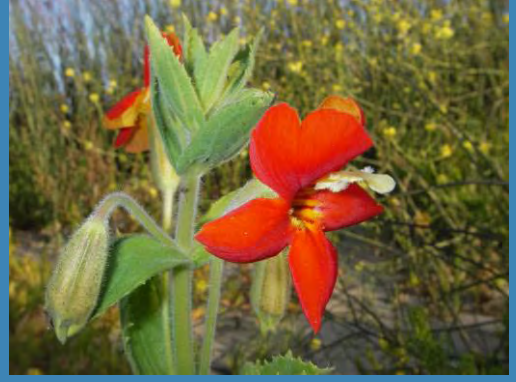


A case study from the lower Santa Clara River, CA:

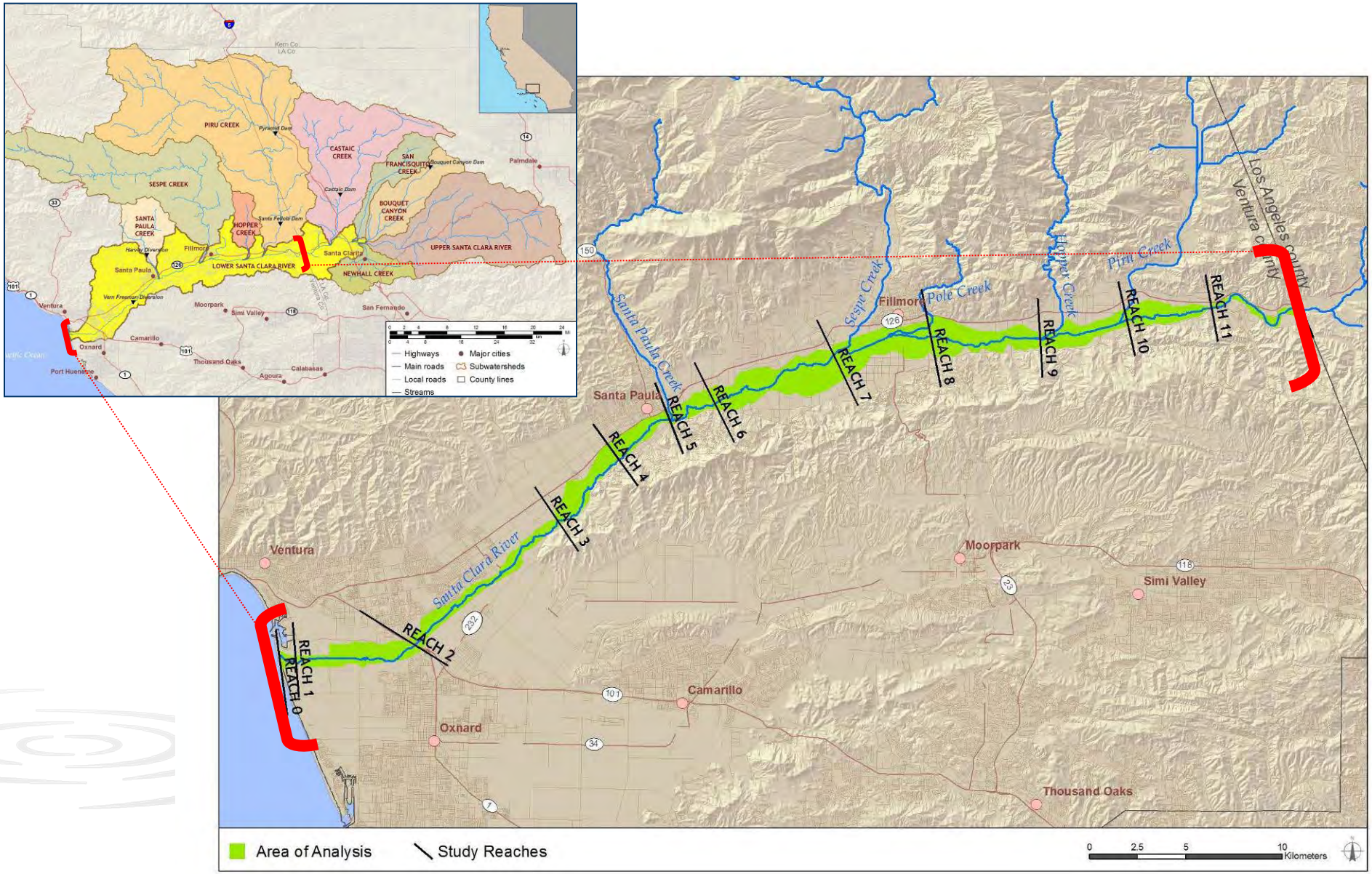
Strategic planning for control of *Arundo donax* and restoration of riparian vegetation in semi-arid landscapes

Bruce Orr and Zooey Diggory
STILLWATER SCIENCES

Tom Dudley
UC SANTA BARBARA

Stillwater Sciences

SANTA CLARA RIVER WATERSHED & ANALYSIS AREA



WATERSHED IMPACTS

- Agriculture
- Water supply development
- Levees and urban development

WATERSHED IMPACTS

- Invasion by giant reed (*Arundo donax*)

COMPONENTS OF THE SCR PARKWAY RESTORATION PLANNING EFFORT

1. Historical flood mapping and fluvial geomorphic analysis
2. Riparian vegetation mapping and classification
3. *Arundo donax* percent cover mapping (also *Tamarix*)
4. Riparian vegetation dynamics analysis
5. Synthesis to inform restoration strategies and management decisions
6. Develop strategic plan for arundo control and riparian restoration (*just beginning*)

FLOOD DYNAMICS:

- Vegetation infilling (encroachment) during ‘normal’ or drier periods

pre-high flow

FLOOD DYNAMICS: El Niño Rules!

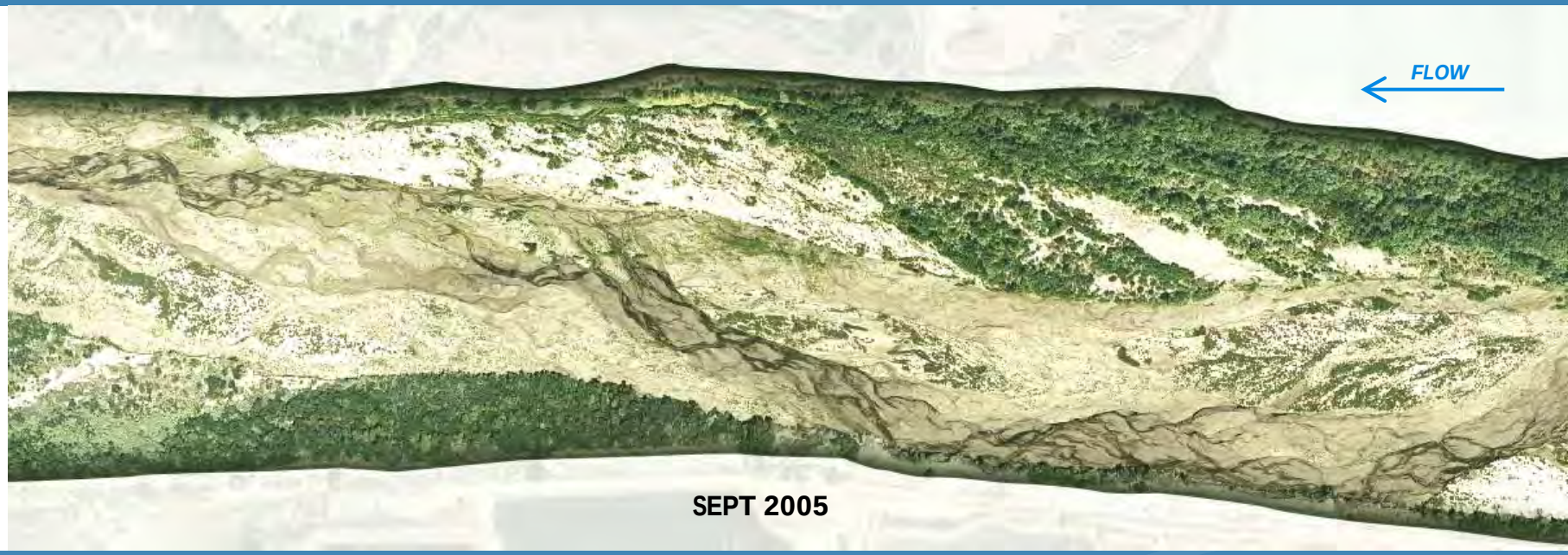
- Vegetation reset after large floods in El Niño years

high flow

FLOOD DYNAMICS: Post-flood Response

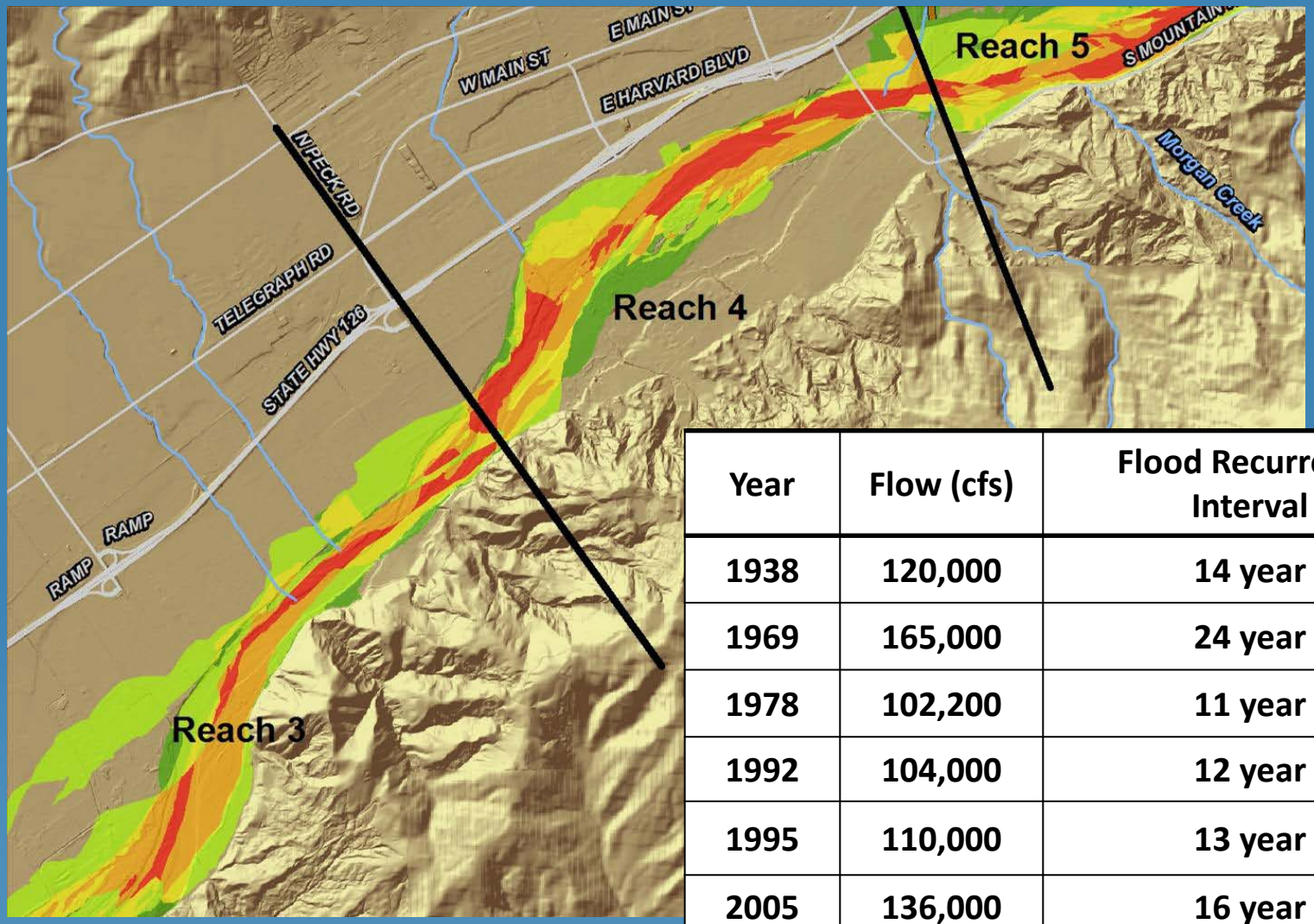
- Rapid vegetation response after large resetting floods

post-high flow



FLOOD MAPPING

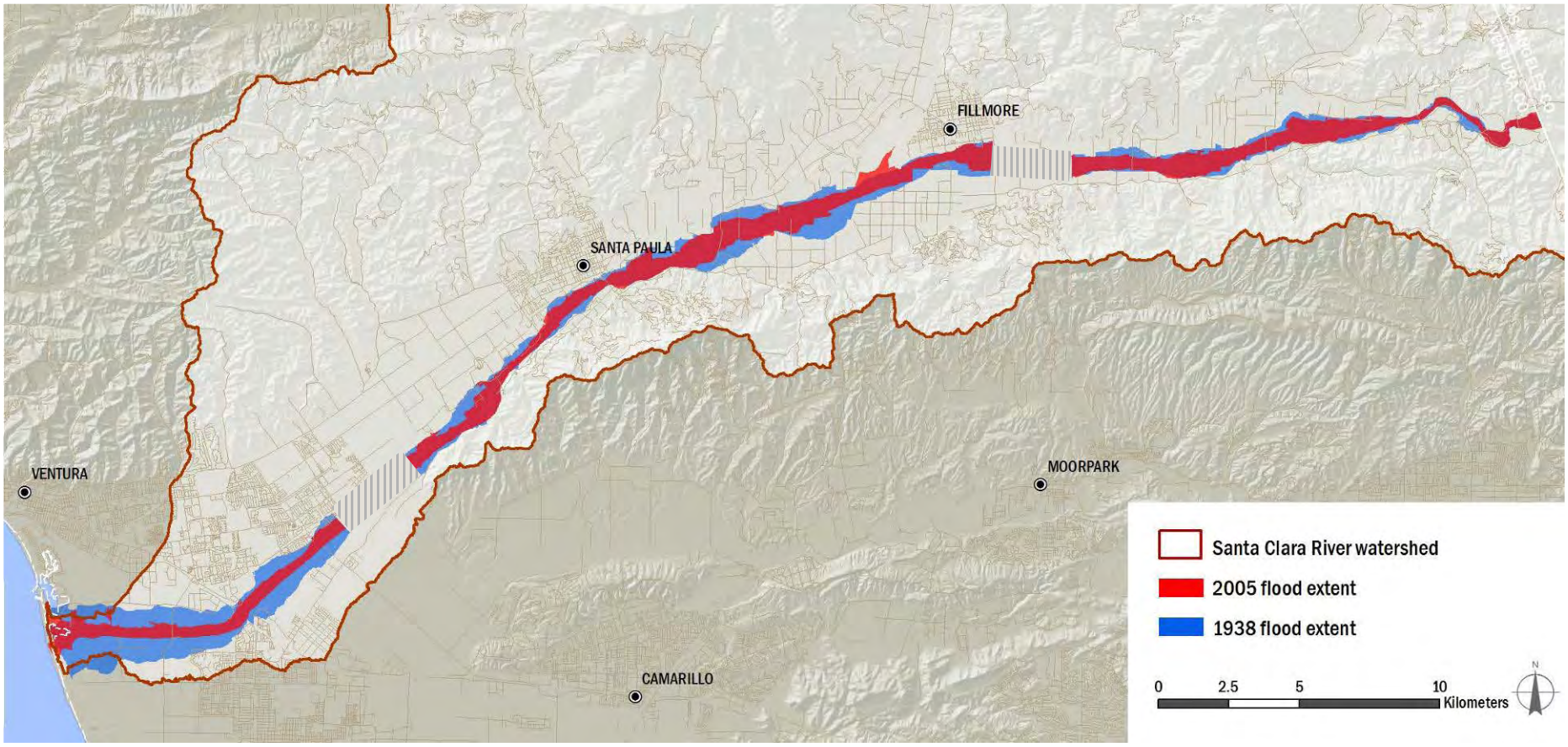
- Highly dynamic mainstem



Year	Flow (cfs)	Flood Recurrence Interval
1938	120,000	14 year
1969	165,000	24 year
1978	102,200	11 year
1992	104,000	12 year
1995	110,000	13 year
2005	136,000	16 year

FLOOD MAPPING

- 40% reduction in historical floodplain extent

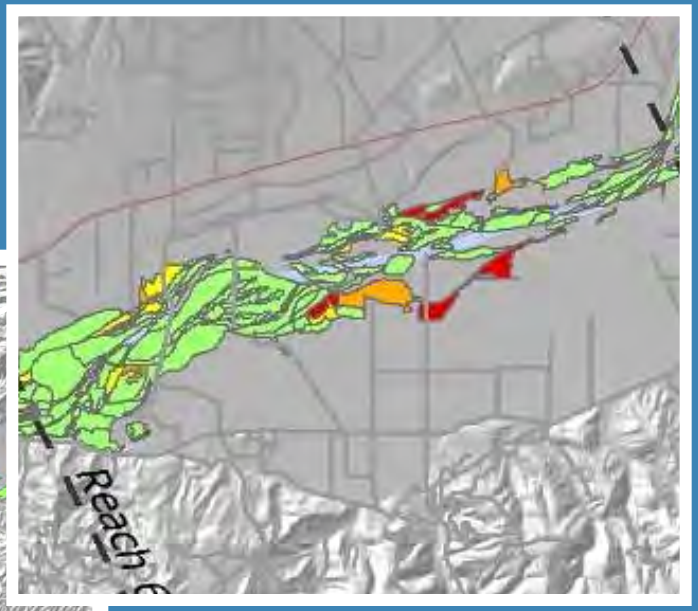


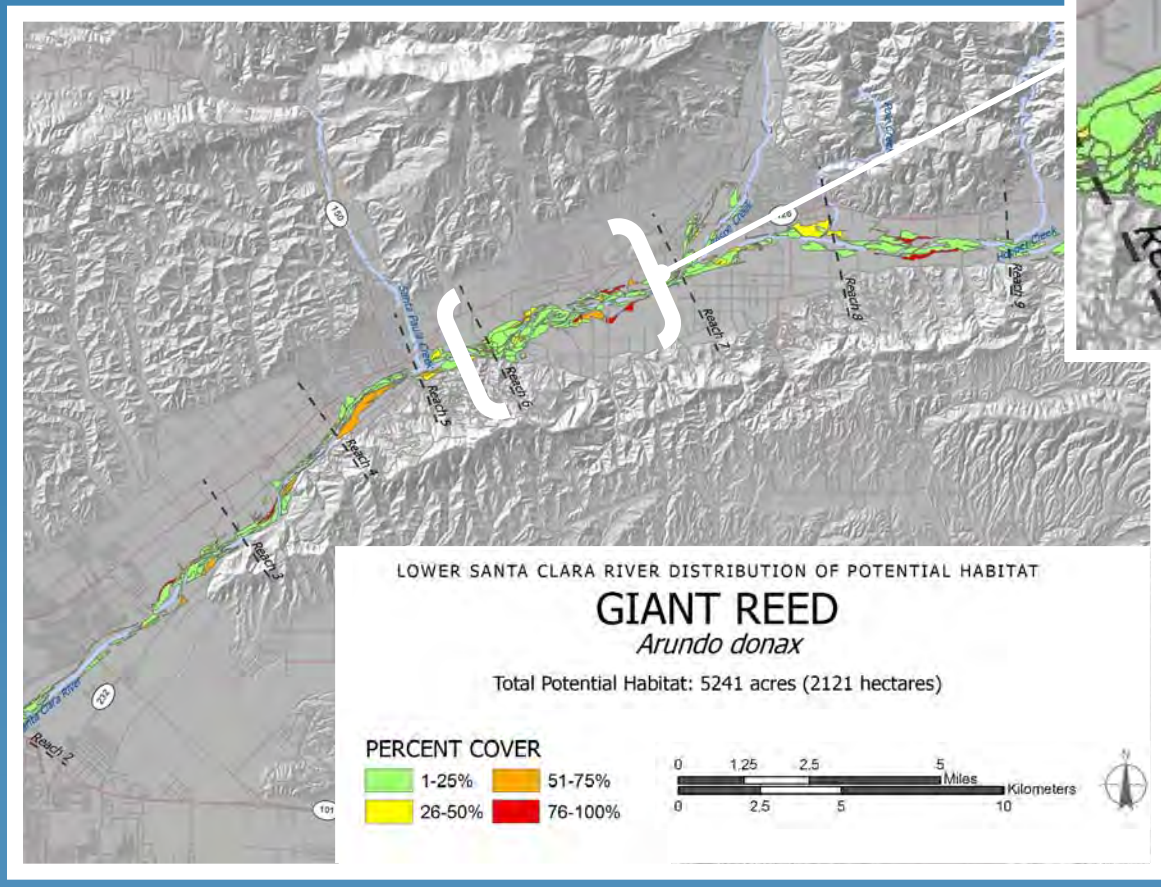
RIPARIAN VEGETATION MAPPING & CLASSIFICATION

- Diverse and dynamic riparian vegetation
  - "Classic" cottonwood-willow types plus more xeric alluvial scrub types
  - 58 alliances and 130 map unit types

RIPARIAN VEGETATION MAPPING & CLASSIFICATION

- Invasion by Arundo
  - Replaces native vegetation
  - Alters ecosystem processes
  - >5,000 acres





RESTORATION OPPORTUNITIES & CONSTRAINTS

- Floods and dynamic channel and vegetation are both the asset and the hazard

RESTORATION & CONSERVATION STRATEGIES

1. Acquire Floodplain Lands from Willing Sellers
2. Increase & Improve Floodplain Connectivity
3. Promote Revegetation via Natural Recruitment & Active Planting (in appropriate areas)
4. Implement Strategic Actions to Control Arundo

STRATEGIC ACTIONS TO CONTROL ARUNDO

Multi-scale Top-Down Approach

- Upstream to downstream (watershed, main river corridor, tributaries)
- Upslope to downslope (corridor, reach, site)

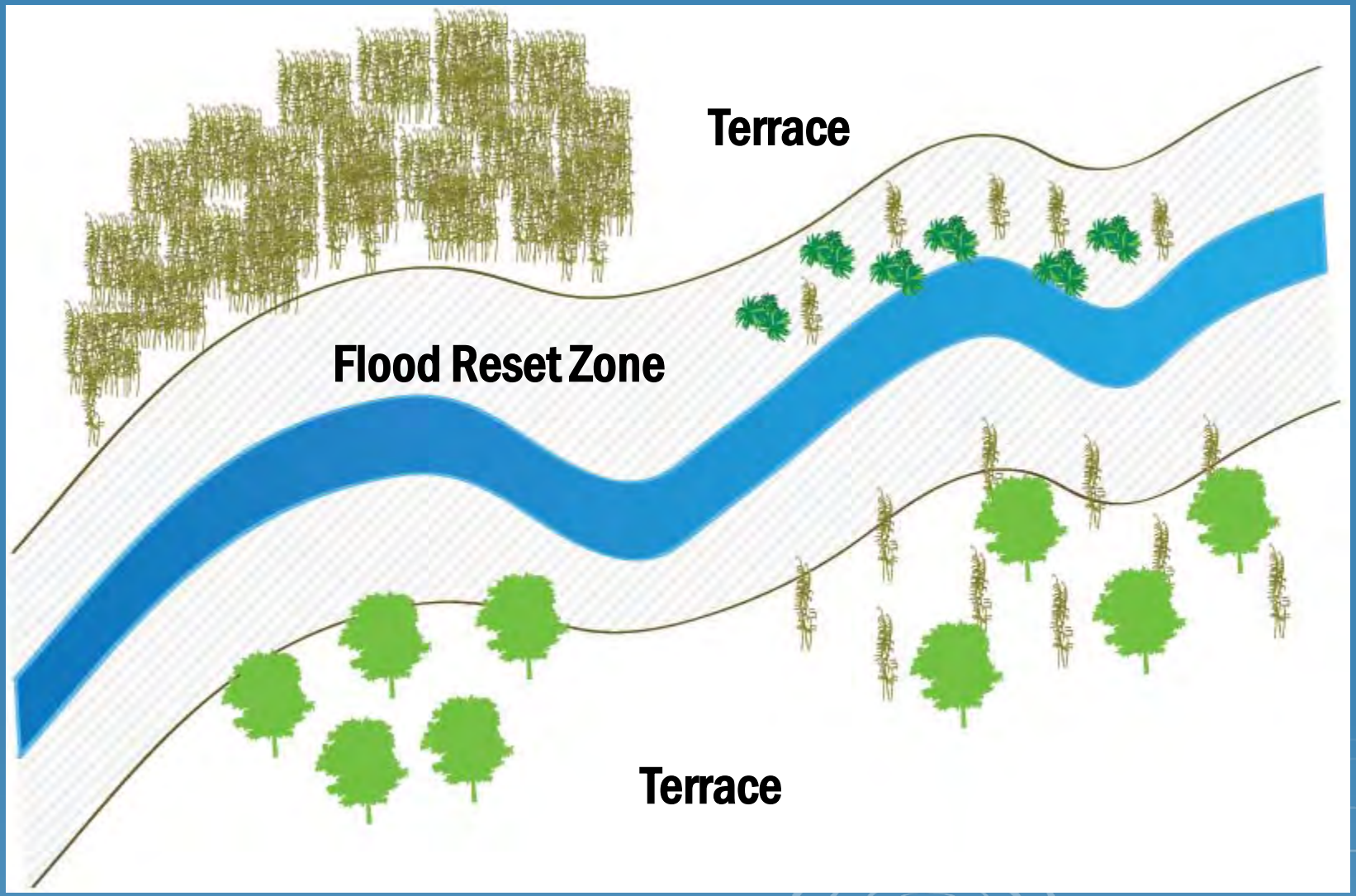
Priorities based on economic cost, ecological benefit, & feasibility

- Protect & enhance high quality habitat
- Reduce fire and flood risk to infrastructure and habitat

Contingency Plans

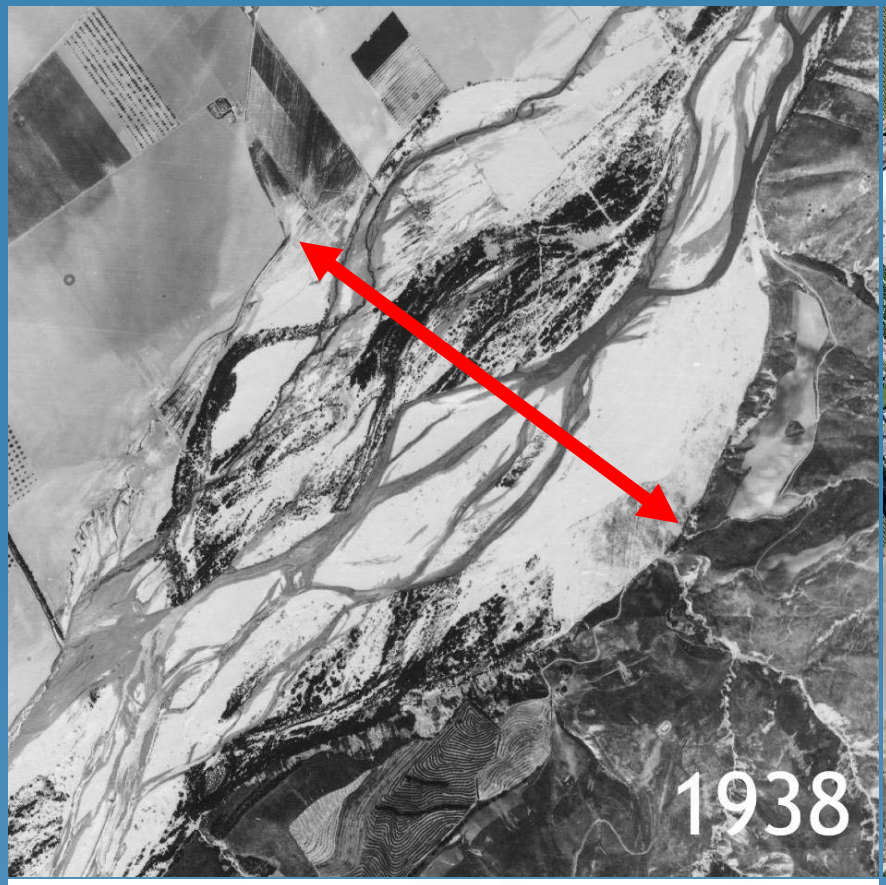
- Post-flood control actions in flood reset zone
- Post-fire actions to promote native plant recovery

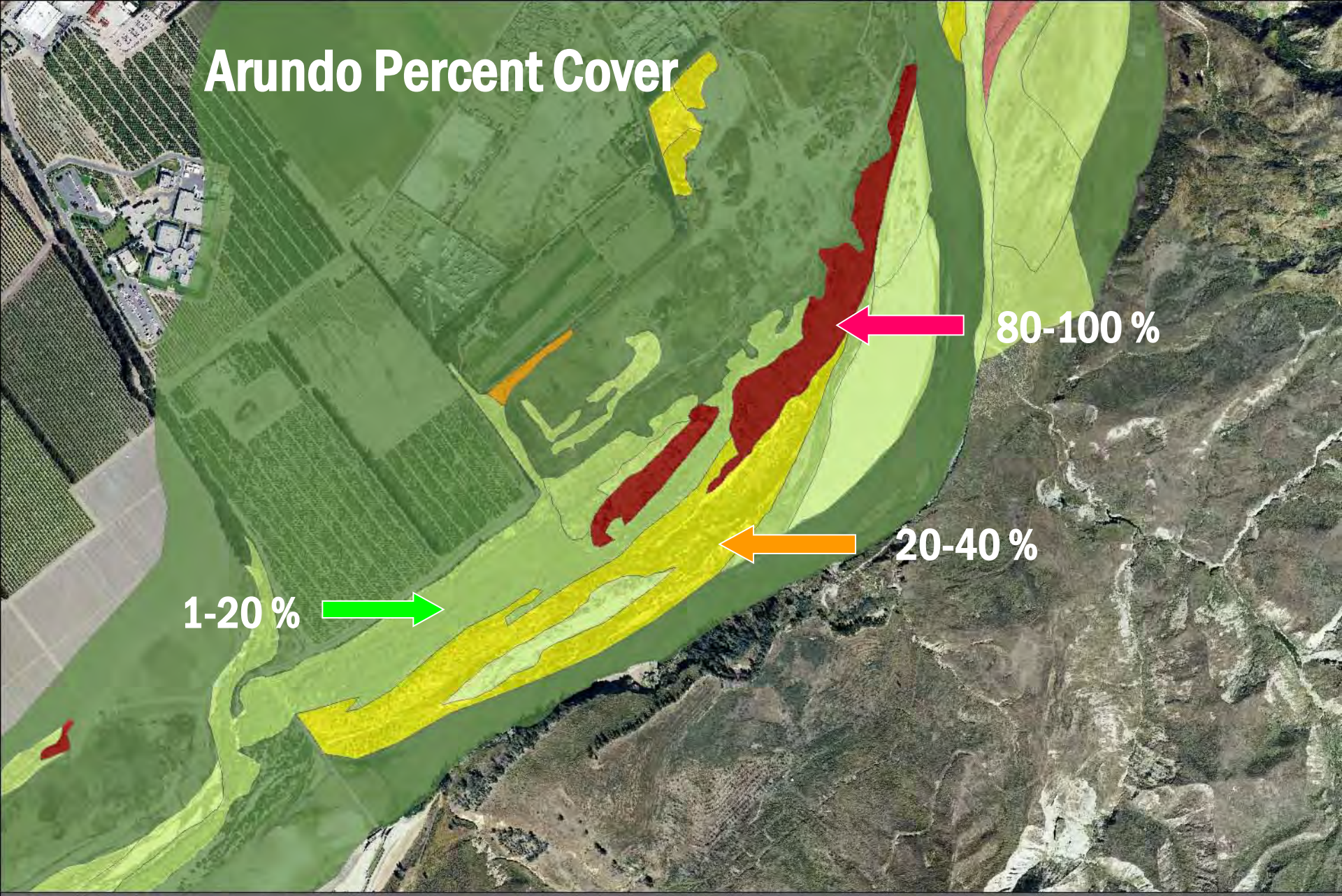
APPLICATION OF APPROACH

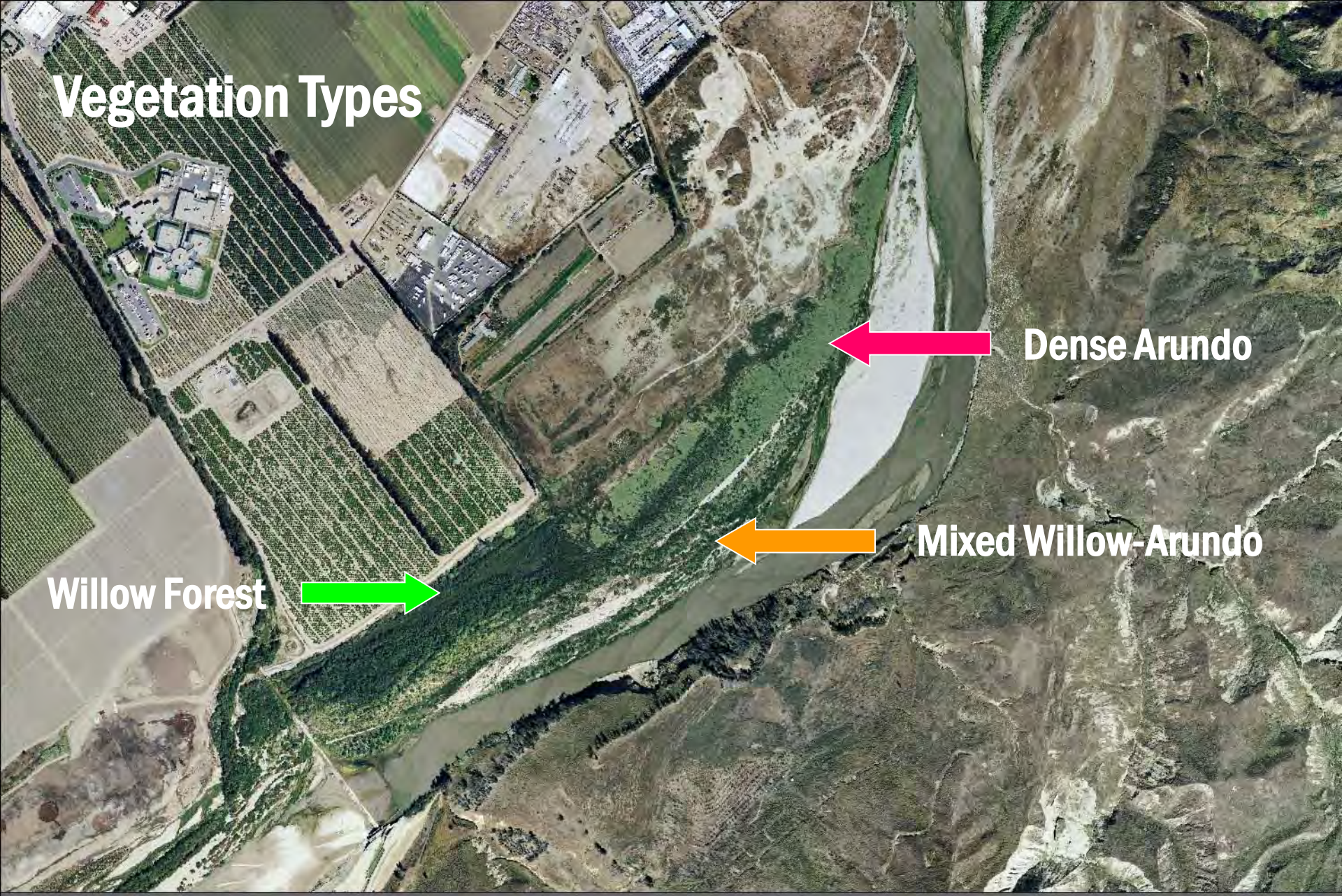


Example application at site scale

- Severely constrained floodplain and limited extent of riparian vegetation




Arundo Percent Cover
80-100 %
20-40 %
1-20 %
SANTA CLARA RIVER - Arundo Coverage
2005 imagery
0%
1–20%
20–40%
40–60%
60–80%
80–100%
0
500
1,000
2,000
Feet
N
Stillwater Sciences
www.stillwatersci.com


Vegetation Types
Dense Arundo
Mixed Willow-Arundo
Willow Forest
SANTA CLARA RIVER
2005 imagery
0
500
1,000
2,000
Feet
N
Stillwater Sciences
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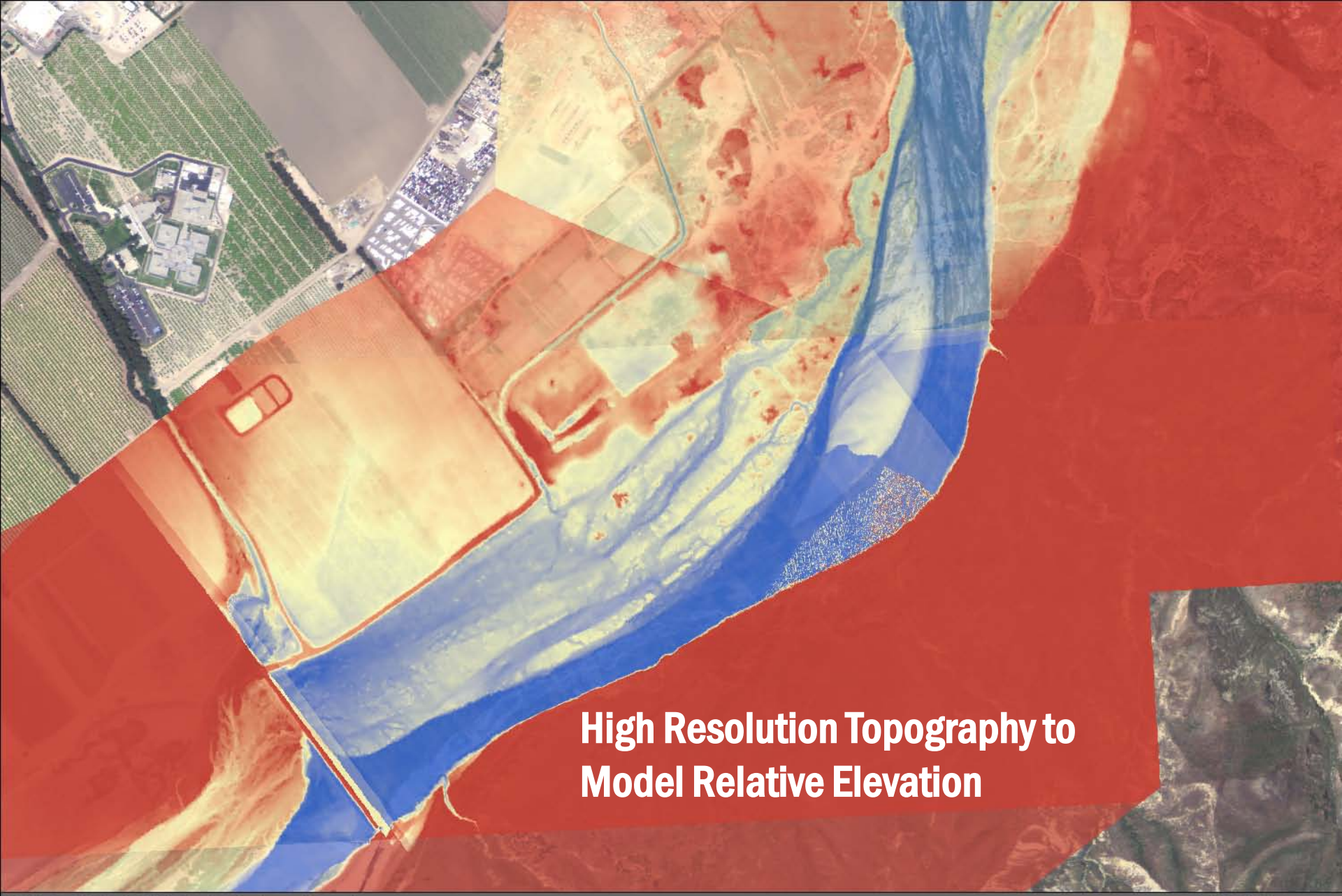
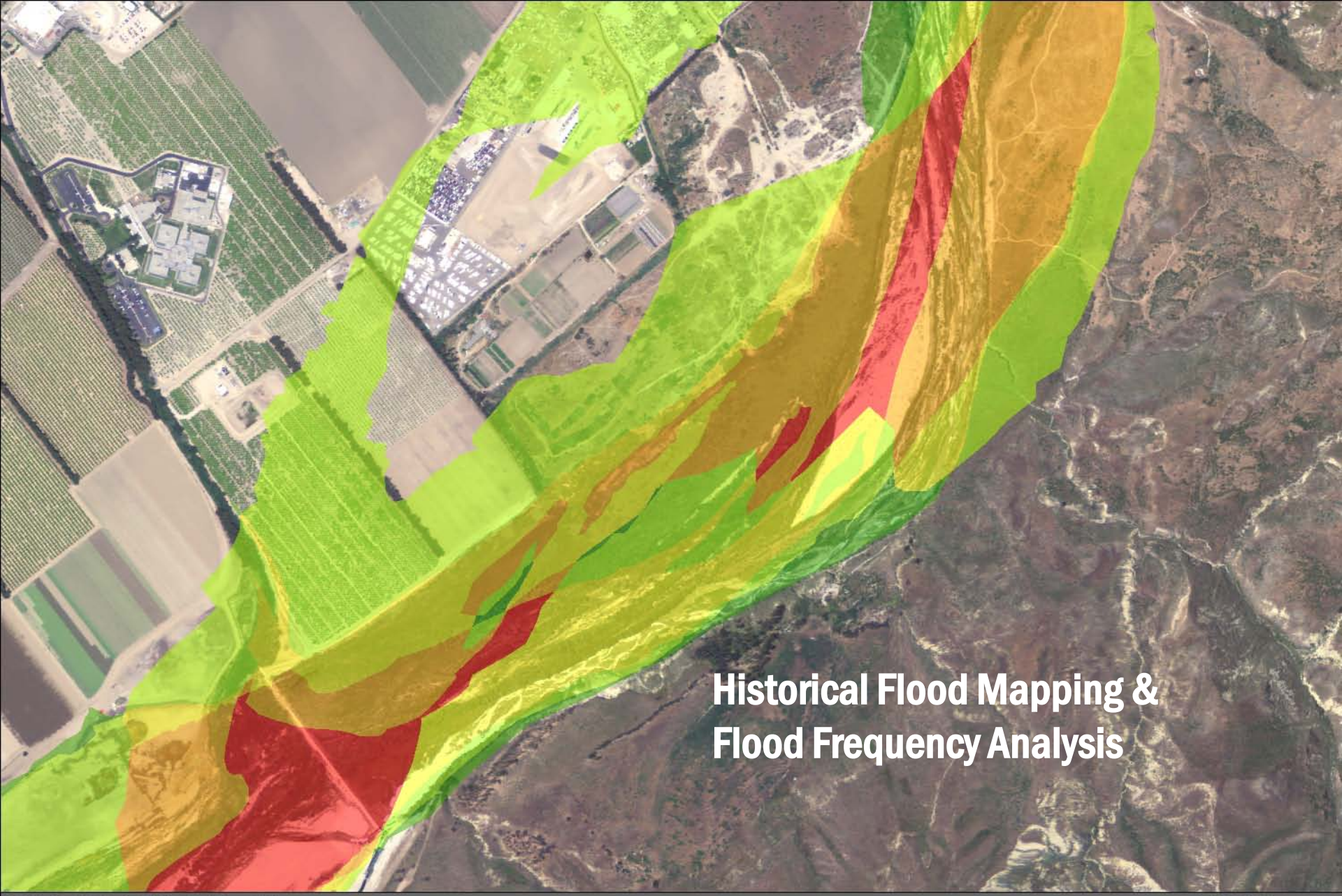

High Resolution Topography to
Model Relative Elevation
SANTA CLARA RIVER - Relative elevation
2009 imagery
High : 20 ft
Low : 0 ft
0
500
1,000
2,000
Feet
N
Stillwater Sciences
www.stillwatersci.com


Historical Flood Mapping &
Flood Frequency Analysis
SANTA CLARA RIVER - Flood frequency
2009 imagery
0.03 - 0.24
0.24 - 0.45
0.45 - 0.67
0.67 - 0.86
0.86 - 1.00
0
500
1,000
2,000
Feet
N
Stillwater Sciences
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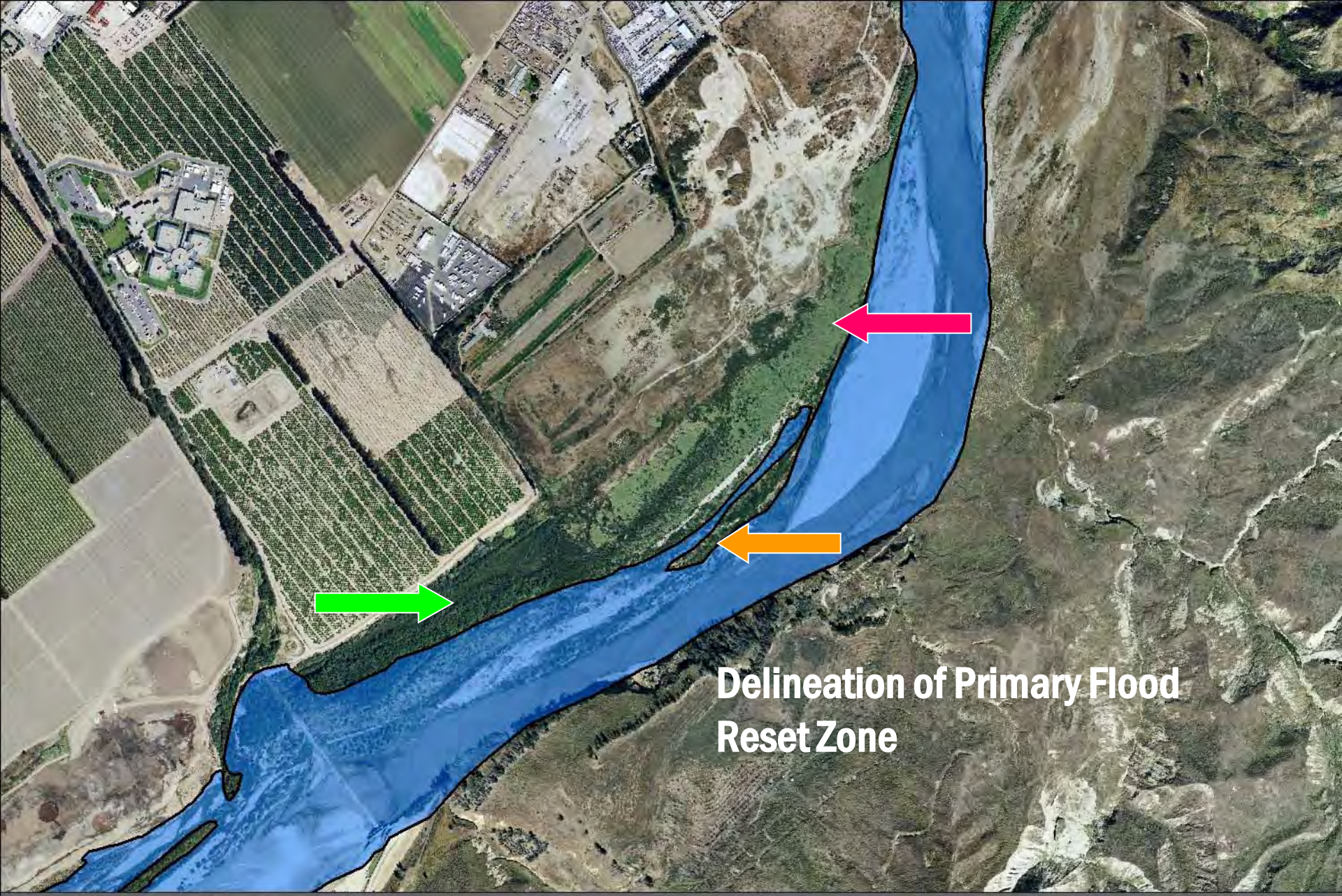

SANTA CLARA RIVER - Flood Scour Zone

2005 imagery

Flood Scour Zone

0 500 1,000 2,000 Feet

N

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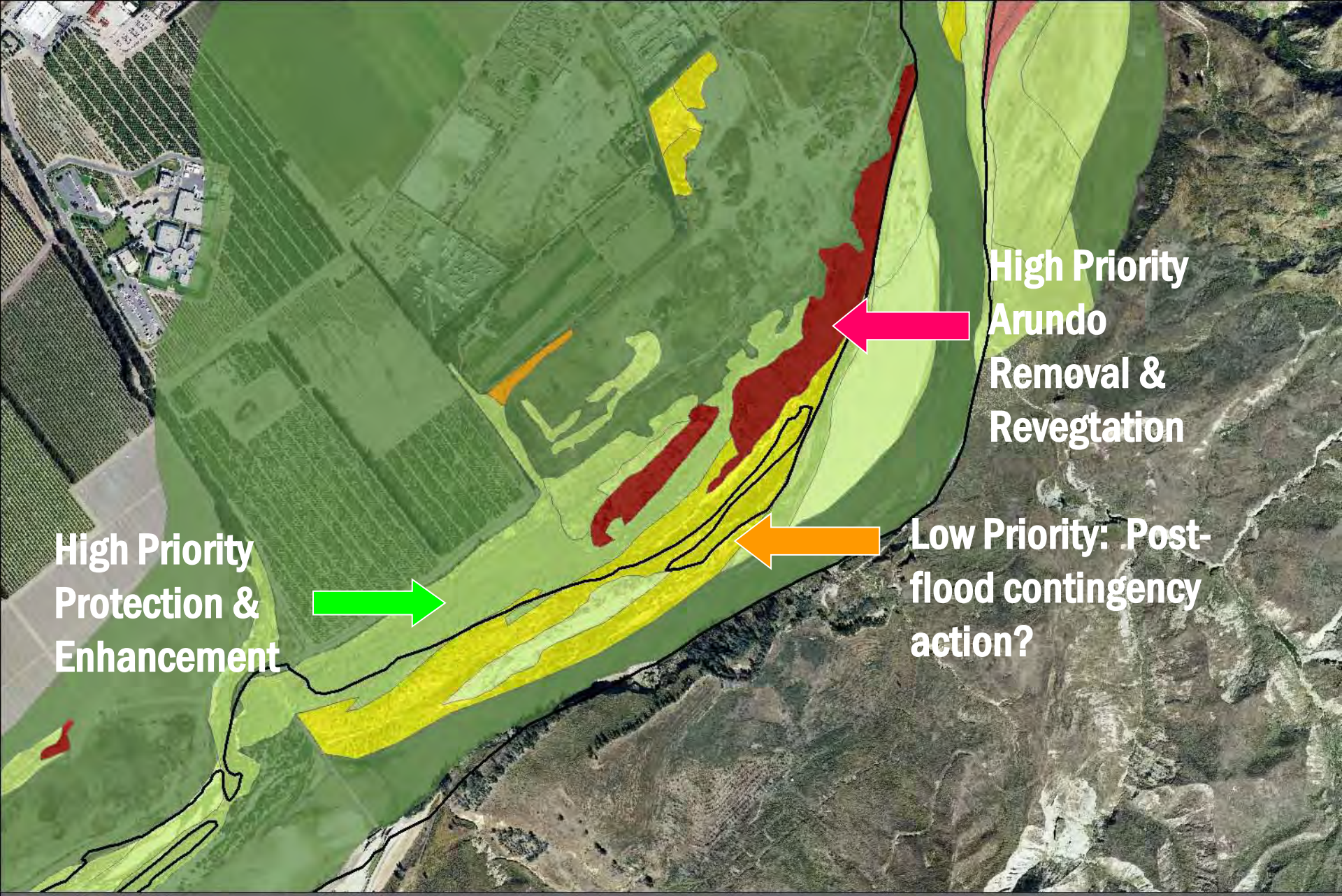
High Priority
Arundo
Removal &
Revegtation
Low Priority: Post-
flood contingency
action?
High Priority
Protection &
Enhancement
SANTA CLARA RIVER - Arundo Coverage & Flood Scour Zone
2005 imagery
0%
1–20%
20–40%
40–60%
60–80%
80–100%
Flood Scour Zone
0
500
1,000
2,000
Feet
N
Stillwater Sciences
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STRATEGIC ACTIONS TO CONTROL ARUNDO

- Multi-scale Top-Down Approach
- Priorities based on economic cost, ecological benefit, & feasibility (including permitting)
- Contingency Plans
- We are just in the initial stages of developing the strategic arundo control plan:
  - If you're willing to tell us about lessons learned from other efforts we'd love to talk with you!

FOR MORE INFORMATION

Bruce Orr
bruce@stillwatersci.com

Stillwater Sciences Website
www.stillwatersci.com

Santa Clara River Parkway Website
(includes project reports plus data layers viewable with Google Earth)

www.santaclarariverparkway.org

Also see our poster or join the Saturday field trip