

Incorporating the **Coastal Blue Band (CBB)** aboard
Satellites and Unmanned Aerial Surveillance (UAS):
A **Remote Sensing Toolkit** for
Mapping Intertidal **Mudflats** in South SF Bay



Mudflat Mapping Team



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Need, Issue(s) and Approach

- Track **full geographic extent of mud flat**
- Spatial Resolution: **50 square meters** (~7 meters)
- Tide at **Mean Lower Low Water** (MLLW) to allow for full exposure of mudflats
- **2D** is adequate to meet needs of management
- Track changes every 1 to 3+ years
- **Low Cost** Option

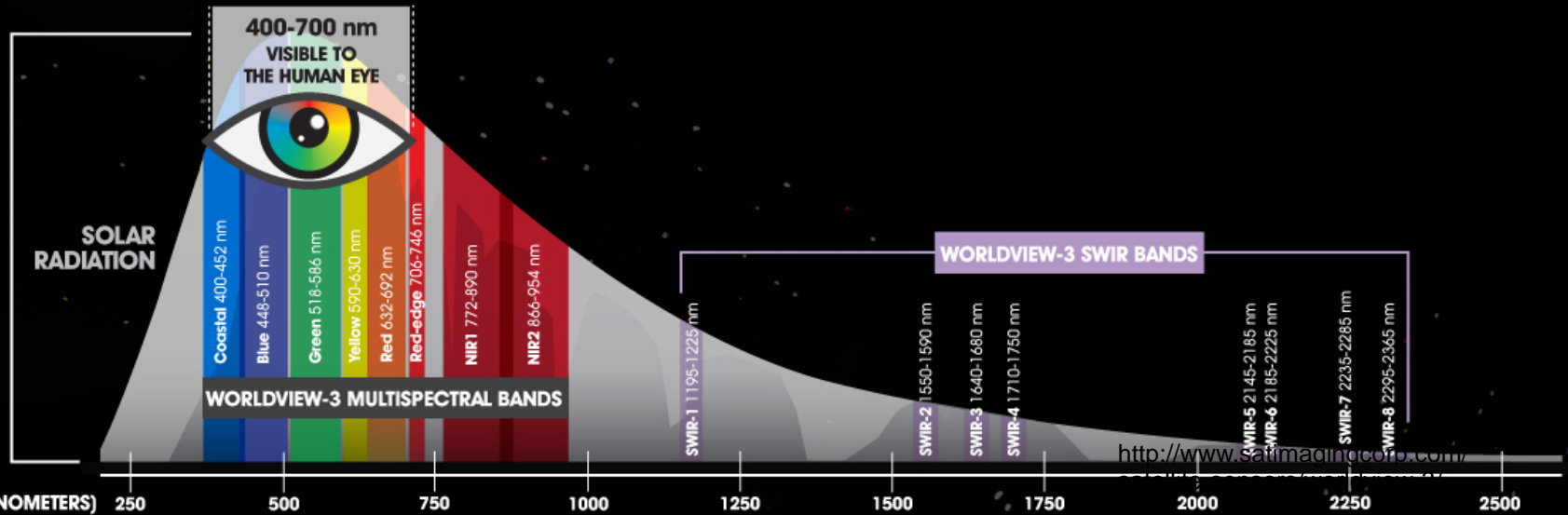
Goal: Map Mudflats with Coastal Blue Band (CBB) on



Step #1: Image Acquisition - completed

Digital Globe World View-3 Satellite Data

Free Via USGS CRSSP Imagery Derived Requirements (CIDR) Tool

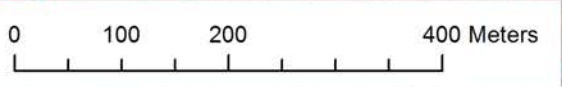


- 1.3 meter resolution
- 8 multispectral bands, including coastal blue band (400-452 nm)
- Tasked satellite to correspond with <0 MLLW predicted low tides
- RPC orthorectification in ENVI w/ SF Bay topo/bathy DEM, RMSE~0.5m
- Atmospherically corrected with ENVI FLAASH

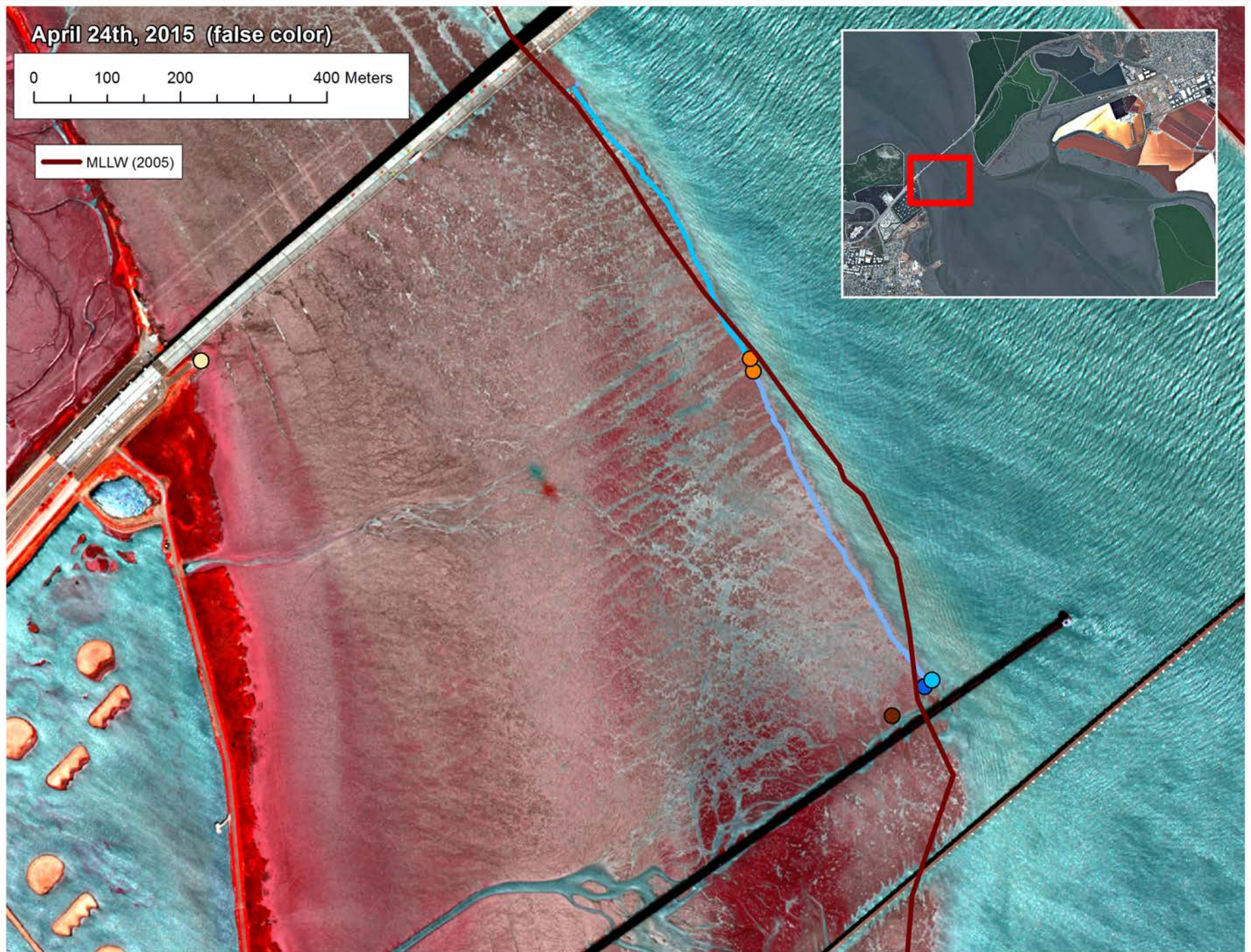
4/24: 12:05 pm collection;
Redwood City water level 0.561 ft.
Coyote Creek water level 0.919 ft.

6/7; 12:00 pm collection;
Redwood City water level 0.43 ft.
Coyote Creek water level 0.328 ft.

April 24th, 2015 (false color)



— MLLW (2005)



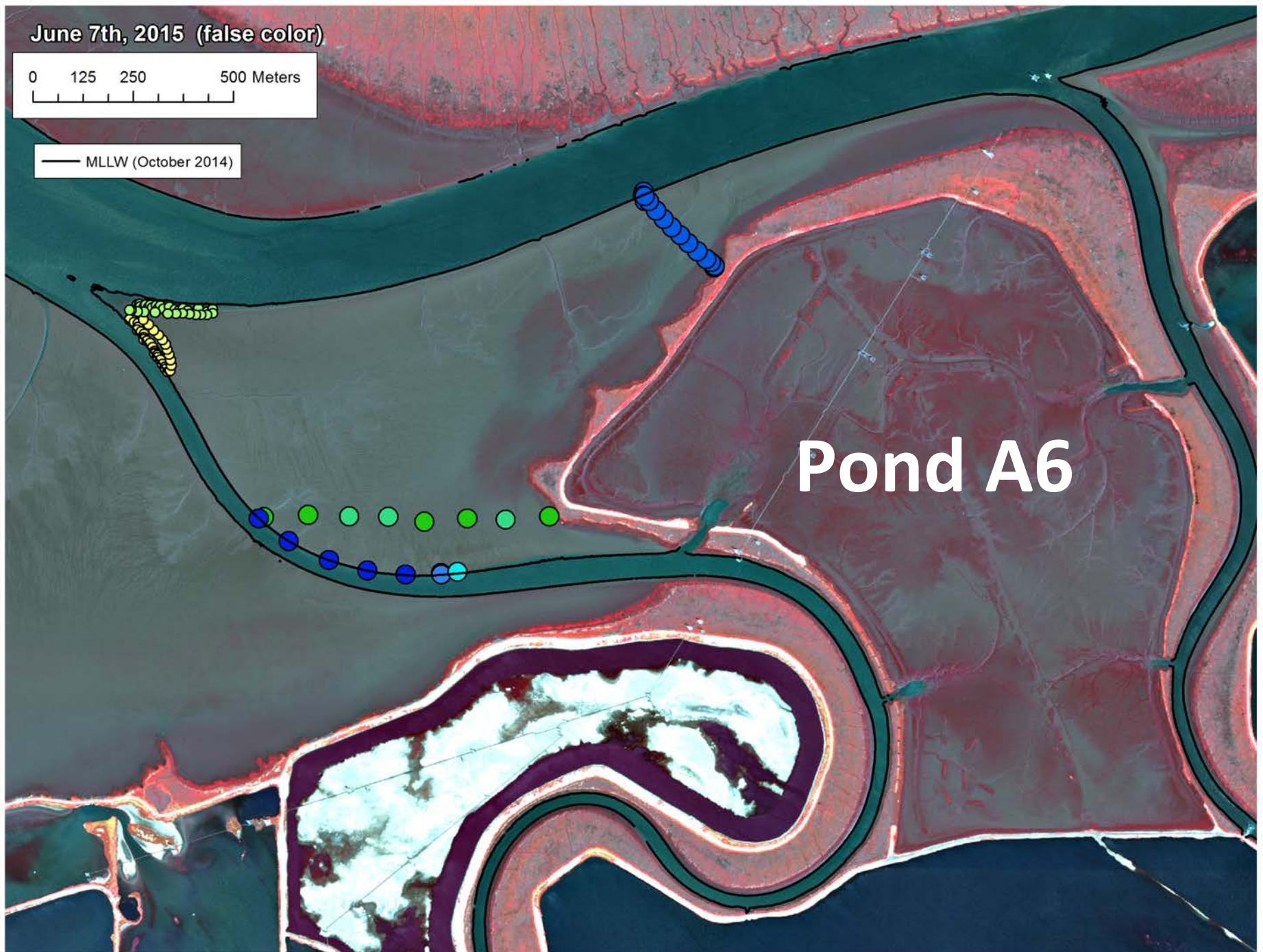
June 7th, 2015 (false color)

0 125 250 500 Meters



— MLLW (October 2014)

Pond A6



Step 2a: Map Mudflats with Multispectral Remote Sensing (WorldView3) – *in process*

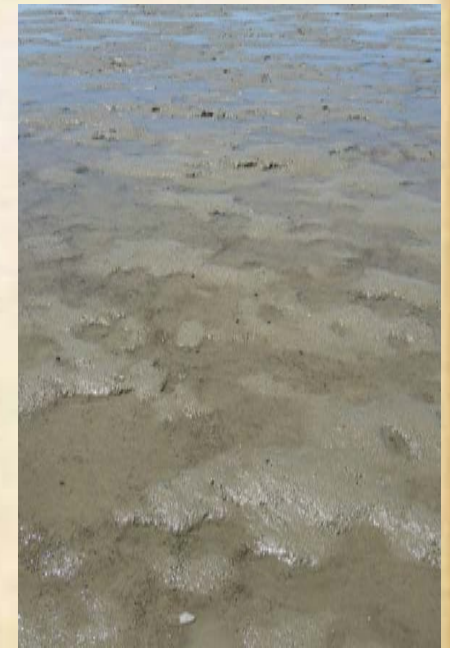
Mudflats spatial and spectral variability:

(1) exposed mudflats

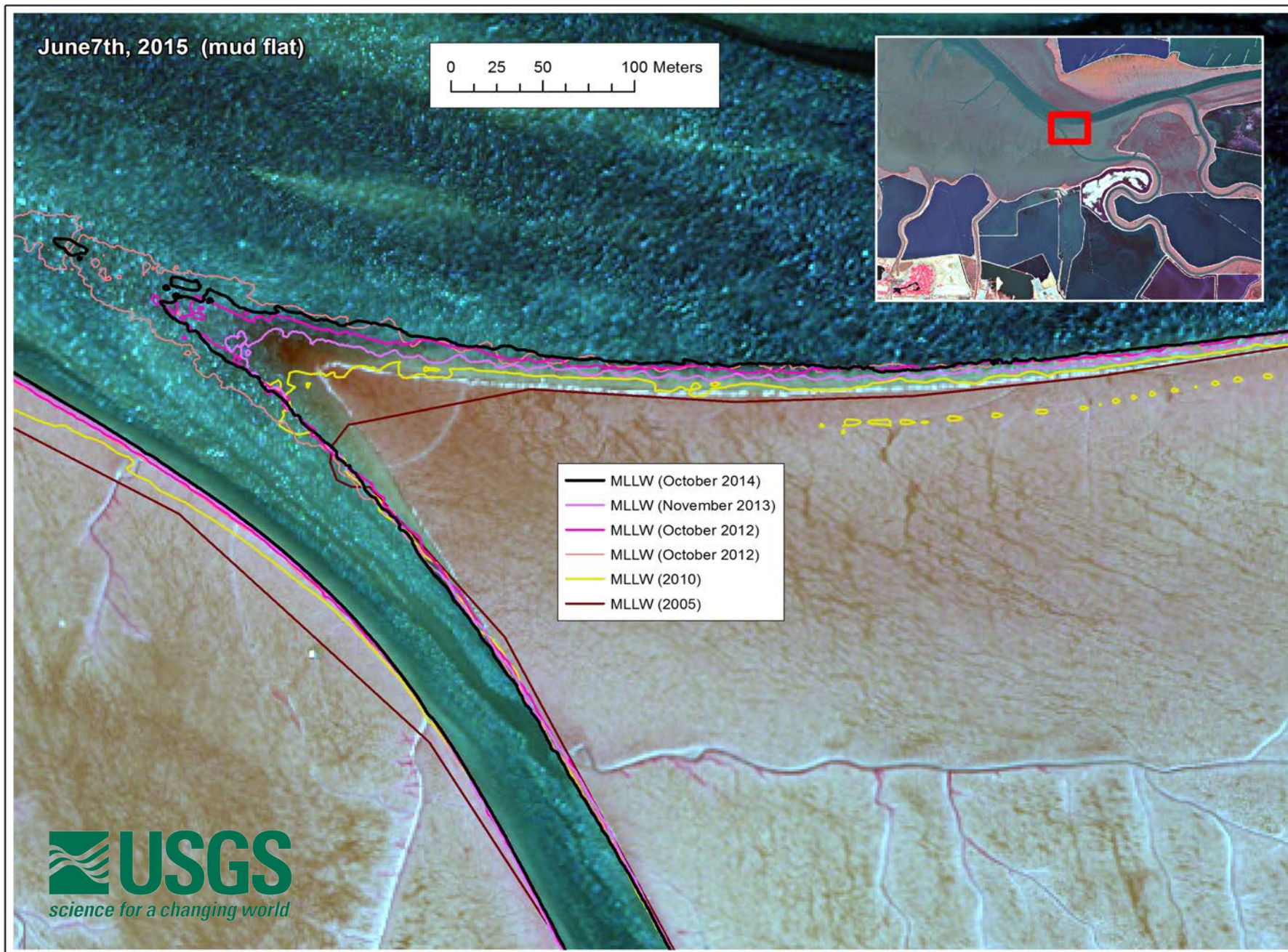
(2) mudflats with “ponding”

(3) mudflats under water (tidal issues) and mudflat “edge”

(4) mudflats with biofilm



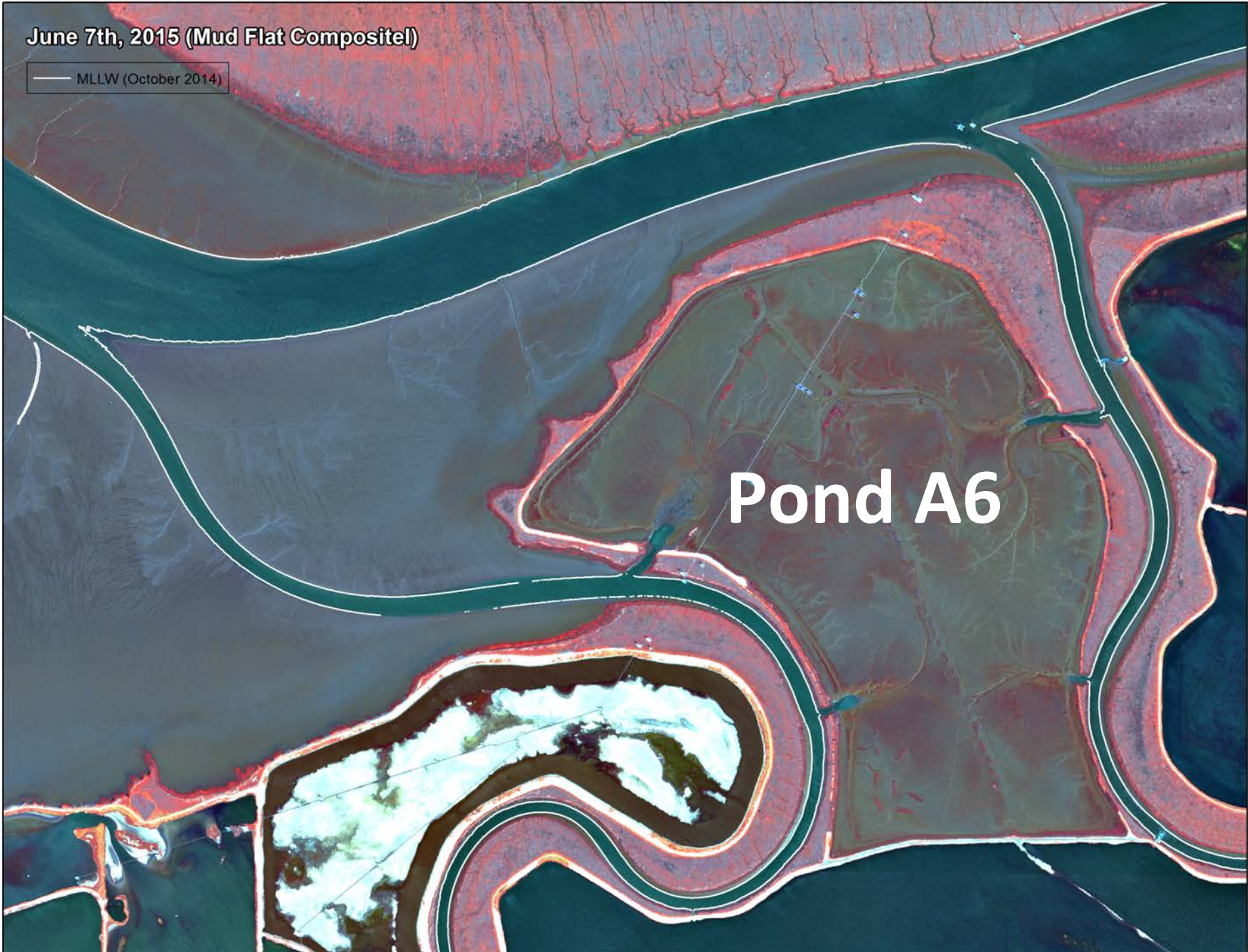
Step #2b: Use Lidar (MLLW) as baseline Mudflat "edge" - *in process*



June 7th, 2015 (Mud Flat Compositel)

— MLLW (October 2014)

Pond A6



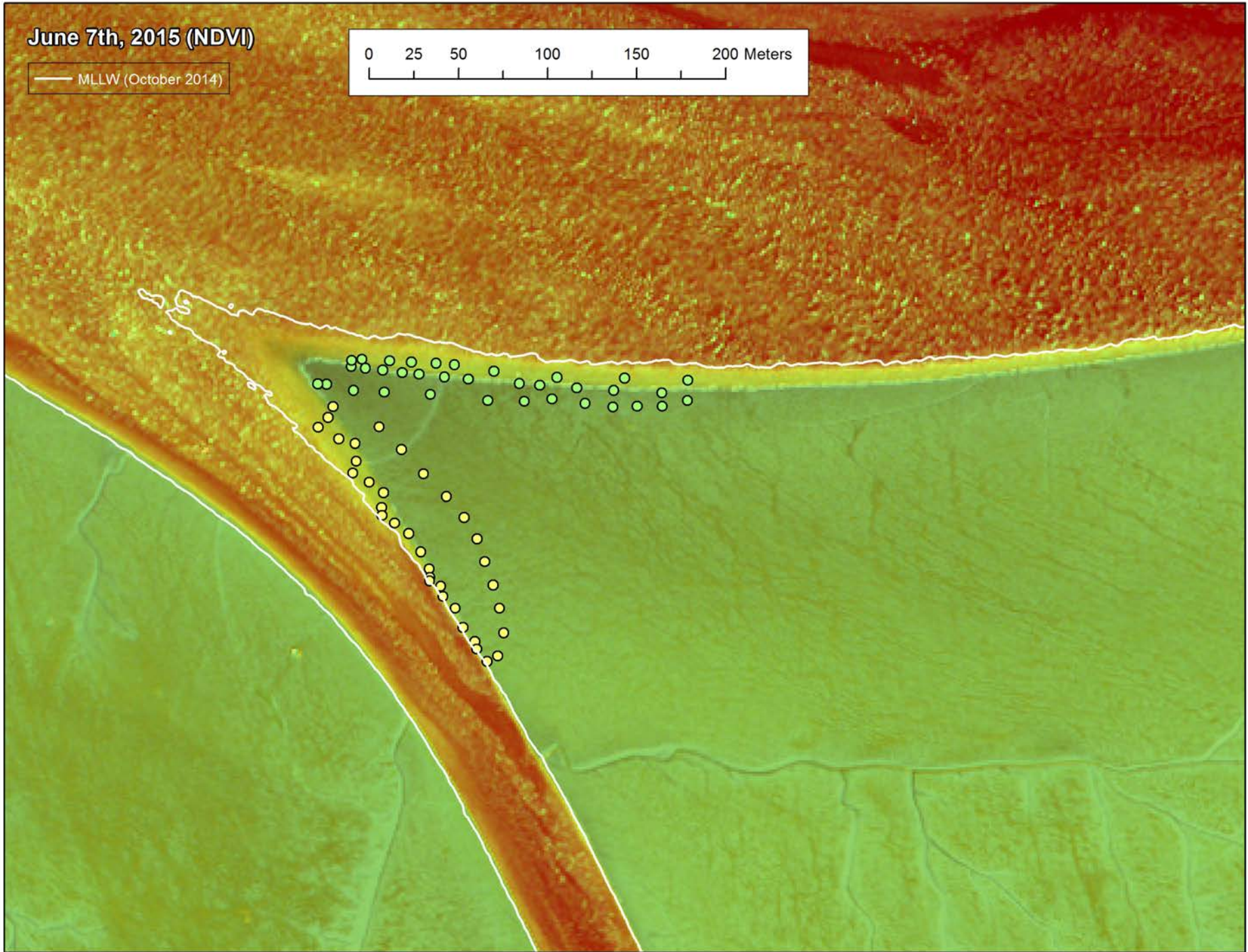
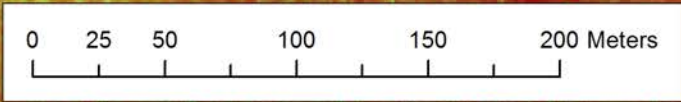
June 7th, 2015 (NDVI)

— MLLW (October 2014)



June 7th, 2015 (NDVI)

— MLLW (October 2014)



June 7th, 2015 (Mud Flat)

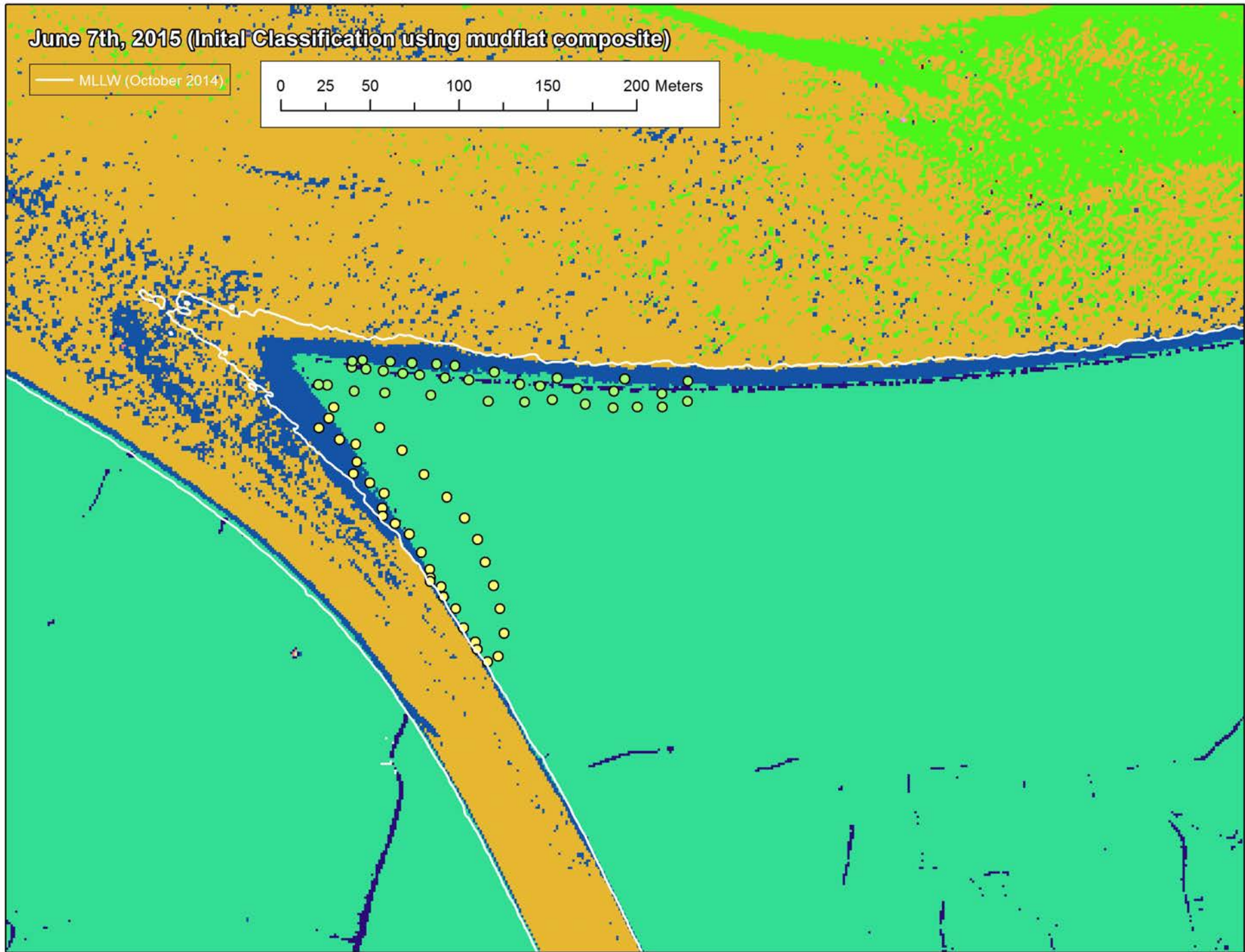
0 25 50 100 150 200 Meters

— MLLW (October 2014)

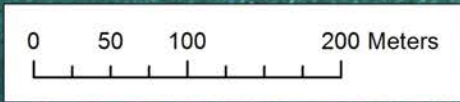


June 7th, 2015 (Initial Classification using mudflat composite)

— MLLW (October 2014)



June 7th, 2015 (mud flat)

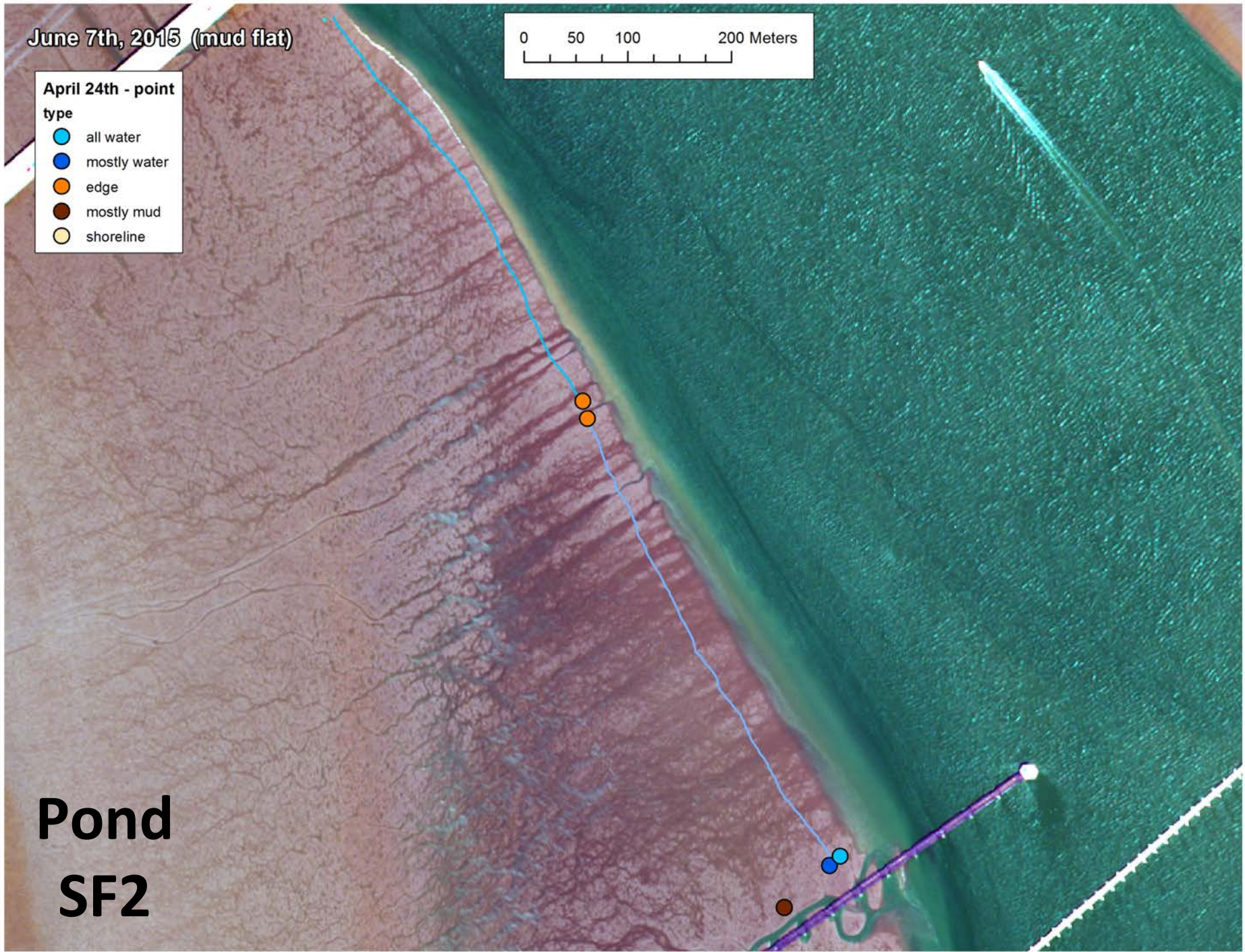


April 24th - point

type

- all water
- mostly water
- edge
- mostly mud
- shoreline

Pond
SF2

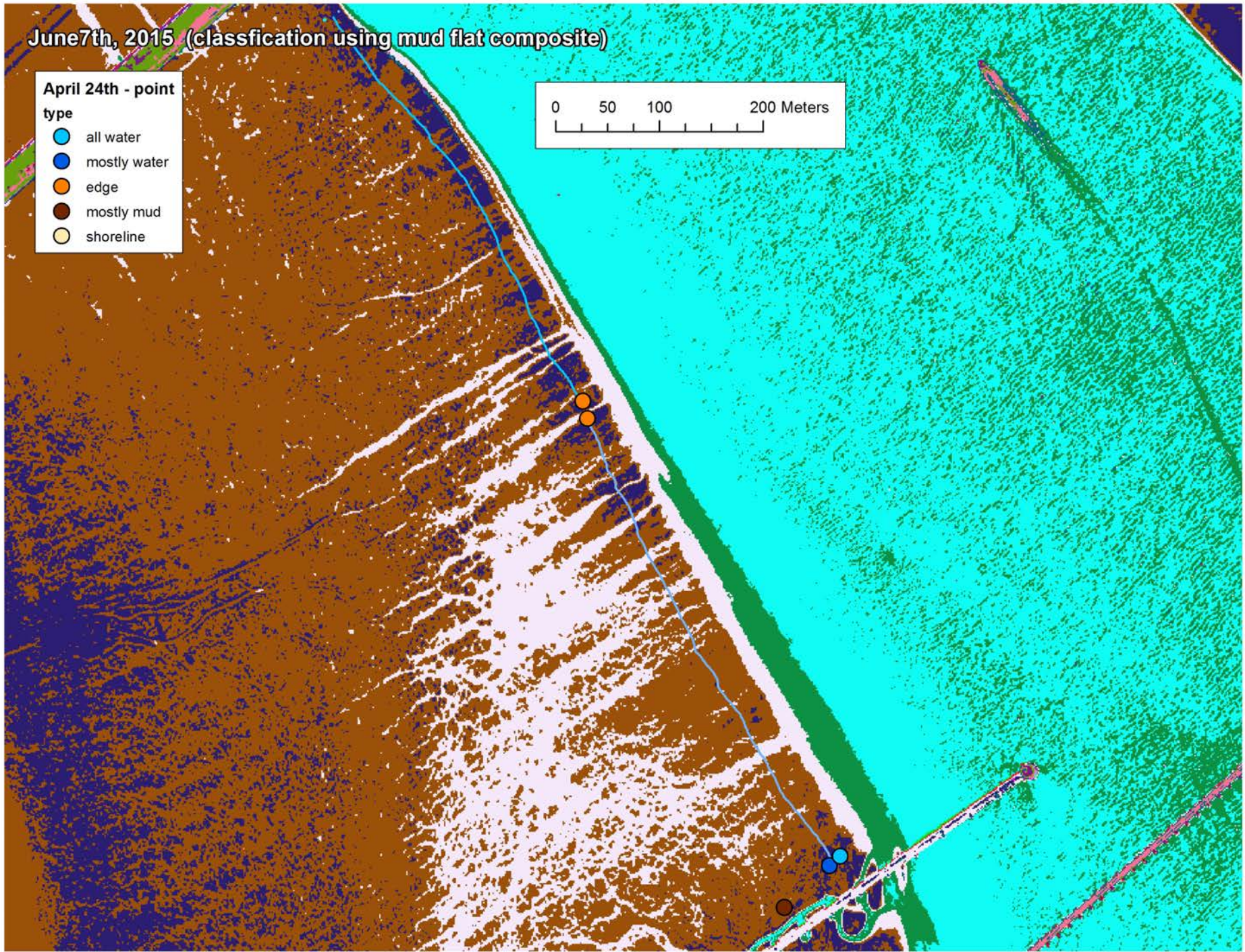
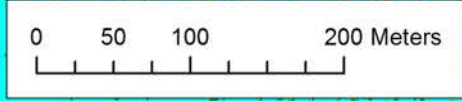


June 7th, 2015 (classification using mud flat composite)

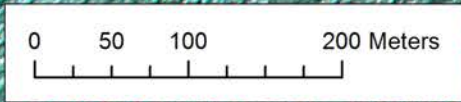
April 24th - point

type

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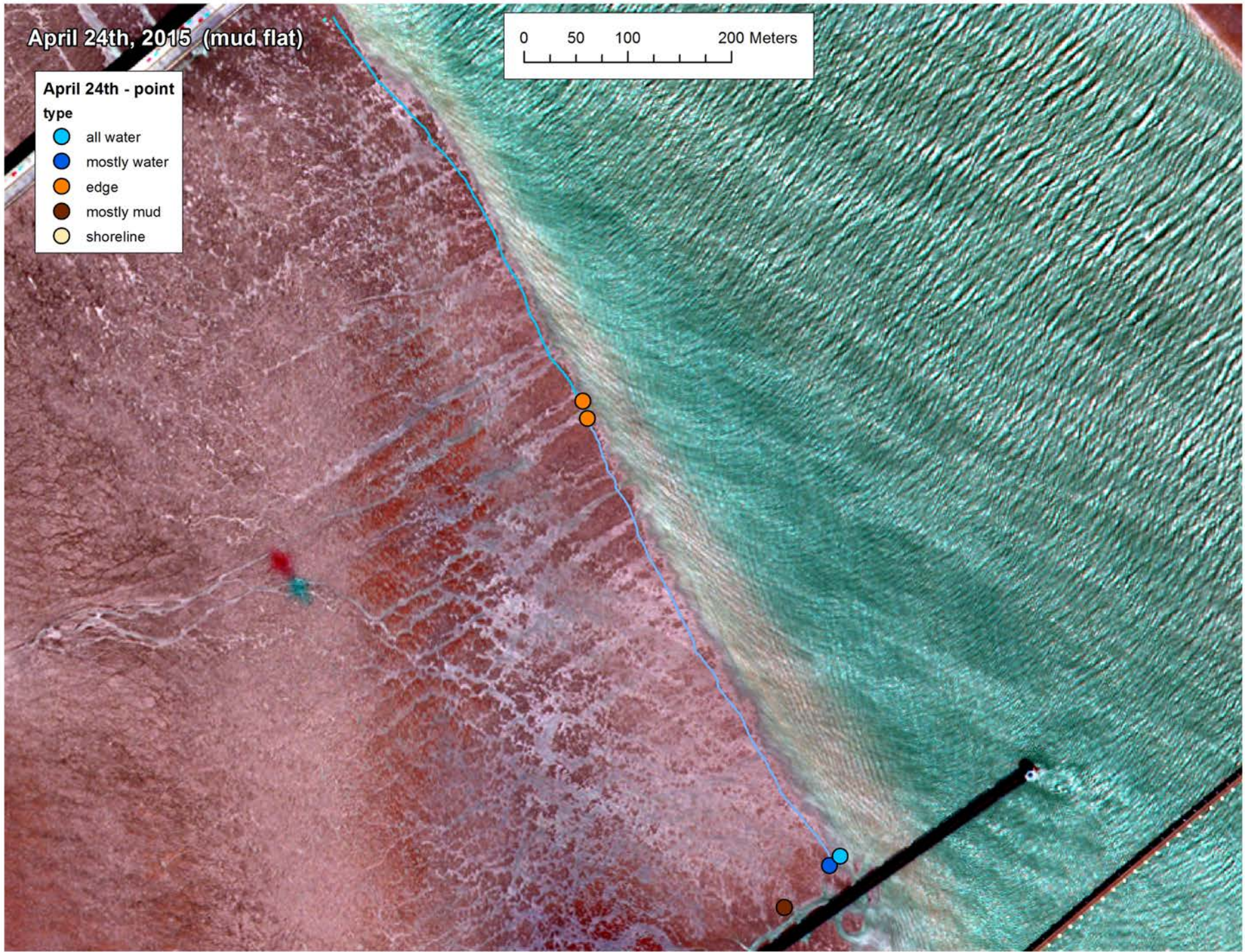
April 24th, 2015 (mud flat)



April 24th - point

type

- all water
- mostly water
- edge
- mostly mud
- shoreline



Step #3: Use Unmanned Aerial Surveillance (UAS) to map mudflats (currently unfunded)

Significant advantages over satellite imaging *for smaller areas*:

- (1) significant increase in time flexibility for image acquisition
- (2) potentially increase in spectral and spatial accuracy
 - in shallow water, turbid water, and mudflats w/ biofilm
 - lower elevation and higher time over site

Also:

- (3) cost effective for platform and sensor
- (4) serve as calibration for satellite mapping over entire SBSRP area

Step #3: Use Unmanned Aerial Surveillance (UAS) to map mudflats (currently unfunded)



The AggieAir is a multispectral remote sensing unmanned aerial vehicle (UAV) available by collaboration with Dr Chen at UC Merced

The MESA Lab Mechatronics, Embedded Systems and Automation



H. Chao, A. Jensen, Y. Han, Y. Chen, & M. McKee. 2009.

Commercial-off-the-shelf camera and image sensor. Camera could support Coastal Blue Band by replacing the visible light filter with a custom (400-450nm) narrow band filter

Acknowledgments



Mud Flat Mapping Project



Questions?

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