Santa Ana River Watershed Cloud Seeding Pilot Program: Year 1 Summary

Agenda Item No. 6.A

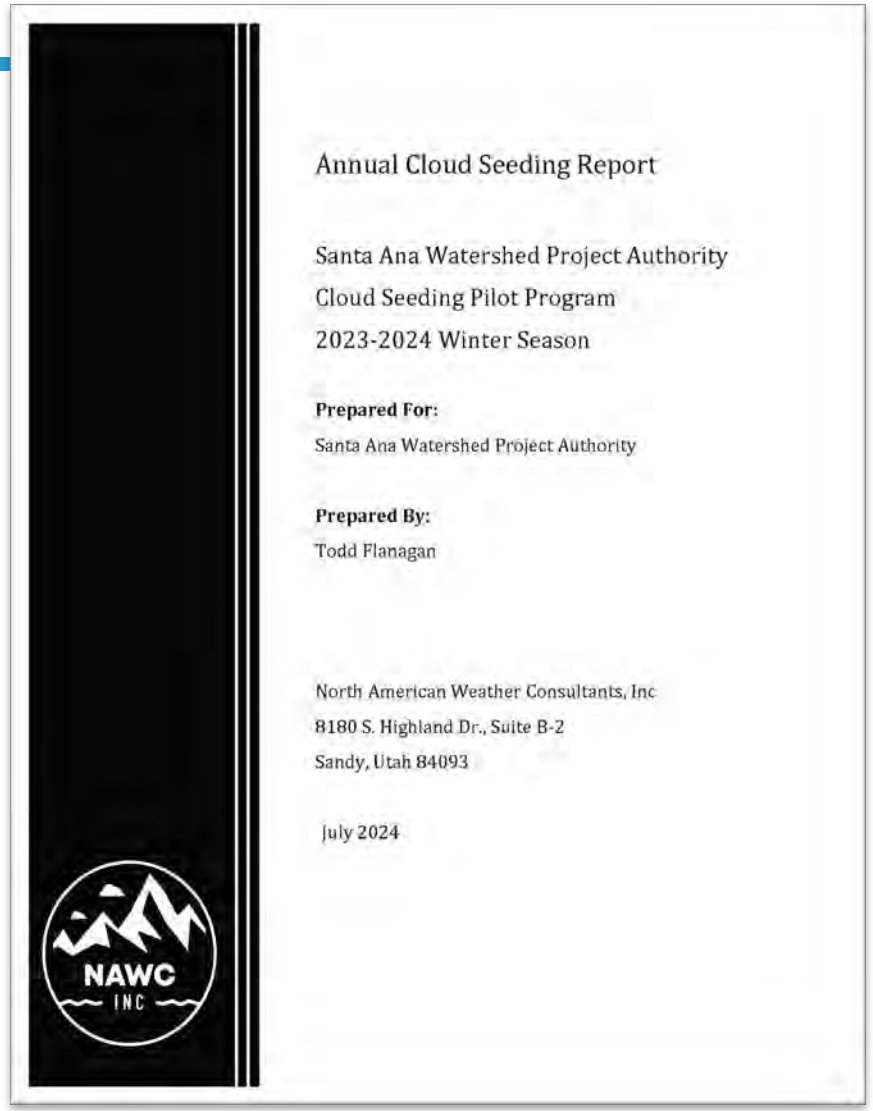
Rachel Gray
Water Resources and Planning Manager
August 6, 2024

Recommendation

- Staff recommendation is that the Commission receive and file the Santa Ana River Watershed Annual Cloud Seeding Report for the 2023-2024 Operational Season.

First Year Annual Cloud Seeding Report Outline

1. The Science Behind Cloud Seeding
2. Program Design and Implementation
   - Differences between the feasibility study and actual project design
3. 2023-2024 Season Operations
   - Seeded Storms: occurrence and justification
   - Unseeded Storms: occurrence and justification
   - Storms project design unable to capture
   - Operational issues encountered
4. Implementation of Suspension Criteria
5. Findings and Recommendations for Future Operational Seeding Years



Annual Cloud Seeding Report

Santa Ana Watershed Project Authority
Cloud Seeding Pilot Program
2023-2024 Winter Season

Prepared For:
Santa Ana Watershed Project Authority

Prepared By:
Todd Flanagan

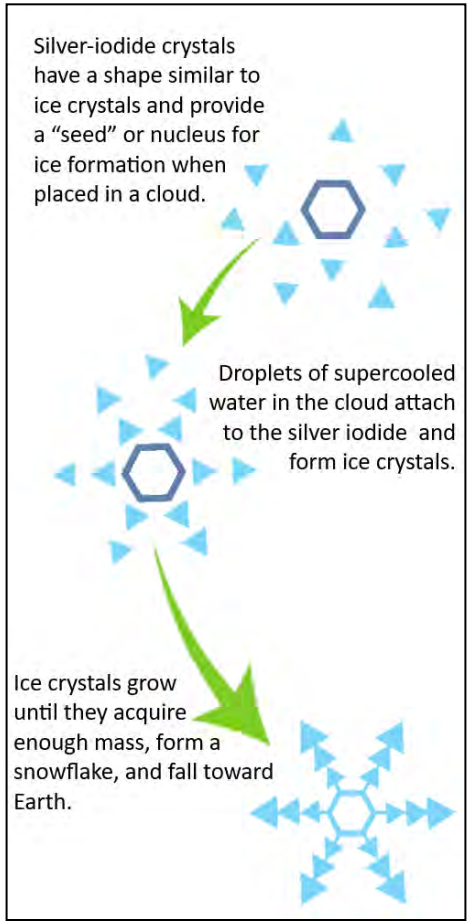
North American Weather Consultants, Inc
8180 S. Highland Dr., Suite B-2
Sandy, Utah 84093

July 2024

NAWC INC

The Science Behind Cloud Seeding

- The cloud-seeding process aids precipitation formation by enhancing ice crystal production in clouds. When the ice crystals grow sufficiently, they become snowflakes and fall to the ground.
- Silver iodide (AgI) has been selected for its environmental safety and efficiency in producing ice in clouds because of its structural similarity to natural ice crystals.
- Based on decades of experience, the use of silver iodide for the purpose of cloud seeding has been shown to be safe for people and the environment. The potential environmental impacts of silver iodide have been studied extensively and represents a negligible risk to the environment.



Benefits of Cloud Seeding

Increase of 5% to 15% in precipitation, increasing runoff/streamflow in the Santa Ana River, mitigating the negative effects of climate change.

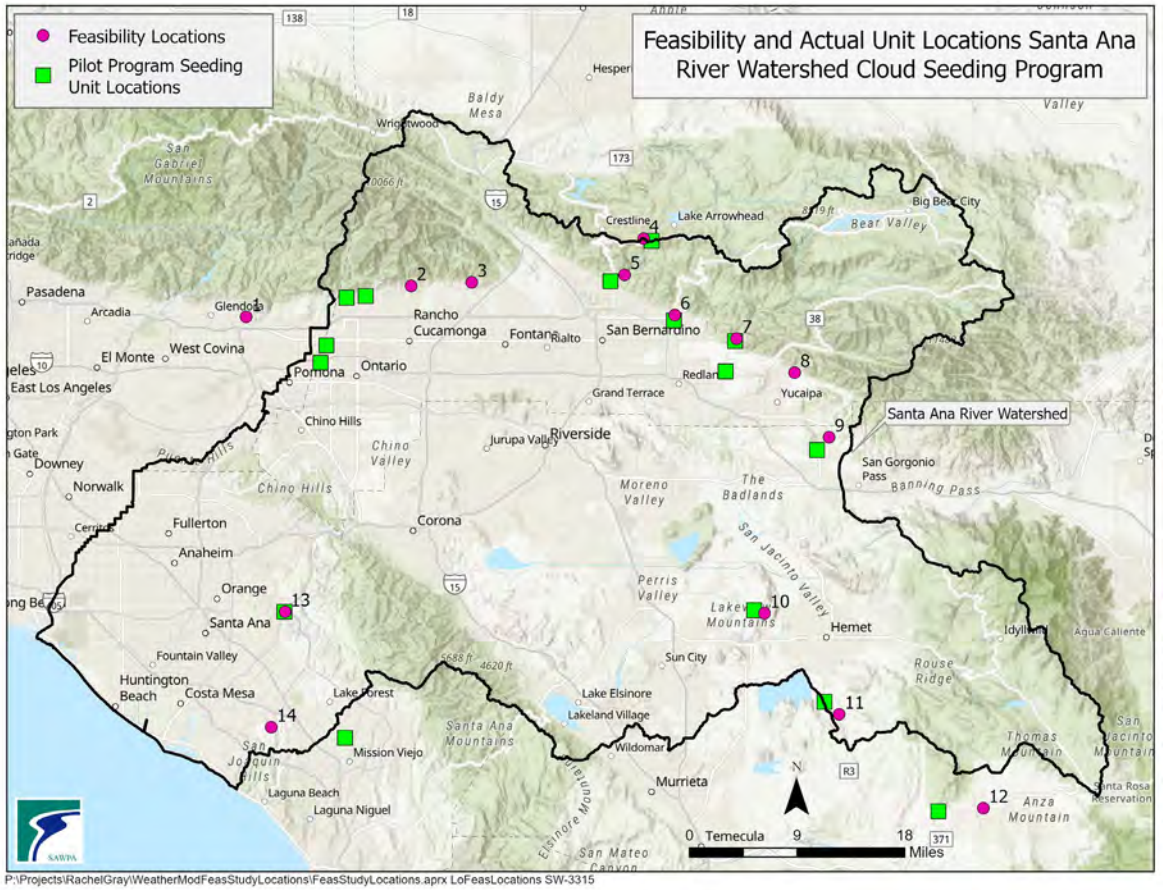
Increase in water supply for the region, enhancing groundwater recharge, and reducing reliability on imported water.

Increase in snowpack for snow season recreational activities.

Provide new source of water

Program Design: Update from Feasibility Study

- Sites were selected that were as close to locations from the feasibility study (SAWPA, 2020).
- Two changes that were made for the Pilot Program that were different than what was presented in the feasibility study (SAWPA, 2020) included:
  - The addition of one CNG unit for the Northwest (NW) Target Area
  - The switch of one of the CNG sites for the Southeast (SE) Target Area to an AHOGS unit, as it was determined that this area may benefit from convective lines pushing in from the coast.
- This increased the total number of seeding units from 14 to 15, with 12 CNG units and 3 AHOGS units.

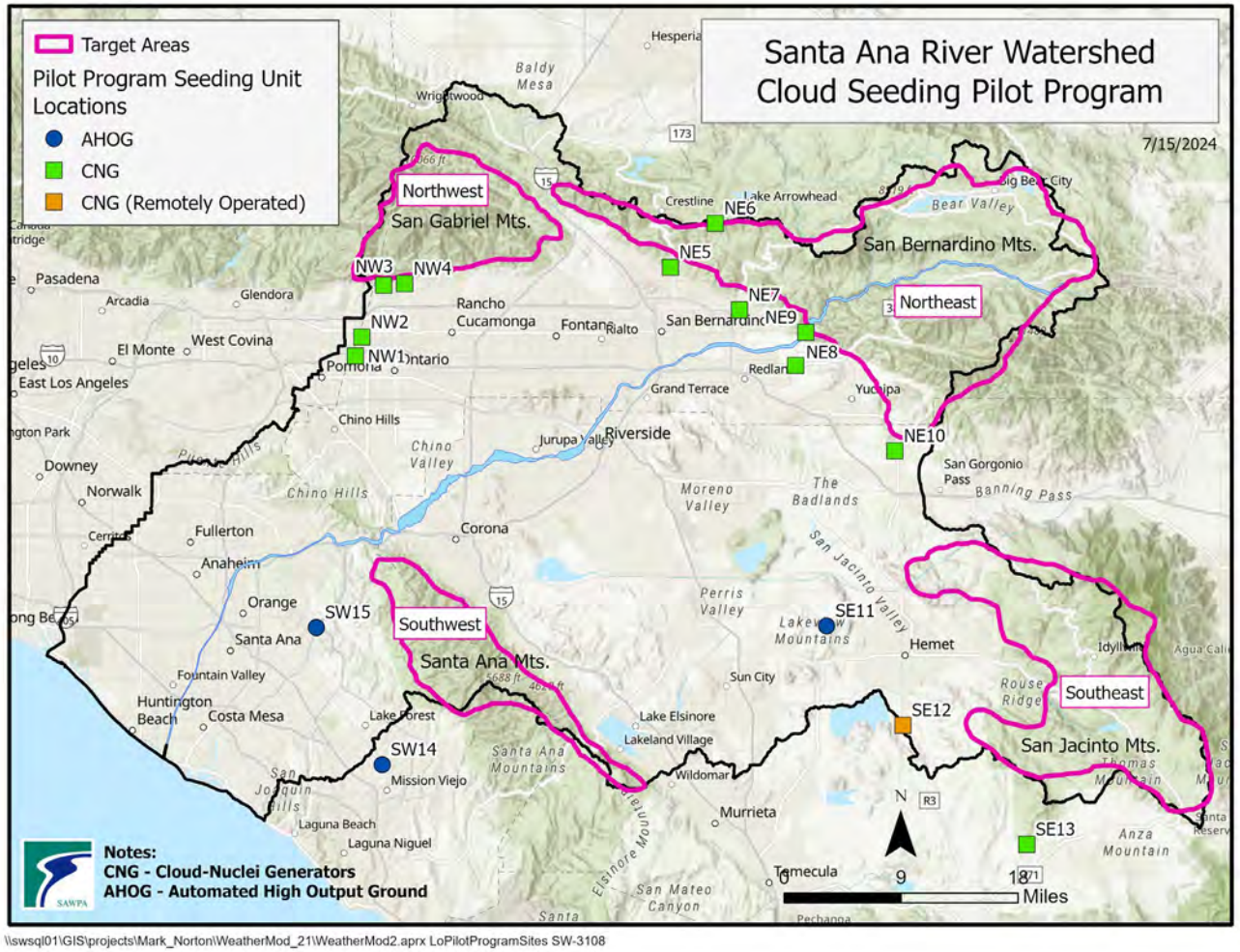


Program Implementation Tasks

These tasks occurred in preparation, during operations, and post-operations for Year 1

Task	Date
Site Access Agreements (11 proponents / 15 units)	August 2022 – August 2023
Operations Plan (project communication, operational criteria, and suspension criteria)	January – October 2023
Communications Plan	July – November 2023
Preliminary Biological Surveys	July 31, 2023
45-Day Public Notice Submission	September 28, 2023
Final Biological Surveys (10 days before construction)	October 5 – 9, 2023
Equipment Set Up, Propane Tank Delivery, and Equipment Testing	October 9 – 20, 2023
Operator Training	October 23 – 27, 2023
Program Kick Off Meeting	November 1, 2023
FY23-24 Program Start	November 15, 2023
Notification to Local Fire Departments	December 2023 – January 2024
FY23-24 Program End	April 15, 2024
Equipment Collected (summer storage)	May 30, 2024

Program Implementation

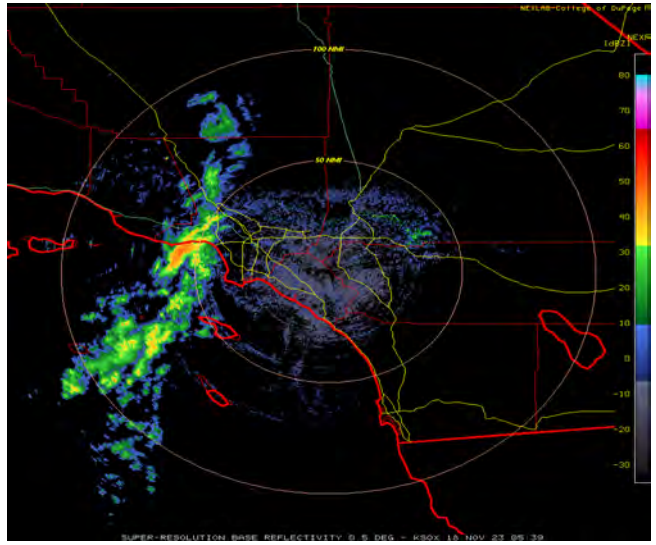


AHOGS unit located at site SW14

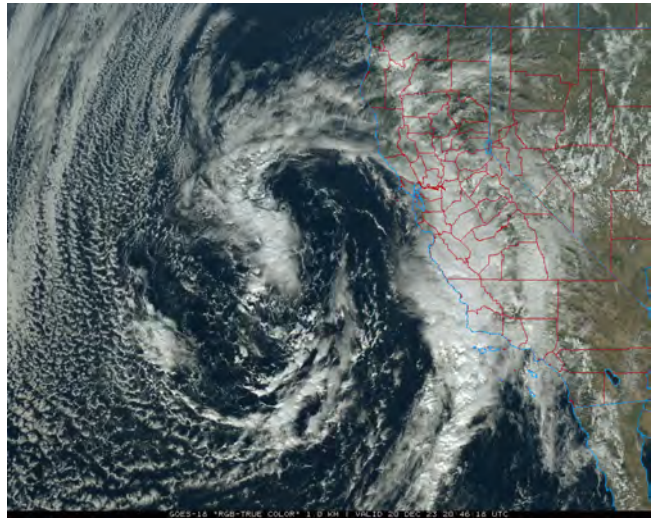
CNG unit with propane tank at site NE10

Weather Data and Models

- Radar data
- Satellite data (e.g., visible, infrared, water vapor)
- Weather forecast model data
- Surface observations
- Rawinsonde (weather balloon) upper-air soundings
- Weather cameras



Weather radar image from Santa Ana (KSOX) during a storm event on November 18, 2023, at 2139 PST (0539 UTC). The scale on the right shows reflectivity (power of returned echoes from reflecting off hydrometeors), which indicates precipitation intensity.



Visible spectrum satellite image on December 20, 2022, at 1246 PST (2046 UTC) showing an area of low pressure centered off the California coast with an area of enhanced cloudiness, the frontal boundary, pushing into southern California around Point Conception.

2023-2024 Operations Summary

- Program design worked well with the weather patterns observed during the season
- The 2023-2024 season was active, with **20 storm event periods**
- **13 seeded storm events** over a total of 22 days
- A total of 2135.25 hours of seeding time from CNG units was recorded, amounting to **17,092 g** of silver iodide (AgI) used
- A total of **32 AgI flares** were used from the AHOGS units, totaling **640 g of AgI**

Date	Number of Seeded Storms	Duration of Storms	Total Duration (days)
November 2023	1	Two consecutive days	2
December 2023	2	Two two-day storm events	4
January 2024	3	• One one-day storm event & • Two two-day storm events overlapping	4
February 2024	2	• One one-day storm event & • One two-day storm event	3
March 2024	3	Three two-day storm events	6
April 2024	2	• One one-day storm event & • One two-day storm event	3

2023-2024 Operations Summary

Units	Storm Periods	Nov 17-18	Dec 21-22	Dec 29-30	Jan 3	Jan 20-21	Jan 21-22	Feb 1	Feb 20-21	Mar 6-7	Mar 23-24	Mar 30-31	Apr 5	Apr 13-14
CNGs (Hours of Generator Runtime)	NW1			23	6.5		*	10	16.75	16	22	30	12.75	7*
	NW2			23	7		*	9	16.25	*	20.25	*	9.25	7*
	NW3	11.25	22	21	5.75	*	*	23.5	19.5	14	22.5	26.75	8.5	24.75
	NW4	13.25	20.75	22		*	*	23	19.75	14	22.5	27.75	8.5	25
	NE5		26.5	21.25	8.75	17.25	24.5	*	*	17	22.75	31.25	12.25	25.5
	NE6		21.5	9	12.25	17	14.25	11.75	18.25	14	18	31.25	14	20.25
	NE7		22.75	21	9	17	*	*	23	17.75	22.75	31.25	12.5	25.5
	NE8		22.25	18.75	9.75	18.5	23.25	7.75	*	15	20.5	*	13	25
	NE9		23	18.75	9.5	18.25	23.25	8	20.5	*	20.25	32.25	12.75	25.5
	NE10		24.25	21.25	9.25	17.75	24.75	23.5	24.25	18.75	22.5	31.25	12.25	25.25
	SE12		8.75	5.5	9.75	*	*	14		17	4.75*	33	9	
	SE13		19	6.5	8	15.25	24.5	12.25		12.75	18.25	32.75	12.75	
AHOGS (Flares)	SE11		5		2		4	1				1	1	
	SW14		1	3		1	3			1		2	2	
	SW15						*			2			1	2

*** Units were not operated or operated at a reduced level due to operational issues.**

2023-2024 Storm Summary (1/2)

Storm Period	Seeded/Not Seeded	Justification
November 15, 2023	Not Seeded	Airmass accompanying the storm system was warm
November 17-18, 2023	Seeded	Moisture was confined primarily to the western parts of the NW target area. Temperatures cooled but not enough for seeding efforts to be effective.
November 30, 2023	Not Seeded	Presence of low-level stable layer prevent seeding plumes from rising above it.
December 19-22, 2023	Seeded	Fair Seedability
December 29-20, 2023	Seeded	Good Seedability
January 3, 2024	Seeded	Good Seedability
January 7, 2024	Not Seeded	Poor Seedability: strong winds would produce long and narrow seeding plumes that were not likely to nucleate before passing the target areas
January 20-22, 2024	Seeded	Fair to Good Seedability

2023-2024 Storm Summary (2/2)

Storm Period	Seeded/Not Seeded	Justification
February 1, 2024	Seeded	Very Good Seedability
February 3-8, 2024	Not Seeded	Suspension Criteria Enacted: Poor to Good Seedability
February 19-21, 2024	Seeded	Good Seedability
February 26, 2024	Not Seeded	Poor Seedability: water temperatures and shallow moisture
March 2-3, 2024	Not Seeded	Poor Seedability: stable layer, warmer temperatures, strong winds
March 6-7, 2024	Seeded	Fair becoming Excellent Seedability
March 14-18, 2024	Not Seeded	Poor Seedability: north to northeast winds
March 23-24, 2024	Seeded	Good Seedability
March 30-31, 2024	Seeded	Good Seedability
April 5, 2024	Seeded	Excellent Seedability
April 13-14, 2024	Seeded	Poor to Fair, then Fair to Good Seedability

2023-2024 Suspension Criteria

- One suspension period was enacted due to a significant Atmospheric River event
- February 3 through February 8, 2024
- Over 15 inches of rainfall in some locations
- Over seven feet of snow in some locations
- Conditions resulted in abundant mountain snow and heavy lower elevation rainfall resulting in significant flooding in some areas.

Site	Name	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	Season Total
1	Upper Day Canyon	0.95	0.90	2.28	7.92	2.33	1.02	15.40
2	Deer Creek Dam	1.26	1.89	2.76	19.77	9.80	3.23	38.71
3	Cable Canyon	1.38	2.96	2.40	12.29	8.08	2.20	29.31
4	Oak Creek Canyon	1.41	1.70	2.24	13.07	6.14	2.44	27.00
5	Big Bear City Airport	0.66	0.53	1.38	7.44	1.78	2.14	13.93
6	Camp Angelus	0.99	1.57	2.91	12.32	4.65	1.50	23.94
7	Oak Glen Watershed	2.01	1.58	3.07	12.72	6.06	1.89	27.33
8	Idyllwild NWS	1.48	1.35	4.45	9.41	5.43	1.74	23.86
9	Hurkey Creek	0.98	0.54	2.65	5.49	3.16	1.14	13.96
10	Upper Silverado Canyon	0.24	1.94	1.02	4.96	7.25	1.34	16.75
11	Riverside Muni Airport	0.17	0.86	1.68	6.94	2.38	0.14	12.17
12	Hemet	0.87	0.80	1.94	4.33	1.69	0.67	10.30

2023-2024 Findings and Recommendations

A period of active weather in mid-March 2024 saw no seeding activity due to positioning of the storm system east of the area resulted in a prolonged period of north to northeast flow with precipitation, the project design did not account for these conditions and meteorological analysis during the feasibility study indicated this to be a rare occurrence.

Consider installing seeding sites on the east and northeast sides of the NE and SE target areas to account for this pattern, with the understanding that these sites may rarely be activated.

HYSPLIT modeling revealed that, at times, sites NW1 and NW2 produced seeding plumes that did not impact the nearby target areas

Consider moving one of the NW1 and NW2 sites further northwest closer to the NW Target area.

2023-2024 Findings and Recommendations

Mechanical Issues

Field technician local to the project area identified and trained to be able to service CNGs and AHOHS units.

Regularly troubleshoot cloud seeding units for optimal equipment operation.

Equipment Operators

Train backup site operators for continuous unit operations.

Logistical Issues

Maintain effective communication with sponsors to mitigate site access issues.

2023-2024 Findings and Recommendations

Obtain input on environmental conditions from Flood Control District and Watershed Agencies

Collaborate with Flood Control Districts for environmental insights.	Understand the impact of successive storms on infrastructure.

Communication

Be transparent with the public about technical studies conducted for cloud seeding.	Send notices to fire departments in advance of the start of Year 2 Operations.

Pilot Program Schedule

Pilot Program Schedule

• First Year Summary Report	July 2024
• Project Validation Tasks	August 2024
• Year 2 Equipment Mobilization	October 2024
• Year 2 Operations – Start	November 15, 2024

Questions

SANTA ANA WATERSHED PROJECT AUTHORITY

SAWPA

Enhancements to Watershed-Wide Water Budget Decision Support Tool Project Update

Commission Meeting
Item No. 6.B
Rick Whetsel
Senior Watershed Manager
August 6, 2024

Meeting Objectives

- Overview of Project
- Reclamation Landscape Modeling/Methodology
- DWR Accuracy Assessment
- Next Steps

Enhancements to Watershed-Wide Water Budget Decision Support Tool: **Grant Awards**

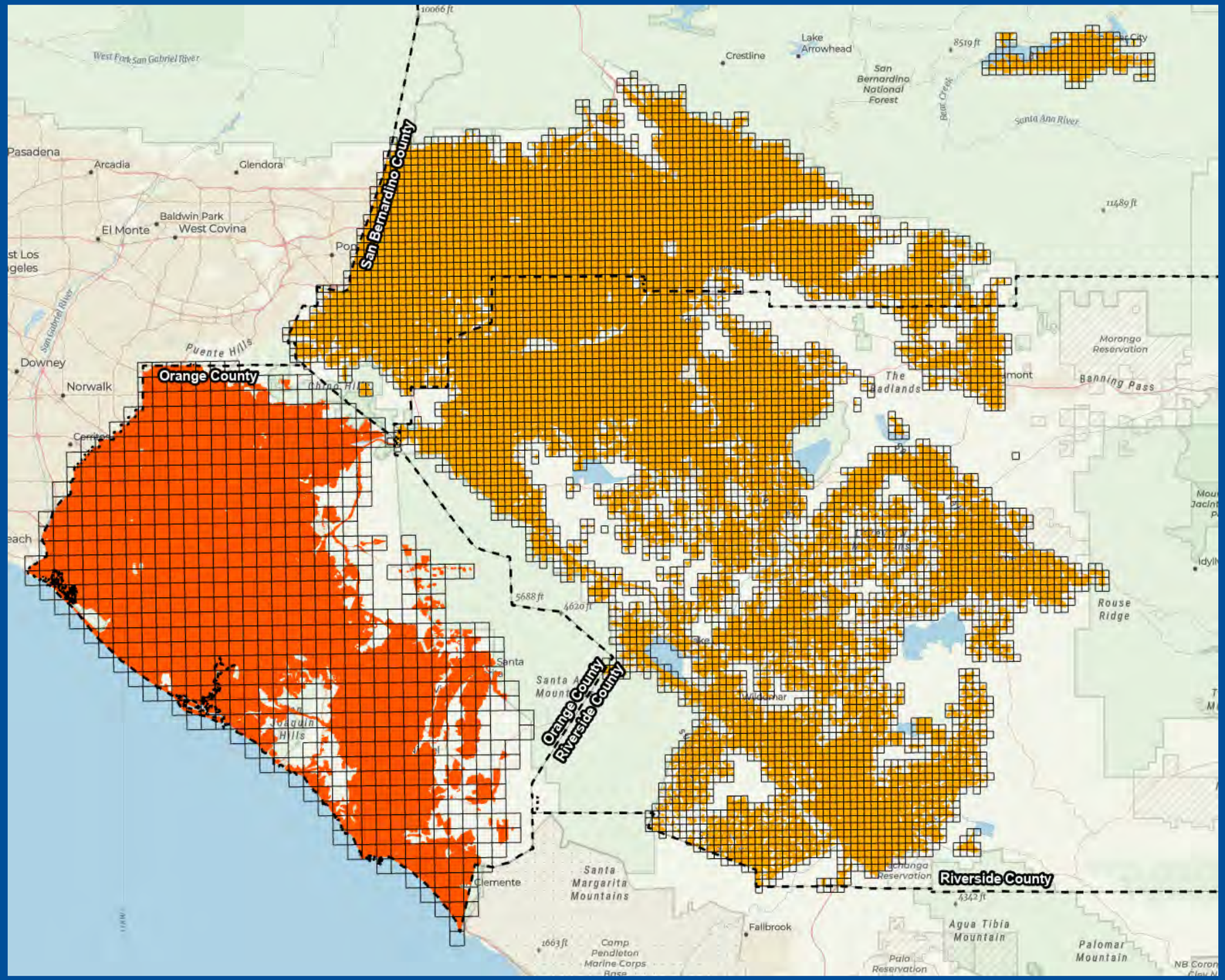
- SAWPA concurrently awarded grants from California Department of Water Resources (DWR) and U.S. Bureau of Reclamation (Reclamation), with each grant serving as match for the other.
- DWR Prop 1 Grant (agreement executed May 2021):
  - **Key Element - upgraded SAWPA/ESRI data viewer.**
  - SAWPA awarded $500,000 from DWR.
  - Completion date December 31, 2025.
- Reclamation WaterSMART Basin Study (agreement executed February 2021):
  - **Key Element – Reclamation proposed an “automated” method to classify land use.**
  - Reclamation grant with a 50% matching share requirement.
  - Amendment extending Term of the grant agreement to December 31, 2024.

Enhancements to Watershed-Wide Water Budget Decision Support Tool: **Project Objectives and Goals**

- **Goals:**
  - Produce a cost effective, consistent, and reproducible method to identify and measure outdoor landscape features.
  - Create parcel level outdoor landscape budget data that meets or exceeds quality and accuracy expectations of DWR.
  - Certify data as an Alternative Residential Landscape Area Data set to be used in place of the 2018 data provided by DWR.
- **Project Objectives:**
  - Acquire high resolution aerial imagery for the urbanized Santa Ana River Watershed, South Orange County, and a portion of the Upper Santa Margarita Watershed.
  - Identify and measure irrigated landscape and irrigable land to create parcel level water budgets for Retail Water Agencies.
  - Create online decision support tool for Retail Water Agencies to access water budgets and associated data.

Task 1 - Aerial Imagery (completed)

- Objective: SAWPA will acquire high resolution 3-inch RGBN (red, green, blue, near infrared) imagery for the entire urbanized Santa Ana River Watershed, South Orange County including portions of the Upper Santa Margarita Watershed.
- Acquisition of Imagery - Complete
  - Orange County Imagery (2020)
    - The Southern California Association of Governments 3 inch, 4-band (red, green, blue, and near infrared) imagery acquired through an agreement with the Municipal Water District of Orange County.
    - Imagery delivered to SAWPA August 2021
  - Upper Watershed (2021)
    - SAWPA acquired 3 inch, 4-band (red, green, blue, and near infrared) imagery for the upper Santa Ana River Watershed including portions of the Santa Margarita Watershed.
      - Upper watershed area flown between May – August 2021
      - Upper watershed orthophotos delivered to SAWPA in March 2022



Project Study Area

Orange County (948 mi²)

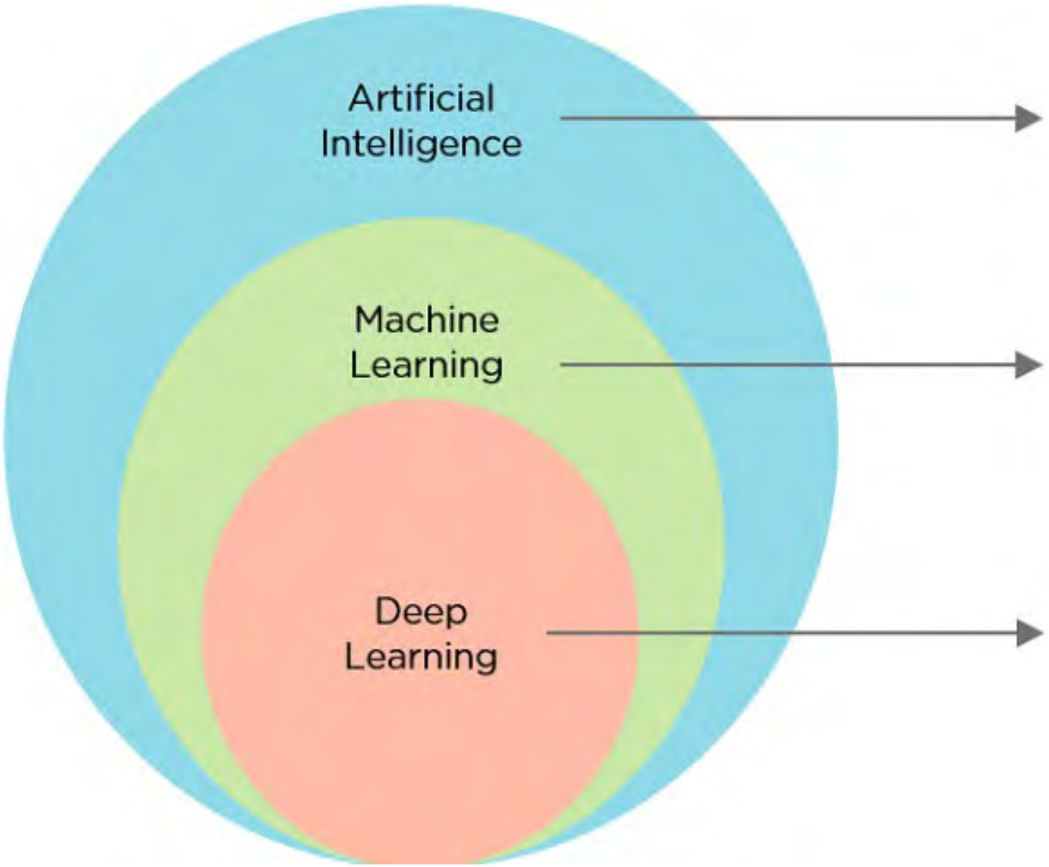
Upper Santa Ana River Watershed (2,032 mi²)

Task 2 – Imagery Analysis (ongoing)

- Objective: U.S. Bureau of Reclamation will analyze imagery to identify and measure irrigated landscape and irrigable land with sufficient detail to provide customer parcel-level outdoor water budgets to water retail agencies to support the achievement of water efficiency requirements prescribed by the state.

  - Conduct analysis of over 2,500 mi^2 of urbanized outdoor landscape:
    - Orange County (948 mi^2)
    - Upper Santa Ana River Watershed (2,032 mi^2)
  - Identify and label landscape features:
    - Irrigated
    - Irrigable but not irrigated
    - Non-irrigable
  - Modeling Process:
    - Reproducible
    - Efficient
  - Assess accuracy of model in identifying key landscape features.
    - Support achievement of water efficiency regulations prescribed by the state.

Deep Learning



The ability of a digital machine to imitate intelligent human behavior

The application of AI that allows a system to automatically learn and improve from experience.

The utilization of Machine Learning involves leveraging sophisticated algorithms and deep neural networks to effectively train a model.

Deep Learning

Deep learning is a type of machine learning that involves teaching a computer to recognize patterns, like rooftops in images, by showing it examples. The computer model learns from these training samples and scans the image to identify similar features.

- ESRI, Rami Alouta, Kate Hess

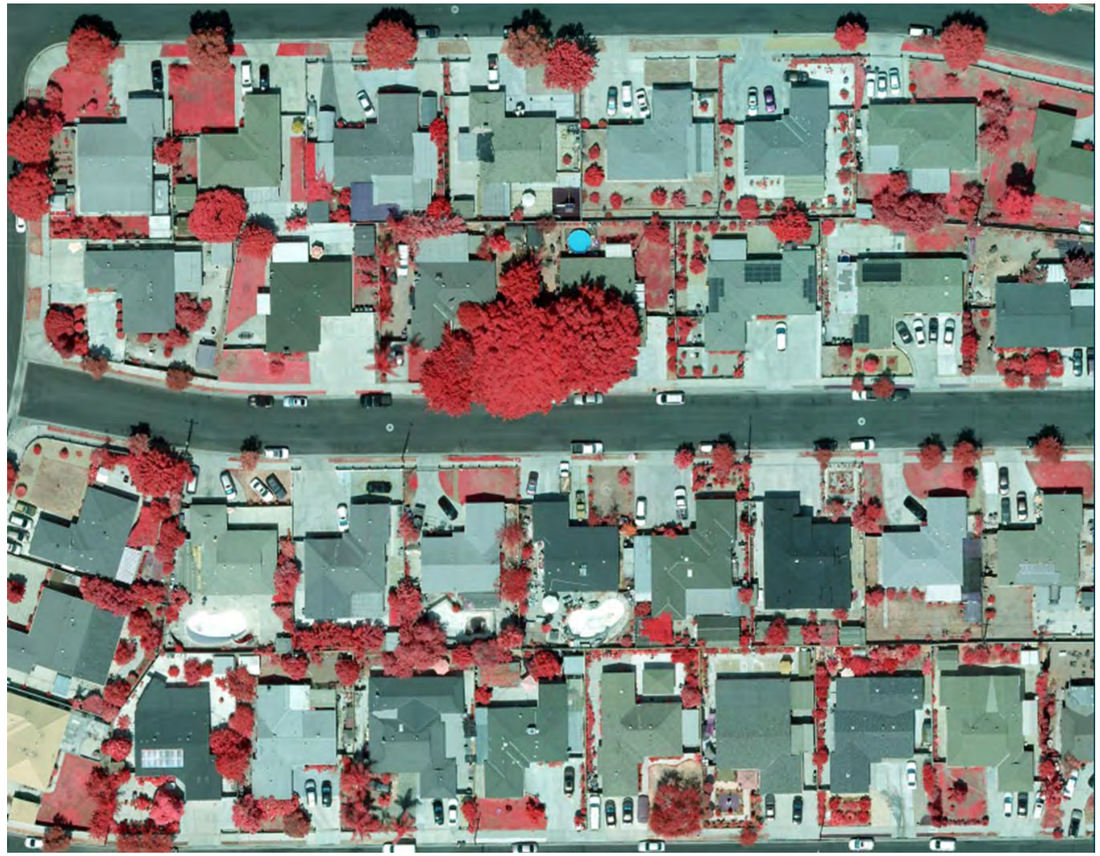
Deep Learning Benefits

- Excels in high-dimensional data (i.e., images, audio, text)
- Scalability
- Versatility
- Adaptability

Raster Data

Imagery

- 3 inches per pixel
- 4-band color-infrared



Land Cover Classes

Child Classes | Parent Classes

Land Cover Class	Class Category
Lawn and Turf	Irrigated
Shrubs and Trees	Irrigated
Swimming pools and constructed water features	Irrigated
Lawn and Turf INI	Irrigable, not irrigated
Bare Earth INI	Irrigable, not irrigated
Bare Earth NI	Not irrigable
Undeveloped Land	Not irrigable
Open Water	Not irrigable
Buildings, shelters, detatched structures and utilities	Not irrigable
Roads and driveways	Not irrigable

Training Data For Deep Learning Model

Features
(raw aerial imagery)

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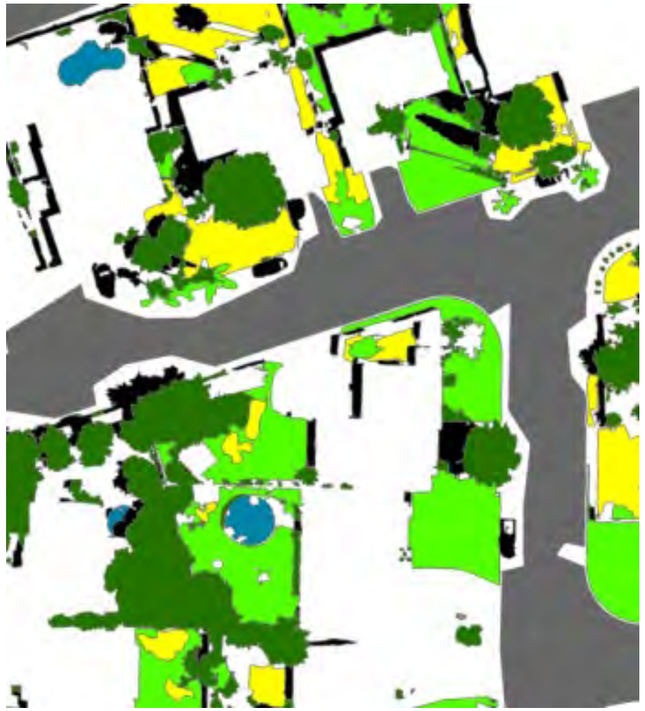

Labels
(polygons with child class label)

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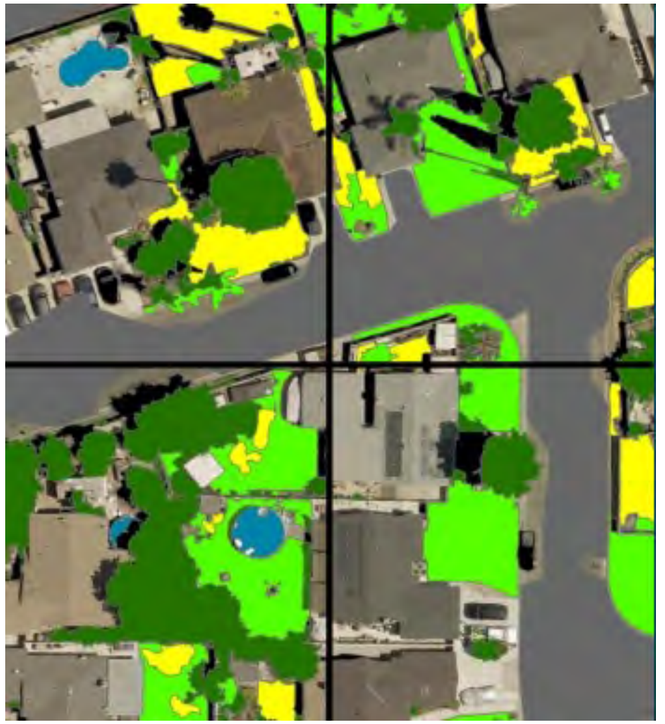
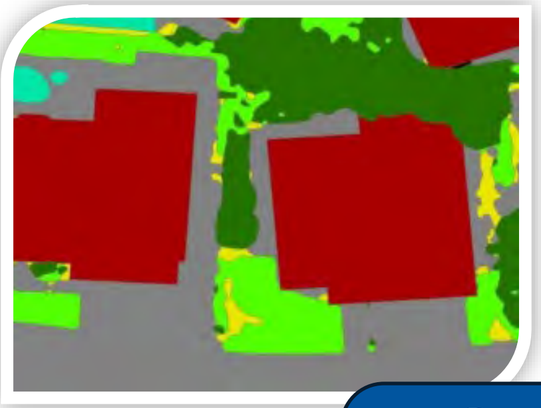


Image chips fed to DL model

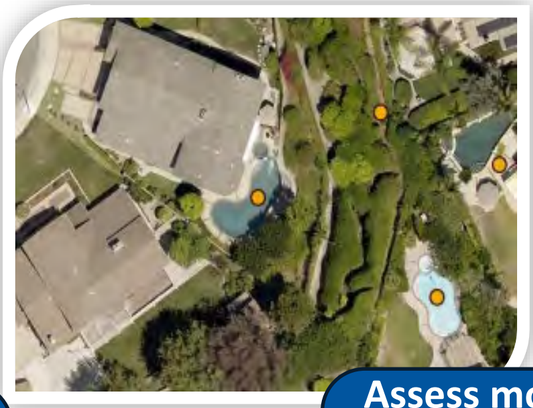
Model Development

Create and export training data
(labeled polygons overtop imagery)

Train deep learning model



Post Processing
(Update buildings, shrubs, and tree layers)



Assess model accuracy based on ground truth sample locations

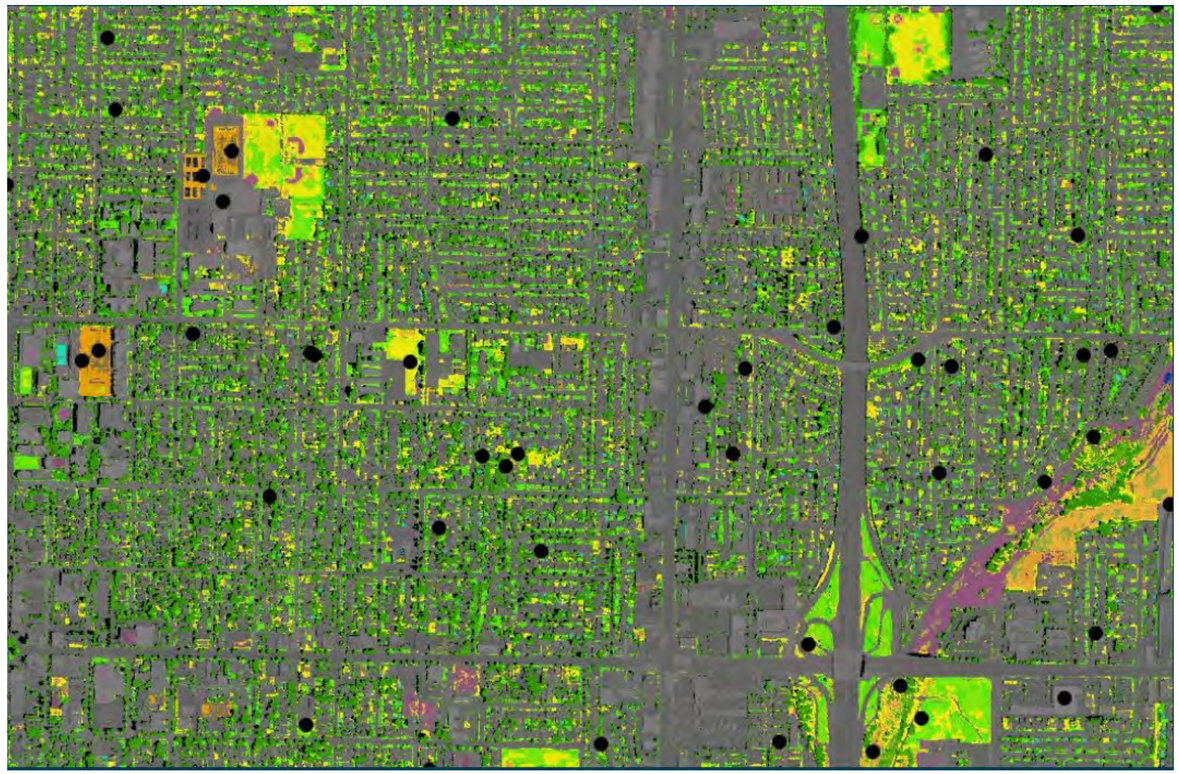
Repeat until accuracy is desirable

Accuracy Assessment (Reclamation)

SAWPA's goals of this project include applying the results of the work by Reclamation to create parcel level outdoor landscape budget data that meets or exceeds quality and accuracy expectations of DWR, so that these data can be used as an Alternative Residential Landscape Area Data set in place of the 2018 data provided by DWR.

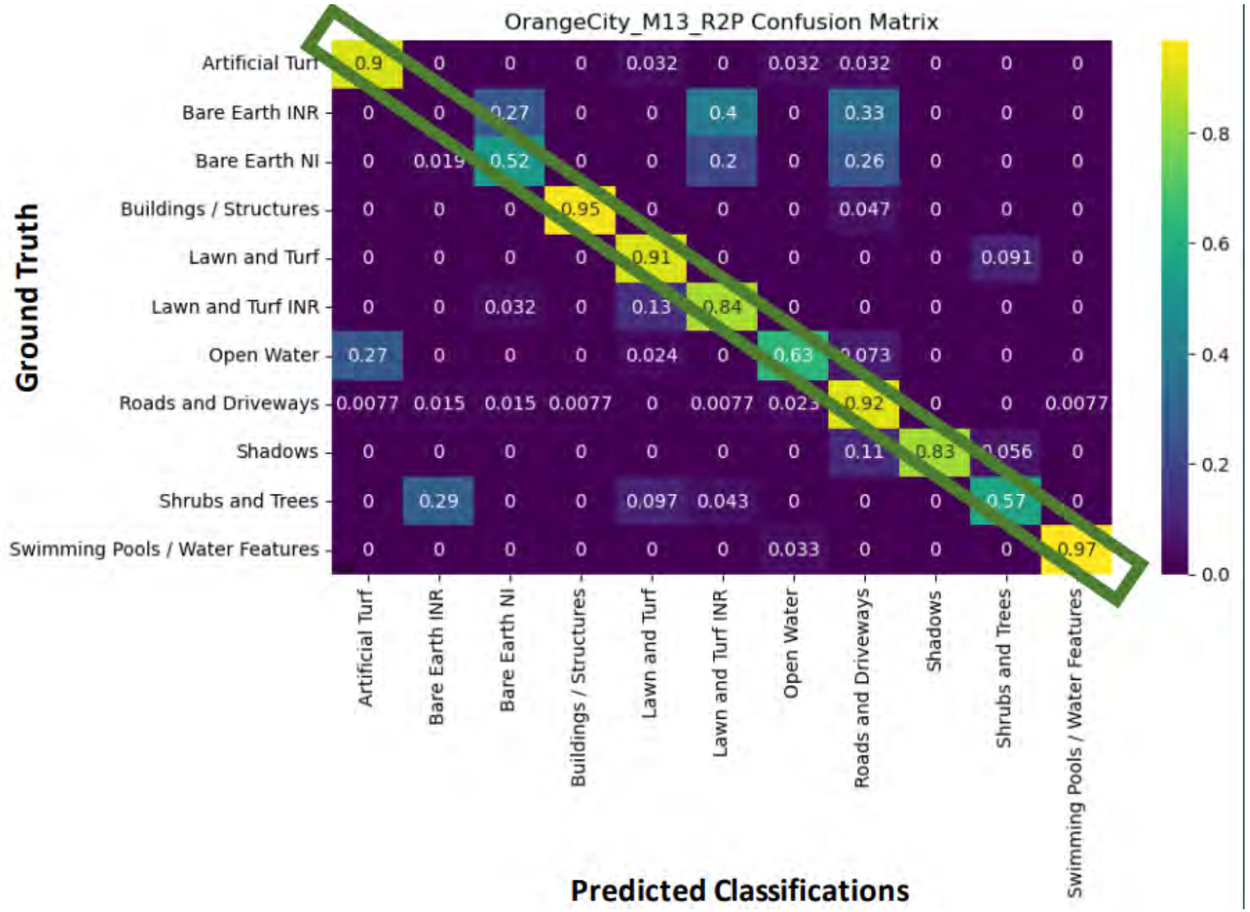
Model Performance Evaluation

- **Assessment Points** used for **confusion matrix**
- **Assessment Polygons** used for **Jaccard Index**
- 10 points/polygons per child class
- Randomly placed across district
- Visual inspection against raw imagery and verified class assignment
- Pull model output value at exact point/polygon location
- Compare verified classifications against model predicted classifications



Confusion Matrix Explanation

- Y-axis represents Ground Truth
- X-Axis represents Predicted Class
- Values are normalized between 0 and 1 across X-axis
- Diagonal entries indicate accurately predicted classes
- Non-diagonal boxes in each row highlight incorrect predictions



Jaccard Index Explanation

- Jaccard Similarity Index:
  A measure of similarity between two sets of data
  - Verified Polygons
  - Model Output
- Percent of area classified correctly against total area in polygons
- 10 polygons per child class per water retailer district

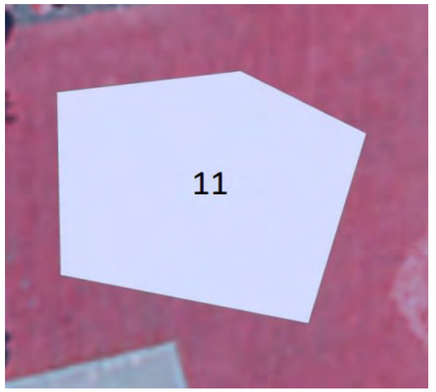
$$J(A,B) = \frac{|A \cap B|}{|A \cup B|}$$

J = Jaccard distance

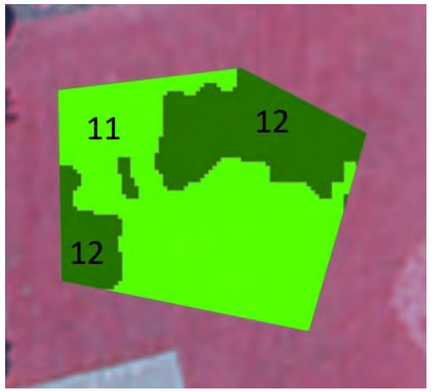
A = set 1

B = set 2

Verified Polygon



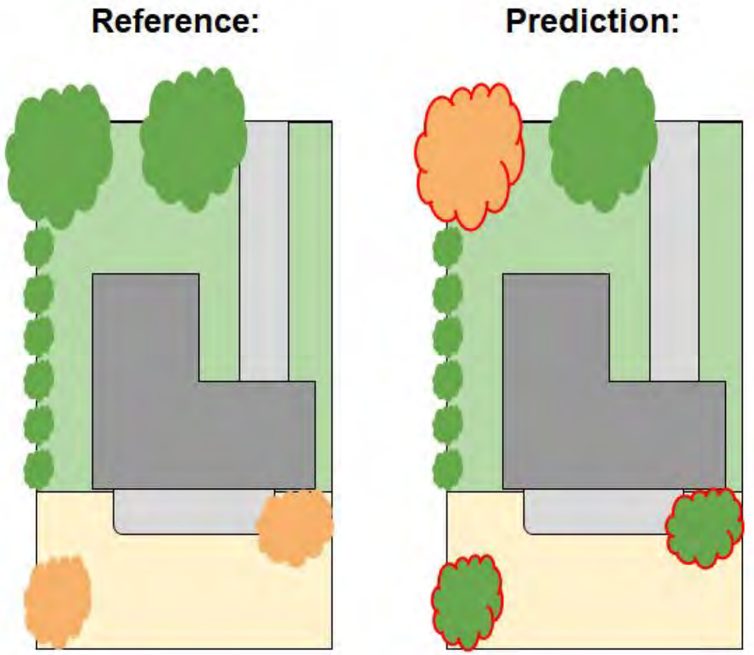
Model Output



	Class Value	Total Area (SQFT)	Correct Area (SQFT)	Percent Correct
Buildings / Structures	39	45168	45168	100
Swimming Pools / Water Features	17	5471	5470	99
Roads and Driveways	391	21857	21846	99
Artificial Turf	38	4955	4891	98
Lawn and Turf	11	1863	1780	95
Lawn and Turf INR	21	3118	2840	91
Shrubs and Trees	12	12459	10804	86
Bare Earth NI	33	9471	8166	86
Shadows	99	2663	2092	78
Bare Earth INR	24	624	0	0

Accuracy Assessment (DWR – NV5)

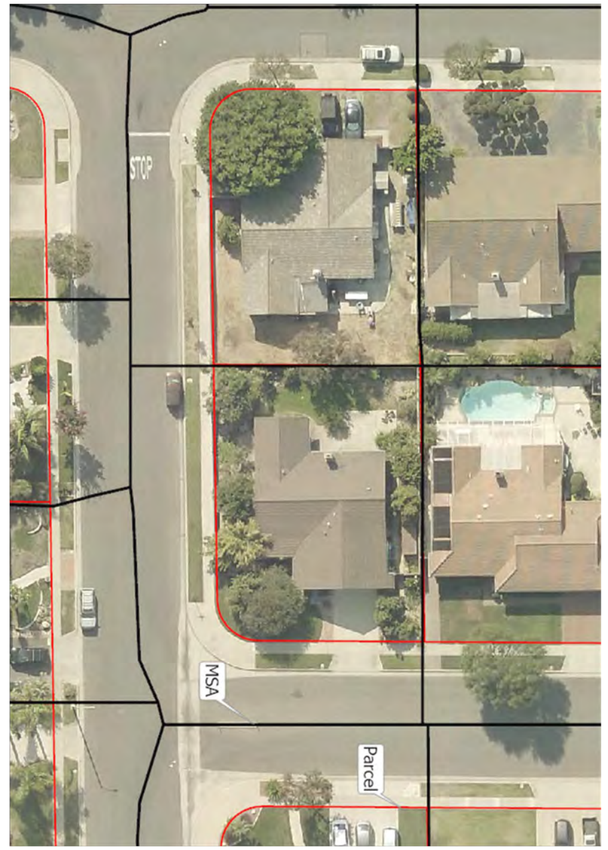
- NV5 conducted their accuracy assessment at multiple resolutions to achieve their final accuracy scores of greater than or equal to 95% accuracy (as prescribed by the State).
- Accuracy Assessment at Multiple Resolutions conducted by NV5
  - Point or Mapped Level Accuracy - Object to object comparison of results with no error cancellation.
  - Parcel Level Accuracy - Allows errors in the mapped classification to cancel at a parcel resolution. If the error is balanced, it cancels.
  - District Level Accuracy - Allows between-parcel errors to cancel such that the overall accuracy is reflective of the error and bias one would expect to find when summarizing to the district level of resolution. If the error is balanced, it cancels.



Comparison Residential Areas

- SAWPA staff compared the residential areas modeled by DWR to was used by SAWPA

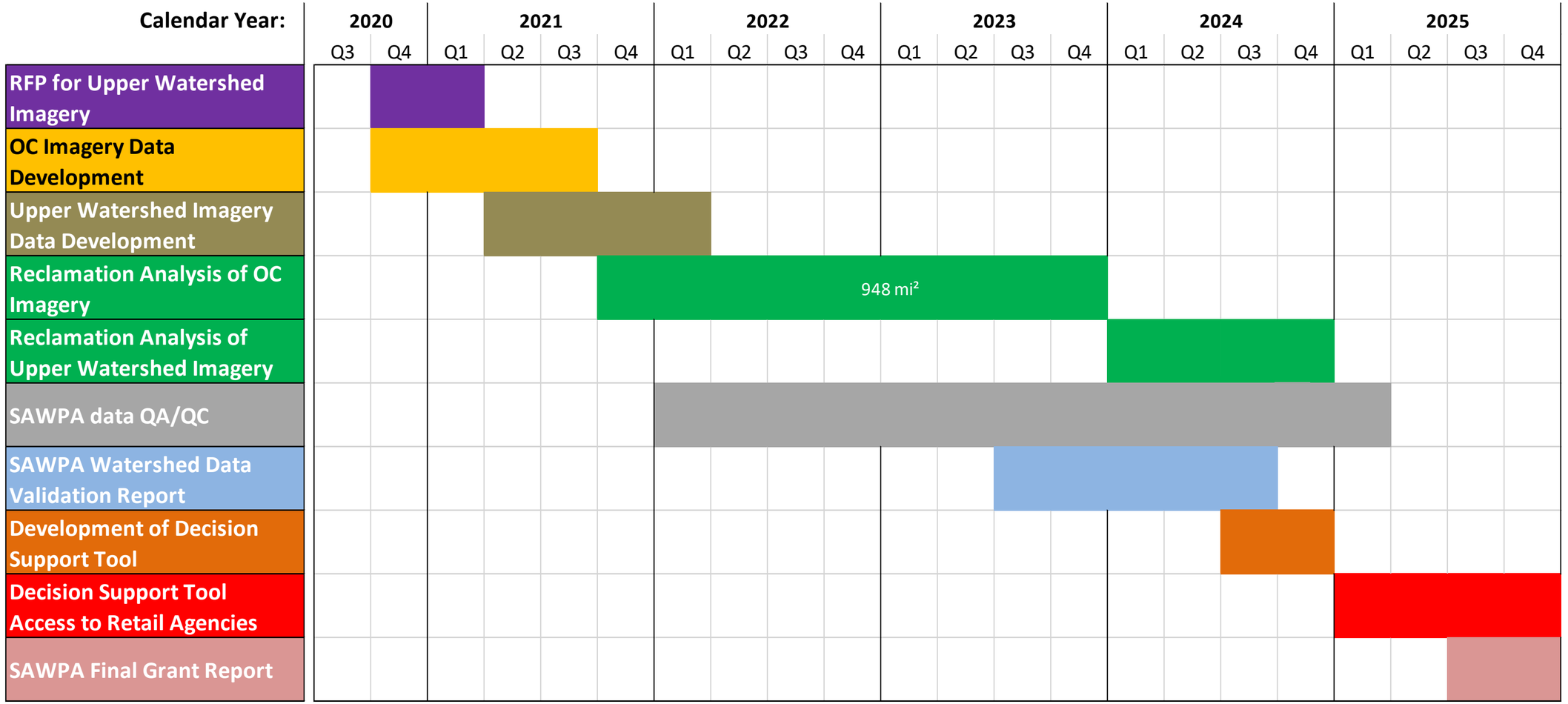
Orange County Retail Water Agency Accuracy Assessment	Quantum Spatial (NV5)	Quantum Spatial (NV5)	Reclamation	SAWPA	Quantum Spatial (NV5)	Quantum Spatial (NV5)	Quantum Spatial (NV5)	Quantum Spatial (NV5)	Reclamation	Reclamation	SAWPA	SAWPA	SAWPA
	Parent Class	Parent Class	Parent Class	Parent Class	Parent Class	Parent Class	Parent Class	Parent Class	Parent Class	Child Class	Child Class		
	Area-weighted overall accuracy (%)	Unweighted overall accuracy (%)	Unweighted overall accuracy (%)	Unweighted overall accuracy (%)	Area-weighted accuracy (%)	Unweighted overall accuracy (%)	Area-weighted accuracy (%)	Unweighted overall accuracy (%)	Unweighted overall accuracy (%)	Accuracy Detail Class overall accuracy (%)	Accuracy Detail Class overall accuracy (%)	Parcel Extension Increase Pct	Pct Residential > DWR
	Point	Point	Point	Point	Parcel	Parcel	District	District	District	Point	Point	%	%
Anaheim City of	87.31	88.03	90.00	94.50	89.15	89.83	95.62	96.39	97.47	79.90	84.50	20.54	24.80
Brea City of	89.09	89.27	91.82	94.00	90.57	90.73	96.02	95.83	95.52	70.91	82.00	18.06	30.21
Buena Park City of	88.36	88.28	89.09	96.00	90.16	90.10	96.94	96.95	96.61	79.09	84.00	29.11	34.52
El Toro Water District	92.20	93.08	92.73	94.50	93.80	94.67	98.45	98.38	98.15	74.55	82.00	14.90	23.22
Fountain Valley City of	89.98	89.74	92.73	95.00	91.66	91.49	95.24	95.27	98.47	78.18	85.00	28.86	38.16
Fullerton City of	88.70	87.95	91.82	92.00	91.29	90.78	96.03	95.99	97.25	78.18	79.00	20.02	29.53
Garden Grove City of	88.52	88.32	98.18	96.00	89.97	89.80	95.18	95.16	99.77	87.27	89.00	30.77	27.47
Huntington Beach City of	94.31	94.54	90.91	94.00	94.90	95.08	95.78	95.82	97.98	85.45	87.50	19.58	28.07
Irvine Ranch Water District **	86.02	79.68	90.91	95.00	90.92	86.63	99.57	99.41	98.84	73.64	77.00	18.06	44.94
La Habra City of	87.68	86.86	88.18	95.50	91.14	90.44	96.36	95.88	90.72	66.36	82.50	21.76	20.91
La Palma City of	92.80	93.32	89.00	95.00	93.41	93.94	96.57	97.02	92.41	70.00	87.00	27.21	34.24
Mesa Water District	90.10	89.92	89.09	96.00	91.89	91.74	95.82	95.74	95.74	75.45	84.00	20.95	20.64
Newport Beach City of	96.19	96.08	91.82	97.50	96.78	96.69	98.15	98.13	97.19	80.00	87.00	26.49	35.99
Orange City of	87.25	86.48	90.91	90.00	88.77	88.11	95.07	95.16	97.40	82.73	75.00	15.00	36.03
Santa Ana City of	84.91	83.38	96.36	95.00	88.37	87.14	95.84	95.25	98.17	82.73	85.00	25.78	16.56
Seal Beach City of	94.86	95.10	94.55	96.00	95.49	95.74	96.93	96.88	99.78	75.45	82.00	6.83	22.06
Tustin City of	85.48	85.76	97.00	94.50	89.10	89.31	98.25	98.22	98.33	66.36	88.00	23.80	20.57
Westminister City of	90.27	89.78	94.00	97.00	90.91	90.49	96.13	96.34	98.39	84.00	87.50	27.28	23.85
Yorba Linda Water District	84.91	84.45	92.73	89.50	87.32	86.94	97.02	96.97	97.06	70.91	72.00	3.56	24.07
Santa Margarita Water District **	92.27	90.90	90.91	93.50	94.73	93.86	98.22	97.92	98.11	79.09	83.00	1.45	54.75
Average	89.56	89.05	92.14	94.53	91.52	91.18	96.66	96.64	97.17	77.01	83.15	20.00	29.53



Task 3 – Decision Support Tool

- Objective: SAWPA will develop a web-based tool to display key GIS data layers (outdoor landscape features, retail water agency boundaries, and watershed imagery), and show model results, and water budget calculations. Access to individual agency data will be controlled by the grantee and available to water agency staff upon request.
- Decision Support Tool
  - Staff envisions this “tool” to reside on a dedicated SAWPA webpage, where Agency staff can go to view (sample data) and request their retail agency level data, including the following:
    - Imagery
    - Modeled outdoor landscape (GIS layer)
    - Landscape budgets (spreadsheet)
    - GIS Tools
    - Landscape Area Measurements Reports
- Work to begin August 2024

Project Schedule



Next Steps

- Reclamation to complete outdoor landscape modeling for retail water agency services areas in the upper Santa Ana River Watershed by December 31, 2024.

- SAWPA staff is working in coordination with MWDOC to prepare and submit a watershed level data validation report to DWR for consideration of the Alternative Landscape Data set.

- SAWPA staff to initiate efforts to design the web-based tool following approval of the data validation report by DWR.

Questions?

Thank You

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