flight requirement.

7. Hard drive(s) with the **final GEOTIFF tiles**. Addition of a **supplemental world file (.tfw)** is required. The hard drive(s) shall be USB 3.0 external hard drives. Hard drives are not returnable and become the property of the watershed agencies. The Project Manager will provide Consultant with a logical naming scheme for the delivered media folders and for the individual image tiles. It is important to the Project Manager to be able to define the naming convention for the individual tiles.

8. **Compression file(s)** of the imagery in ECW format.

9. Report (often called a **Navigation Report**) showing post-processing results and photo capture points. A shapefile showing the photo collection points including the date and time of photo collection, camera elevation, and corresponding image name.

10. Brief weekly email **progress reports** to the Project Manager.

11. **Four updates** – two with staff level workgroup, two with SAWPA governing body.

3.2 Project Procedures Guide

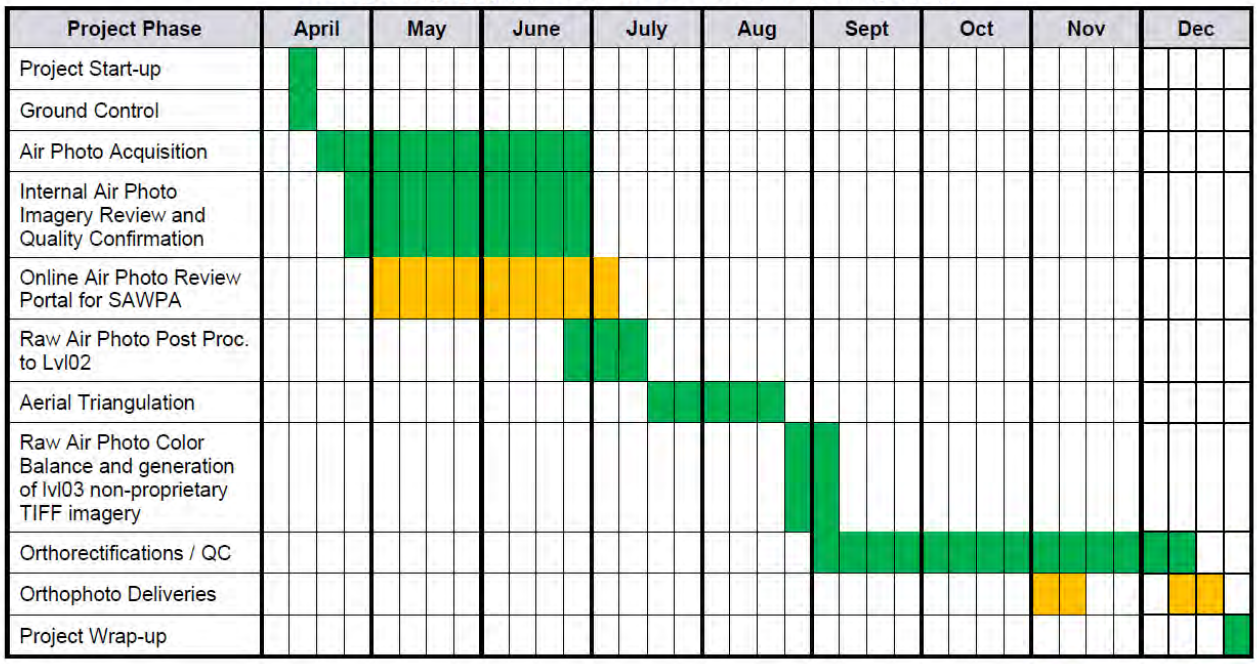
The Consultant shall follow standard production processes and quality assurance and quality control procedures in order to ensure that all products meet the required accuracy and performance standards of these specifications.

3.3 Customer Review and Discrepancy Correction

The Project Manager or, if designated, the purchasing watershed agencies member, shall have 10 days to review submitted deliverables and notify the Consultant in writing of any deficiencies. The Consultant shall be prepared to correct the data or recollect deficient imagery within 7 days, weather permitting, after notification, and will then re-deliver the imagery within 10 days following collection.

4. Schedule

Orthophotography (2,032 sq. mi of 3 Inch Orthophotography)



Schedule Notes:

• The schedule above is based on past performance and the time required to process and QC final deliverables.

• If Aerial Photography is delayed, subsequent project milestones will be delayed the same amount.

5. Warranty

Consultant stands behind all our data deliverables and we back this commitment with long standing warranties. If SAWPA identifies that the data produced does not meet specifications, Consultant shall fix the substandard data at no charge for a period of 1 year after the delivery of the full batch of GeoTIFFs and related files.

6. Invoicing

Invoicing will be per milestone as follows:

- o After successful air photo acquisition of the entire AOI.
- o Final deliverables of the entire batch of GeoTIFF files and related files.

Consultant Fee Schedule

Price Per Square Mile	Square Miles in Project	Total Price
$103.52	2,032	$210,353 (rounded to nearest ones value)