

Are you in or out?

Challenges of identification and mapping



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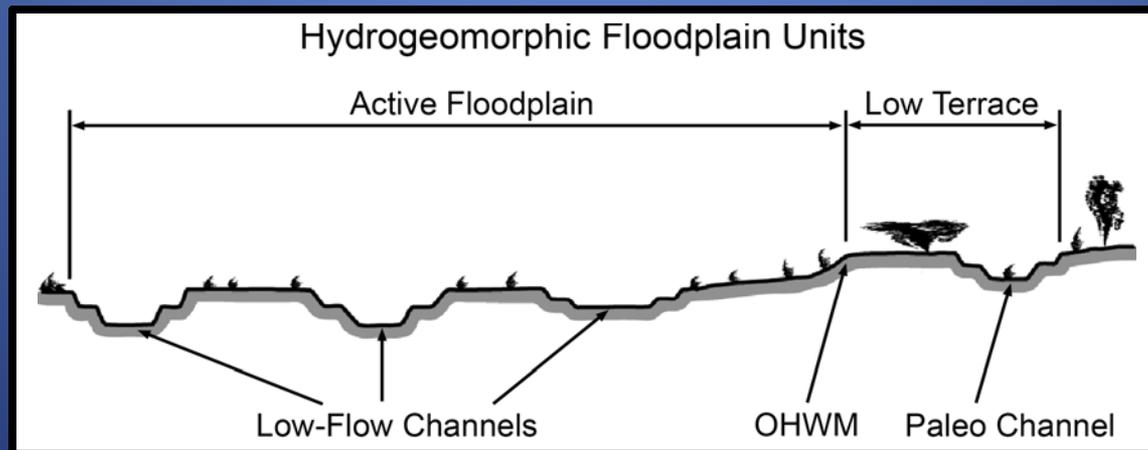
Outline

- Ordinary High Water Mark (OHWM) Definition
- Background research to identify the OHWM
 - Flow Modeling and Indicator Distribution
 - Gage Data Analysis
- Mapping
 - Field methods
 - Watershed-Scale Approach
- Conclusions



Ordinary High Water Mark

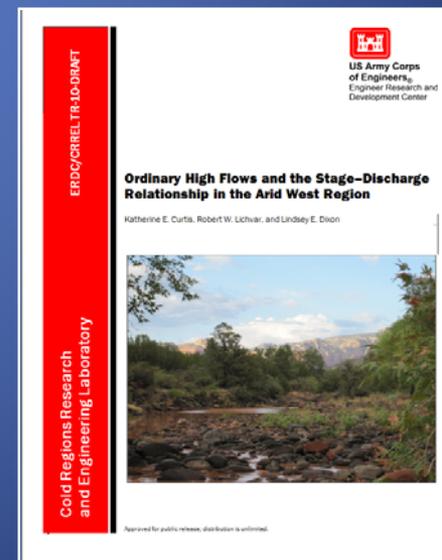
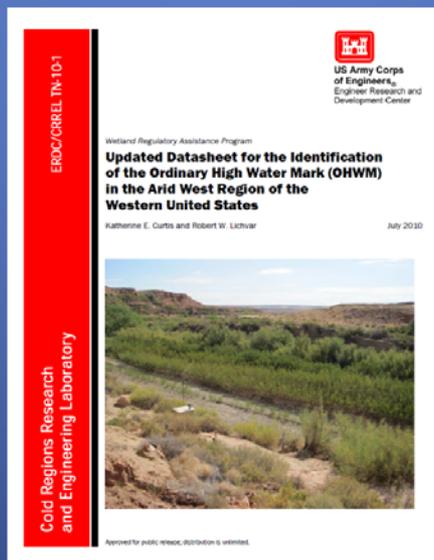
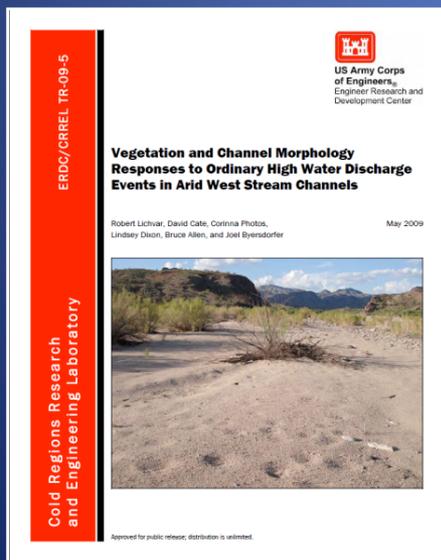
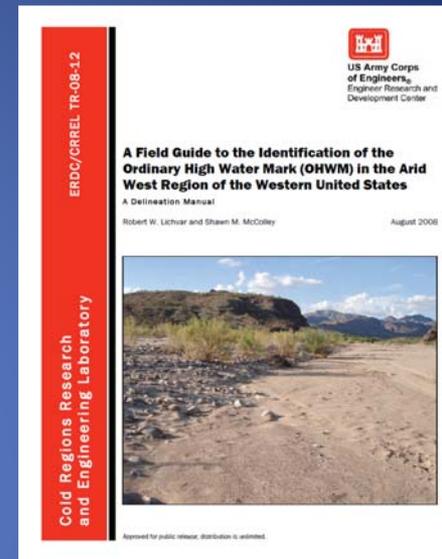
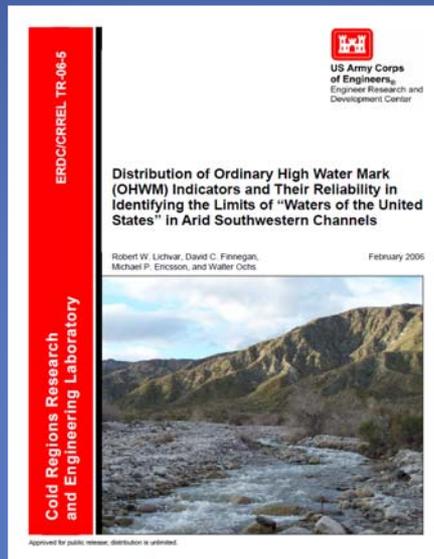
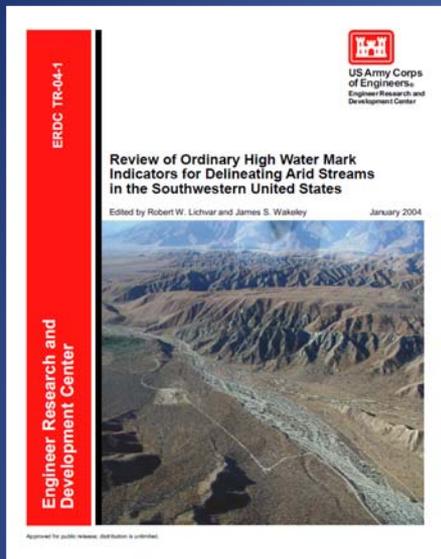
- Regulated under Waters of the US in Section 404 of the Clean Water Act
- “Line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.” (33 CFR Part 328.3)



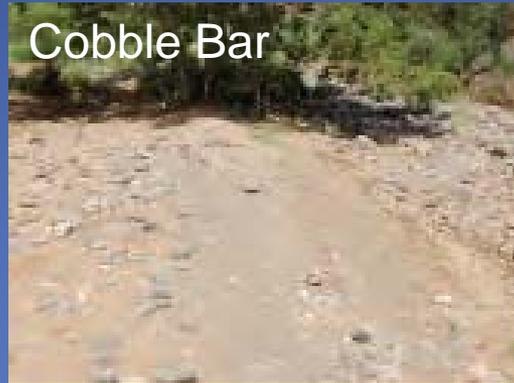
OHWM Geomorphic Signature



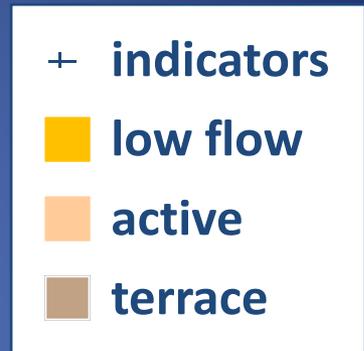
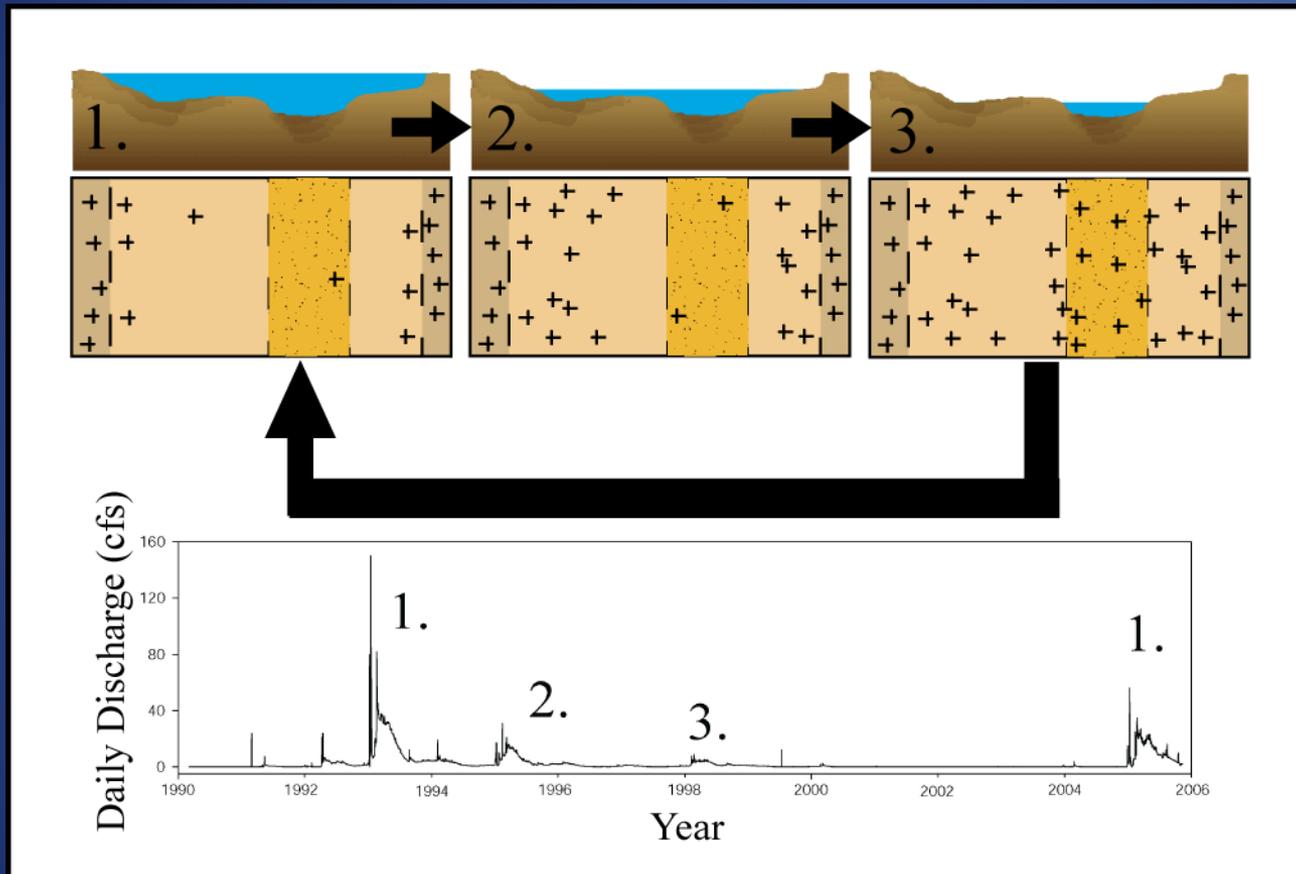
OHWM Background Research



Flow Indicators



Conceptual Model of OHW Indicators



Mission Creek
hydrograph
1990-2006

Are the location of indicators random?

Flow Modeling and Indicator Distribution

Mission Creek

Data Collected

Sept 2003 and Sept 2005



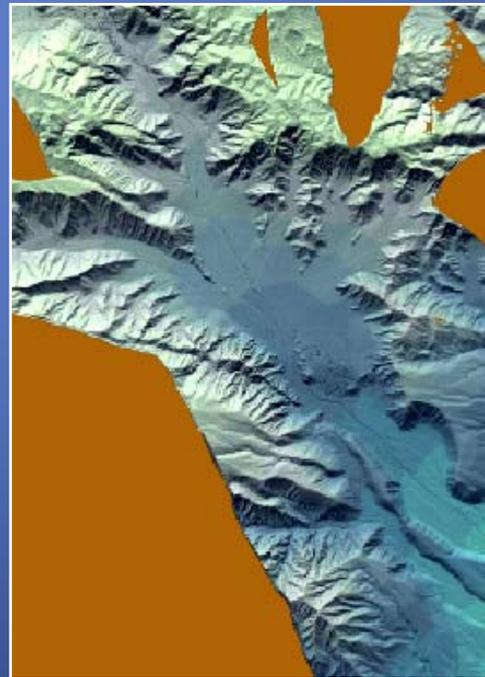
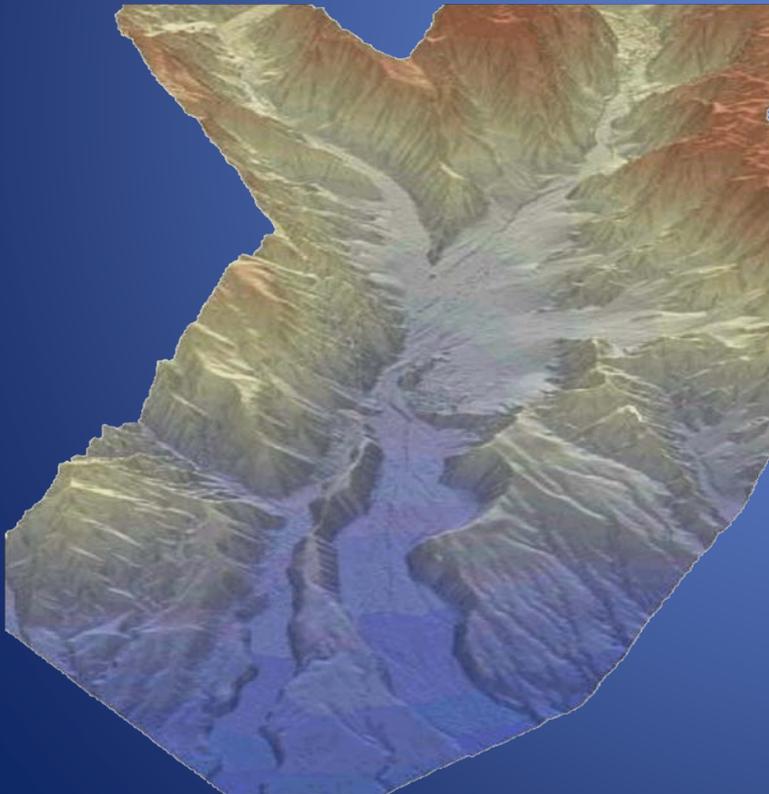
October, 2003



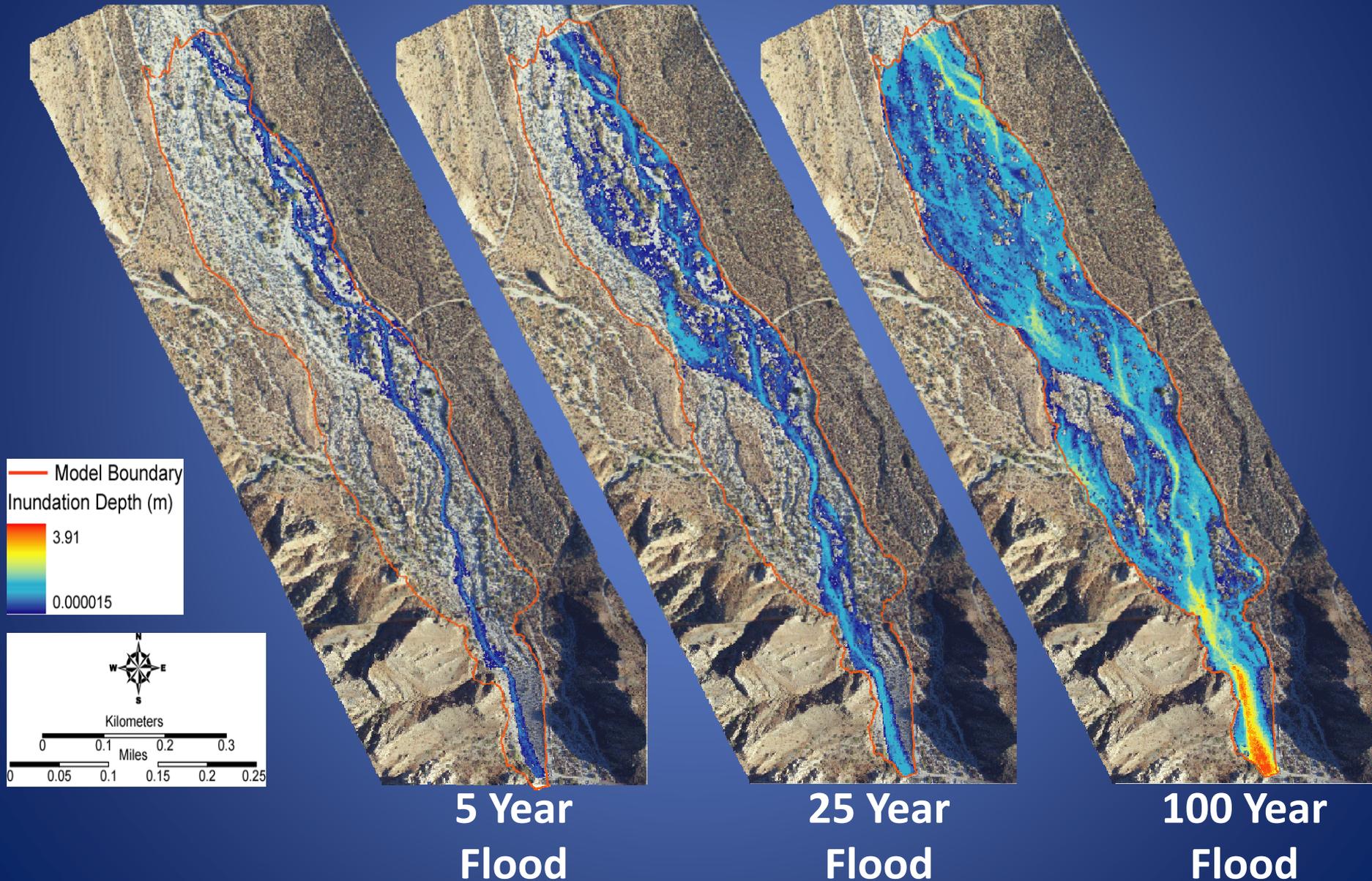
High-Resolution Topography

NASA – ATM-III LIDAR

- DEM accurate to ~5cm vertical
- 1m/pixel color aerial photos
- ~300 million data points collected @ 5-10k/sec

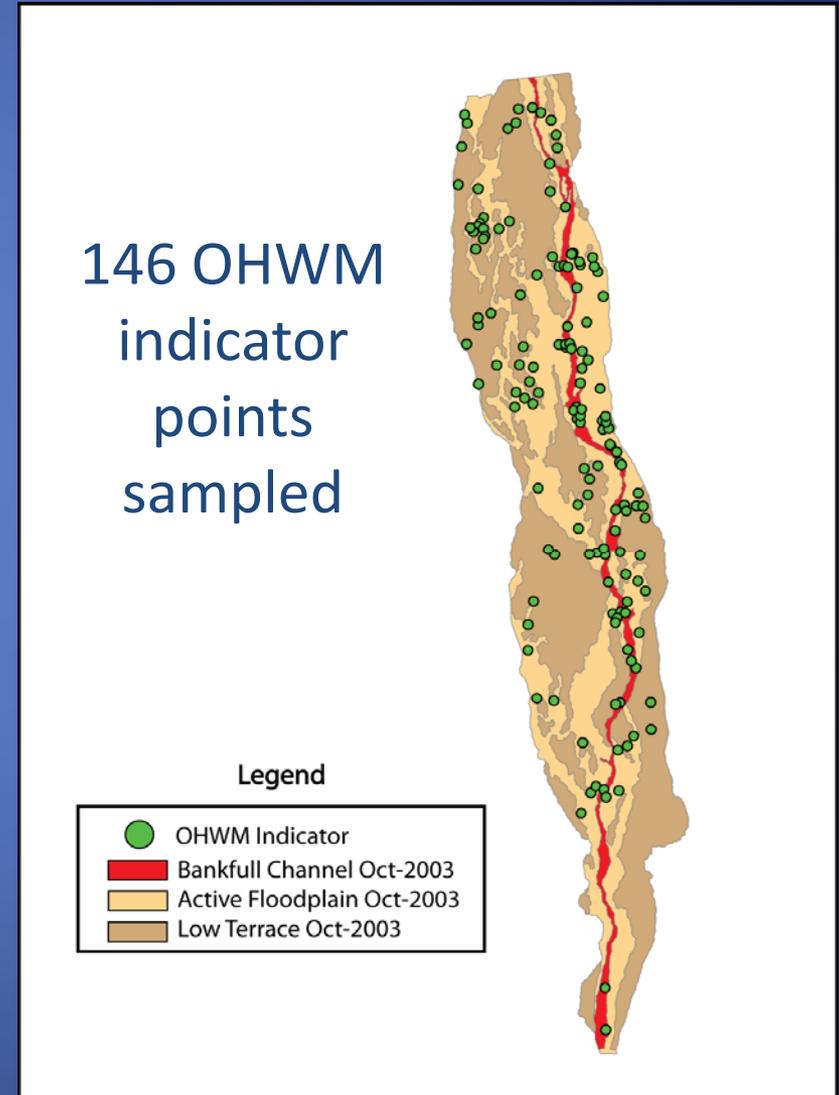


HEC-RAS Modeling Results



Indicator Distribution

- OHWM Indicators
 - Collected GPS points of indicators
- Polygon mapping
 - Fluvial surfaces
 - Sediment characteristics
 - Vegetation- strata, dominant species, percent cover



Indicators Related to Inundation

50yr

25-50yr

10-25-50yr

- Determine indicators associated with a 50yr, 25yr, and 10yr modeled inundation extent

- Determine Nearest Neighbors (NN) for 50yr drift, 25-50yr drift, and 10-25-50yr drift

- NN is defined as the distance to the closest point

Legend

● 50yr Drift

○ 25yr Drift

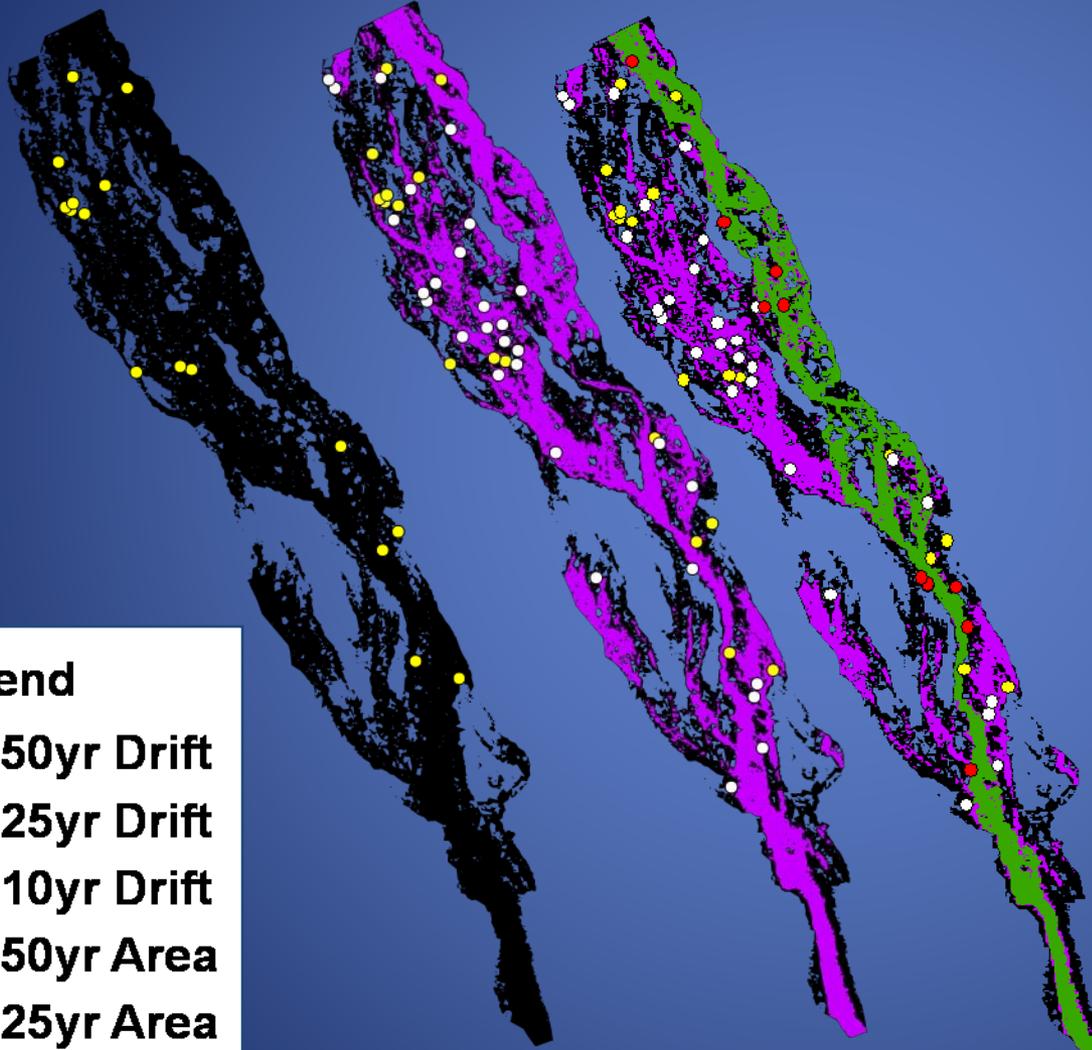
● 10yr Drift

■ 50yr Area

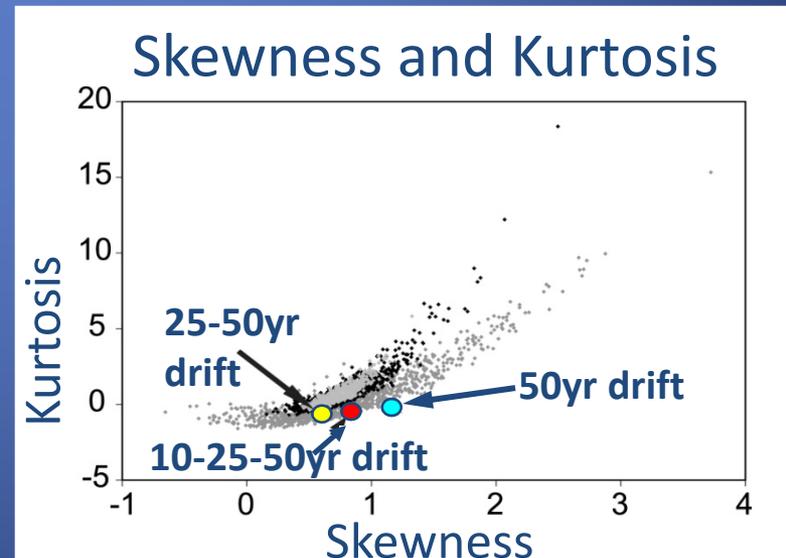
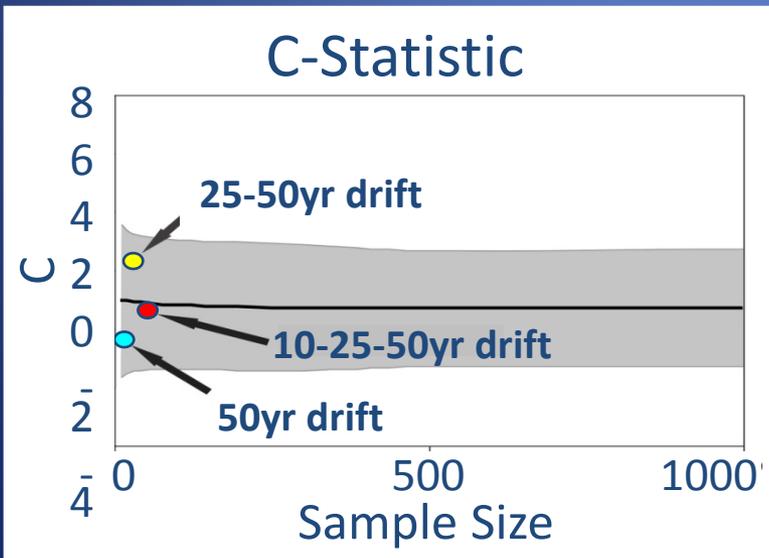
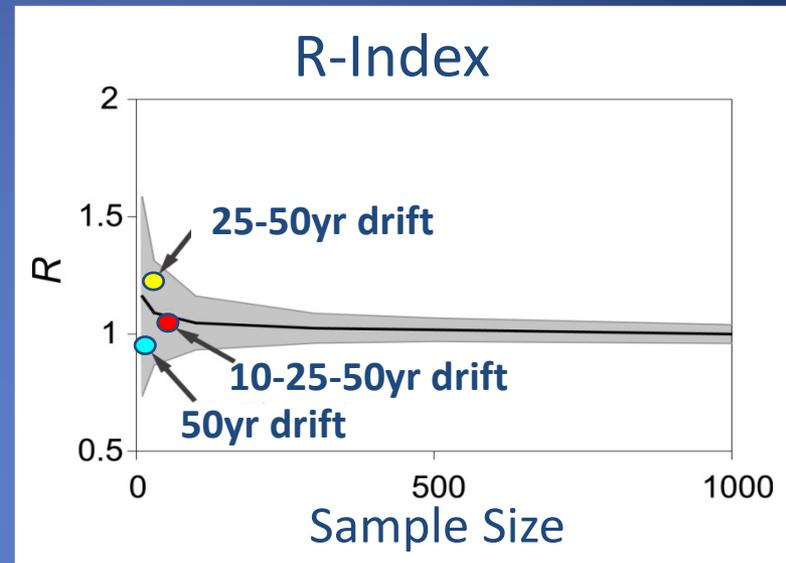
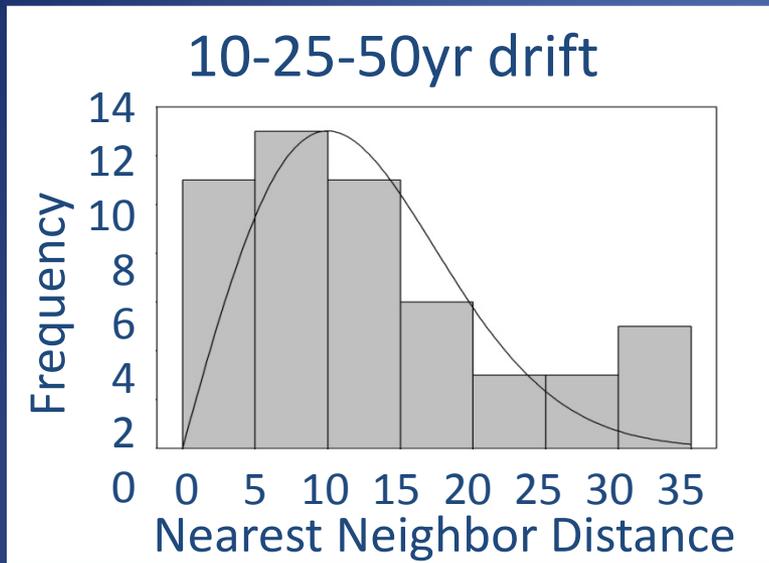
■ 25yr Area

■ 10yr Area

0 75 150 225 300 Meters



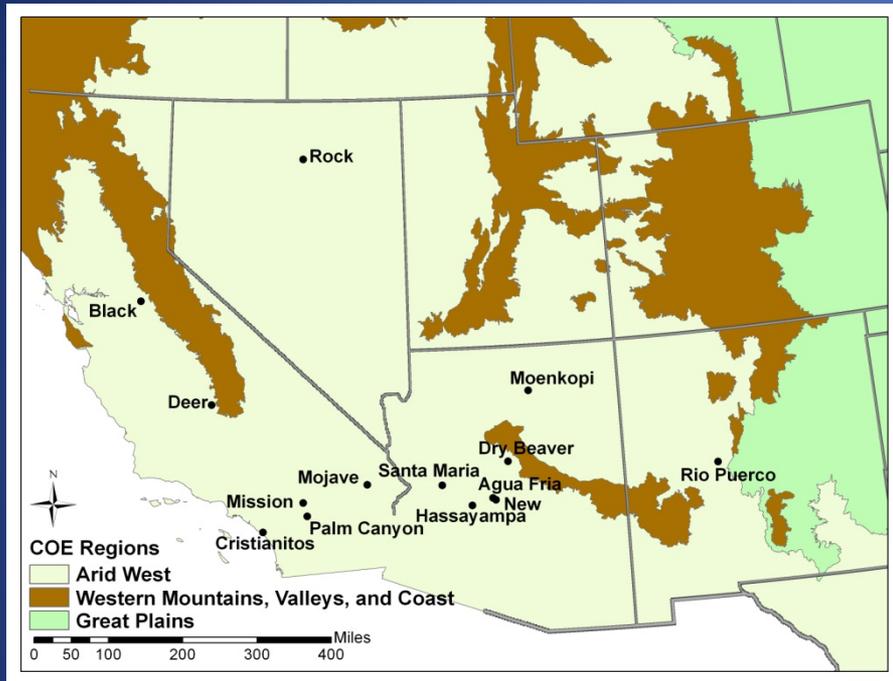
A random distribution



So indicators are not useful to identify
the OHWM...
What about gages?



Gage Data Analysis

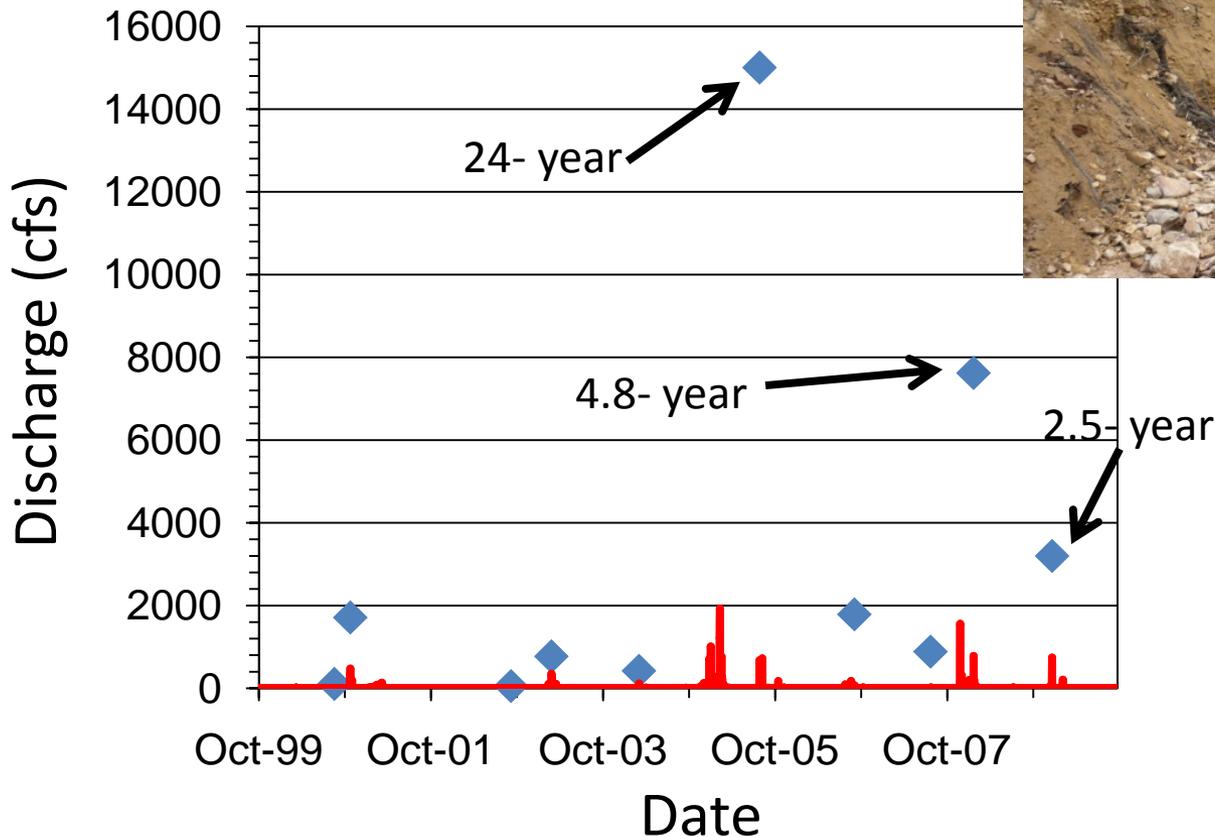


- 14 ephemeral and intermittent streams
- 15+ yrs gage data
- Recent ordinary high flow event (~5–10 yr flood)
- Compared position of gage-predicted OHWM to field geomorphic signature
- Determined recurrence intervals of the field OHWM

- Drainage areas
14.4–7350 mi²
- Days with no flow
10.9–90.8%, mean 57.6%

Challenges

When did the most recent OHW flood occur?



Challenges

Accuracy of the stage-discharge relationship Mojave River

September 2003
after 4 yrs of low flows



July 2006
6 months after a 20-yr flood



July 2009
after 4 yrs of low flows



Gage-predicted OHWM vs Field OHWM

Mission Creek

Field
OHWM



Gage-
predicted
OHWM



	Date	Stage (ft)	Discharge (cfs)	RI (yr)
gage-predicted OHWM	7/20/08	5.84	1480	13.7
field OHWM gage bank		4.5	632	7.4

Gage-predicted OHWM vs Field OHWM Results

Gage Number	River Name	Gage-Predicted OHWM				Field OHWM			Stage height % difference	Discharge % difference
		Peak Flow Date	Stage height (ft)	Discharge (cfs)	Recurrence Interval	Stage height (ft)	Discharge (cfs)	Recurrence Interval		
08353000	Rio Puerco	8/10/2006	19.52	6210	31.0	17.1	3750	15.5	12.4%	39.6%
09401260	Moenkopi Wash	8/16/2006	20.5	5440	4.5	17.6	2860	1.6	14.1%	47.4%
						16.6	2360	1.5	19.0%	56.6%
09424900	Santa Maria River	12/29/2004	6.13	8900	3.2	n/a	n/a	n/a	n/a	n/a
09505350	Dry Beaver Creek	12/7/2007	9.3	9600	5.4	8.6	7880	3.6	7.5%	17.9%
		12/29/2004	10.1	11800	9.8				14.9%	33.2%
09512800	Agua Fria River	2/12/2005	18	26600	4.6	15.6	10200	2.7	13.3%	61.7%
09513780	New River	1/27/2008	8.52	7620	4.8	4.8	1510	1.7	43.7%	80.2%
09516500	Hassayampa River	2/12/2005	13.7	14500	8.8	13.7	14500	8.8	0.0%	0.0%
10257600	Mission Creek	7/20/2008	5.84	1480	13.7	4.5	632	7.4	22.9%	57.3%
10258500	Palm Canyon	10/18/2005	5.88	2480	6.8	5.3	1400	4.6	9.9%	43.5%
10263000	Mojave River	1/12/2005	9.16	12000	19.7	n/a	n/a	n/a	n/a	n/a
11046360	Cristianitos Creek	1/11/2005	12.01	3500	8.0	8.5	1620	4.9	29.2%	53.7%
11200800	Deer Creek	11/8/2002	8.2	1750	4.2	2.9	16	<1	64.6%	99.1%
11299600	Black Creek	1/2/2006	6.14	2690	6.5	3.5	140	1.1	43.0%	94.8%
						3.6	168	1.1	41.4%	93.8%
10324500	Rock Creek	1/1/2006	10.1	2280	6.61	6	1750	5.5	40.6%	23.2%
						5.3	1120	4.4	47.5%	50.9%

Field Recurrence Intervals

- Channels with more available sediment typically have higher recurrence intervals than more stable channels

7.4-years



4.6-years



15.5-years



High
sediment
availability

2.7-years



1.6-years



1.1-years

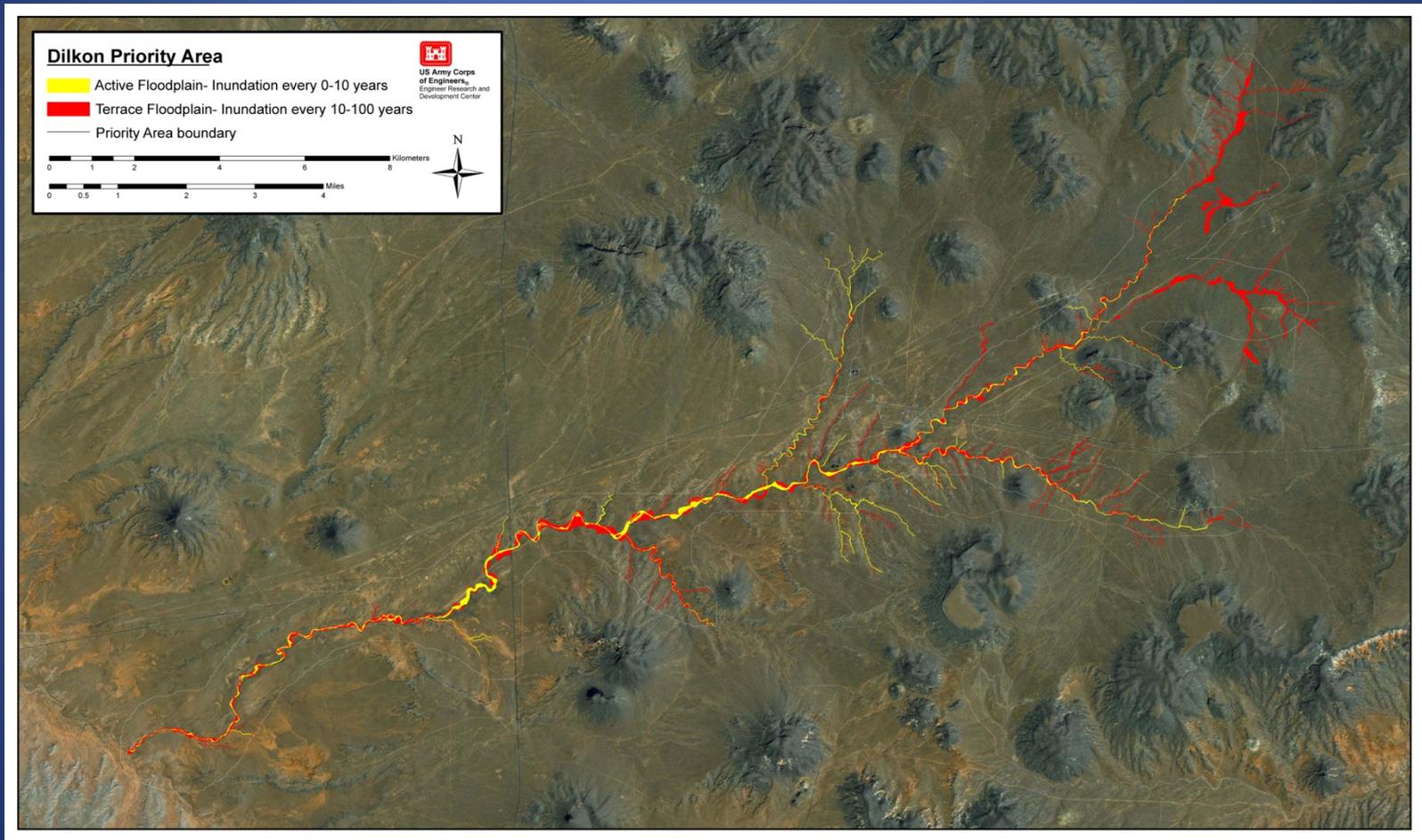


Low
sediment
availability

Use the Geomorphic Signature

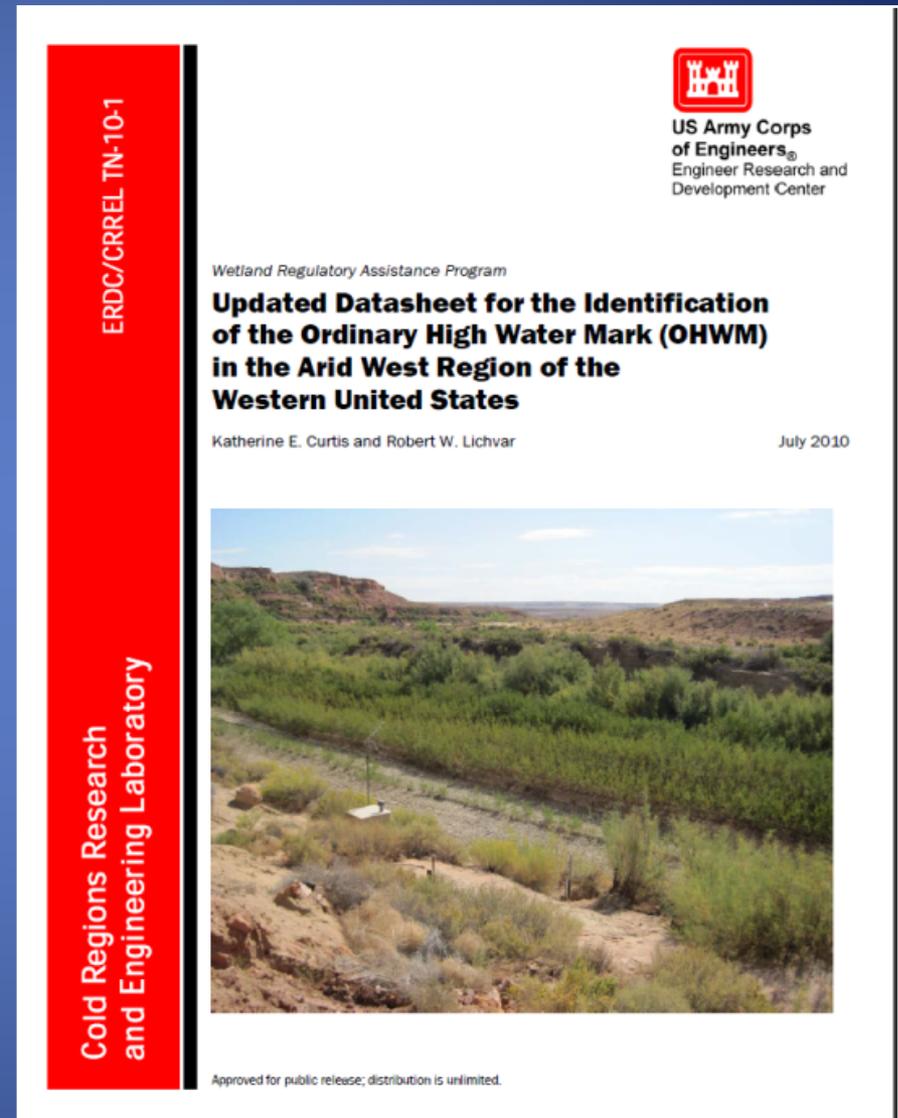
- Gage limitations
 - Lack of gages due to channel instability
 - Gage-predicted OHWM not linked to any field indicators
 - Field OHWM recurrence intervals range from <1 to 15.5 yrs
- Even though the use of gage data is limited for OHWM determinations in ephemeral and intermittent streams, it provides critical insight into flow magnitude and frequency and should be utilized where available to develop an understand of flow dynamics
- Use the physical features to map- most repeatable and reliable methodology for OHWM determination

Mapping



OHWM Mapping Procedure

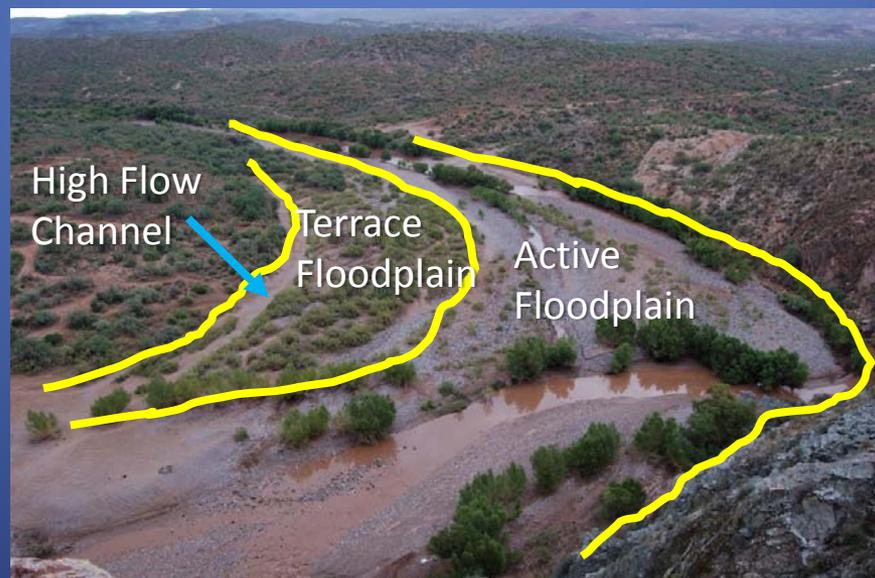
- Use the geomorphic signature
 - Texture changes
 - Vegetation characteristics
 - Slope breaks
- More detailed methodology provided in Curtis and Lichvar 2008



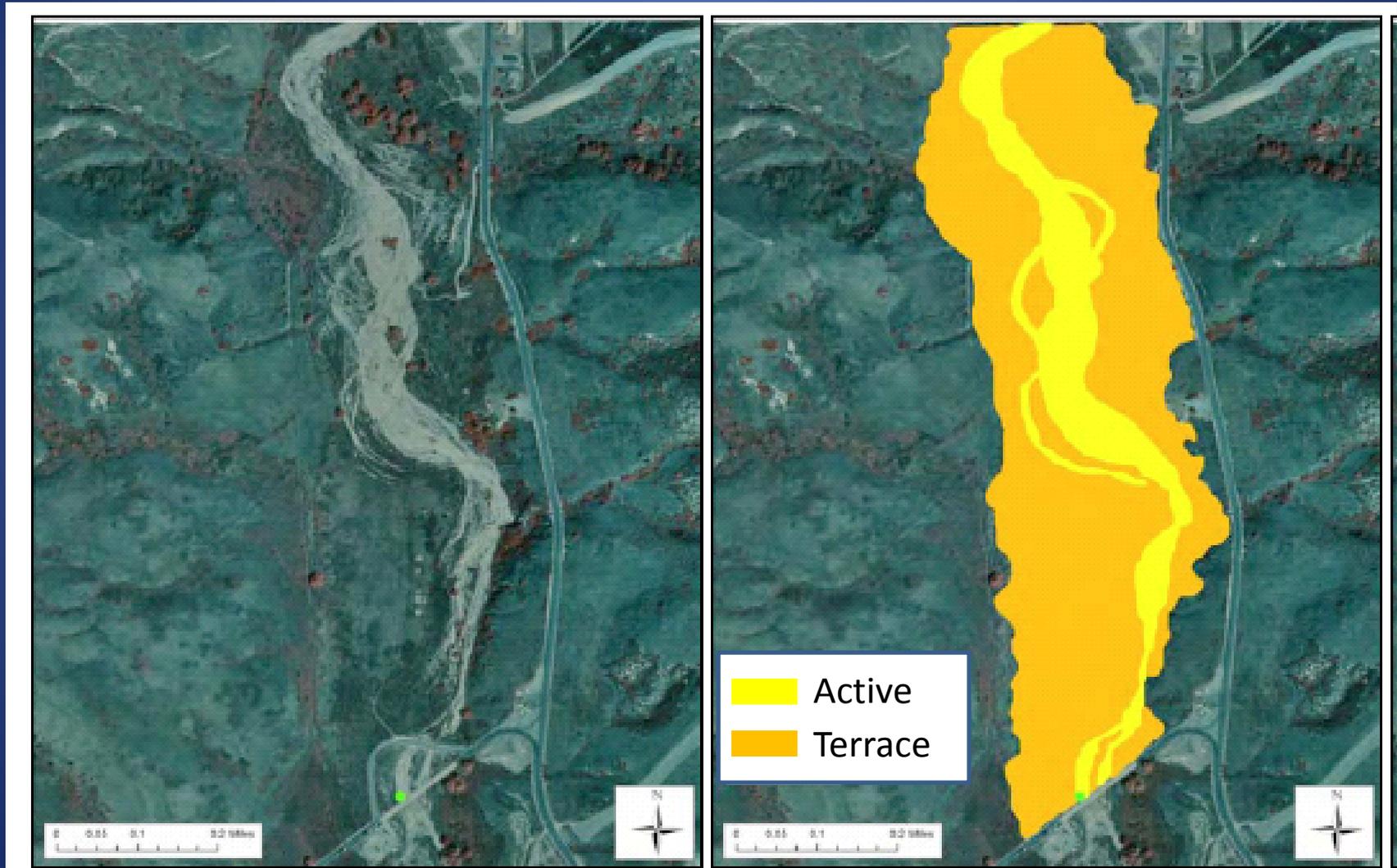
OHWM Geomorphic Signature



Vegetation Trends

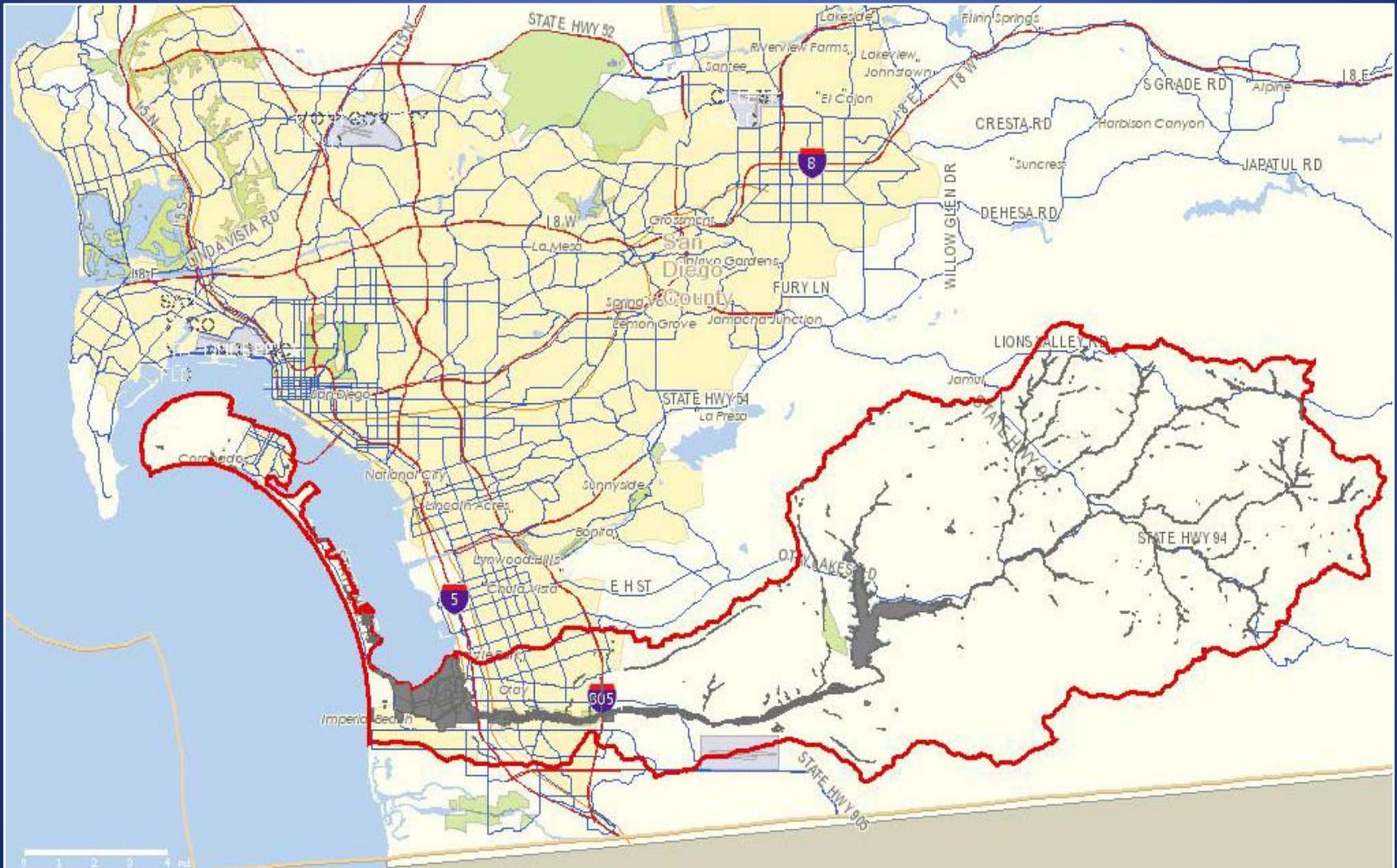


Aerial Photographs



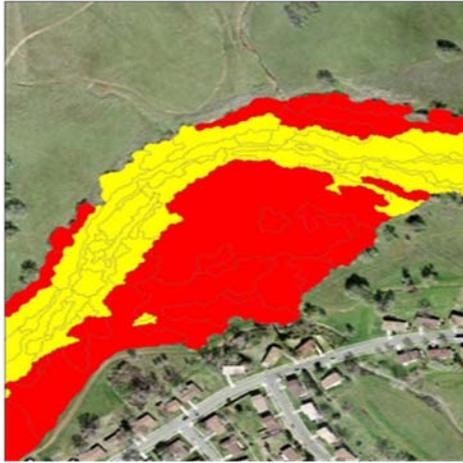
Watershed Scale Mapping

8 Watershed Scaled SAMPS in CA



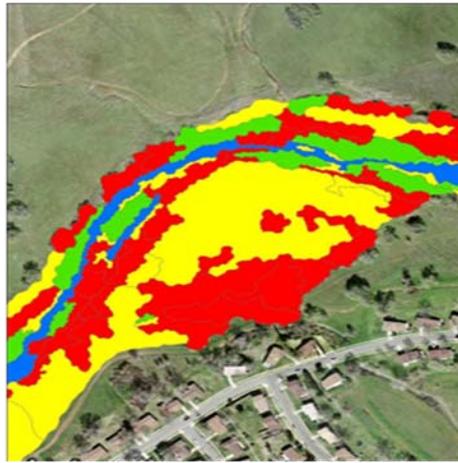
Mapping

Fluvial Mapping Units

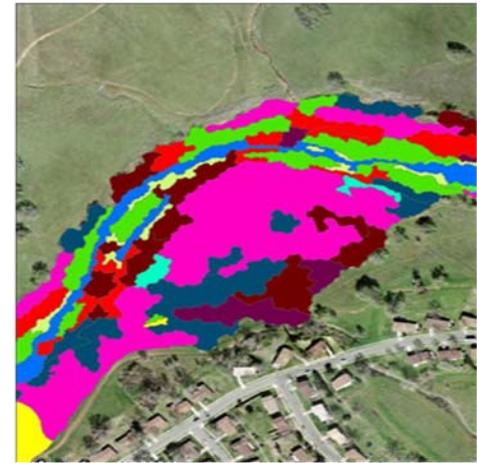


Fluvial Geomorphology

USACE Vegetation Units



Growth Form Units



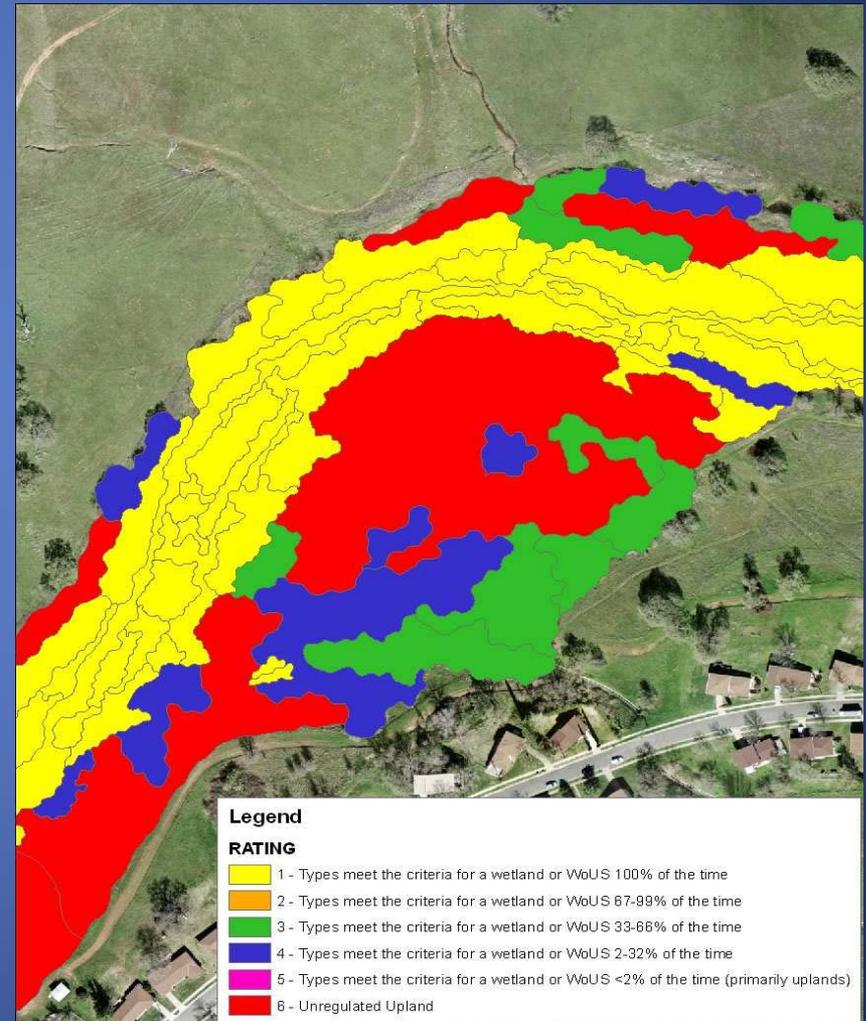
Species-Association Units

- Vegetation Community mapping at 2 scales
- Vegetation units rated for wetland potential
- Overlay vegetation units and fluvial surfaces
- Overlay product of fluvial and vegetation units develops an OHWM Regulatory Rated Map

Final OHW/Wetland Watershed Scale Map

Regulatory probability ratings assigned to riparian vegetation types

Rating	Description
1	Types meet the criteria for a wetland or WoUS 100% of the time
2	Types meet the criteria for a wetland or WoUS 67-98% of the time
3	Types meet the criteria for a wetland or WoUS 33-66% of the time.
4	Types meet the criteria for a wetland or WoUS 2-32% of the time (primarily uplands)
5	Types meet the criteria for a wetland or WoUS <2% of the time (primarily uplands)
6	Unregulated upland



Identification and Mapping

Conclusions

- Biggest challenge with identification and mapping the OHWM is defining the active- terrace boundary
 - Key here is to use the geomorphic signature
 - Texture changes, vegetation characteristics, and break in slope
- Flow indicators may be useful in helping to identify the floodplain units, but the distribution of indicators cannot be distinguished from random
- Gage data provides insight into flow dynamics but recurrence intervals are highly variable
- A field signature should be identified and mapped for reliable and repeatable delineations

Acknowledgements

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