

Gravel Augmentation and Channel Form: Lowden Ranch



**Long-term Gravel Augmentation Objective:
Supply gravel to maintain fluvial processes**

Create functional bar forms

Topographic and hydraulic diversity

Drive hyporheic flow

Increase edge length and shoreline complexity

Scour and fill to maintain substrate quality

Rejuvenate riparian zone

Promote channel migration

Gravel Augmentation Methods

Low-flow Gravel Placement

Build bars with heavy equipment

High-flow Gravel Injection

Inject gravel to be redistributed by flows

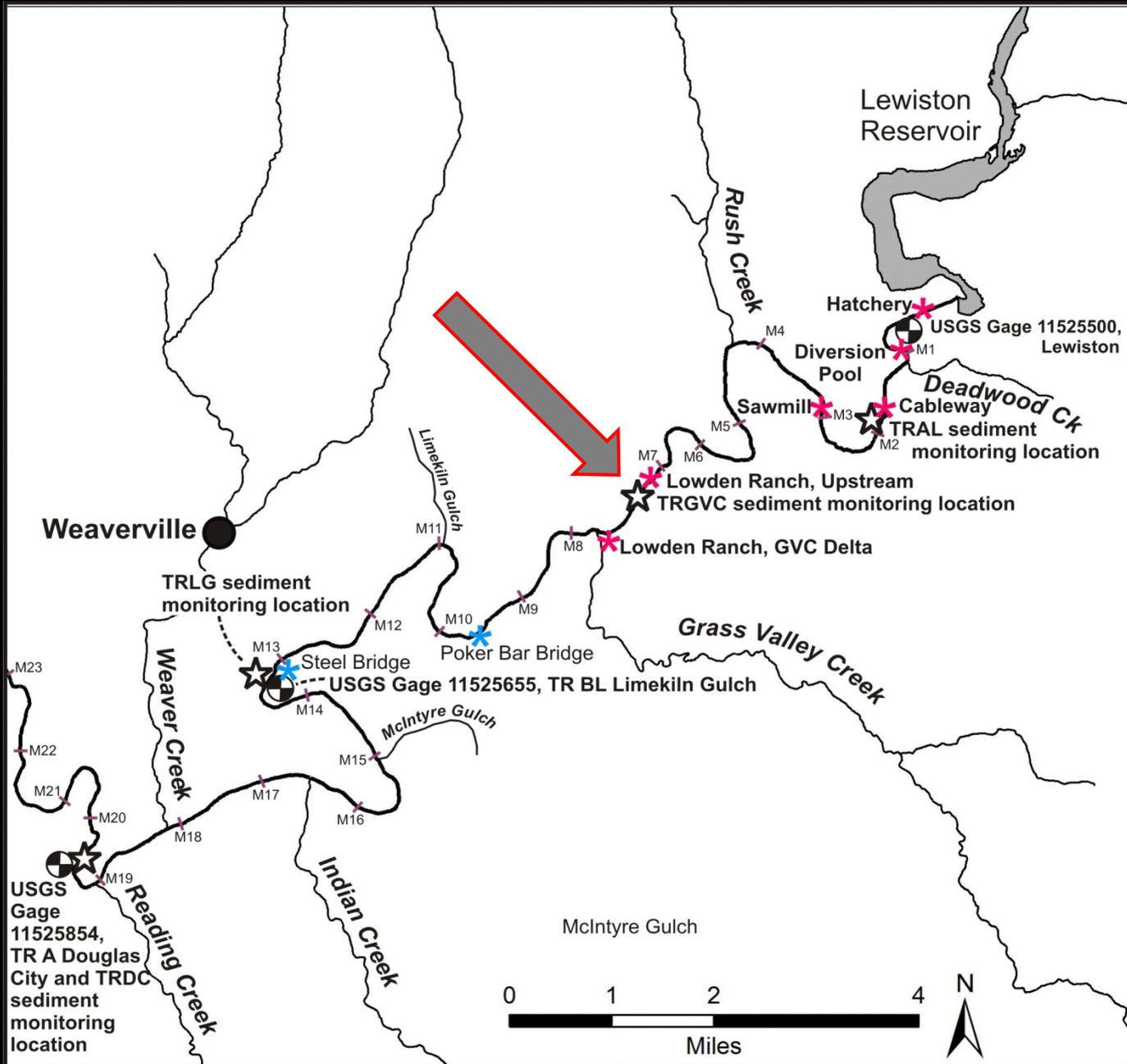
Dynamic Construction

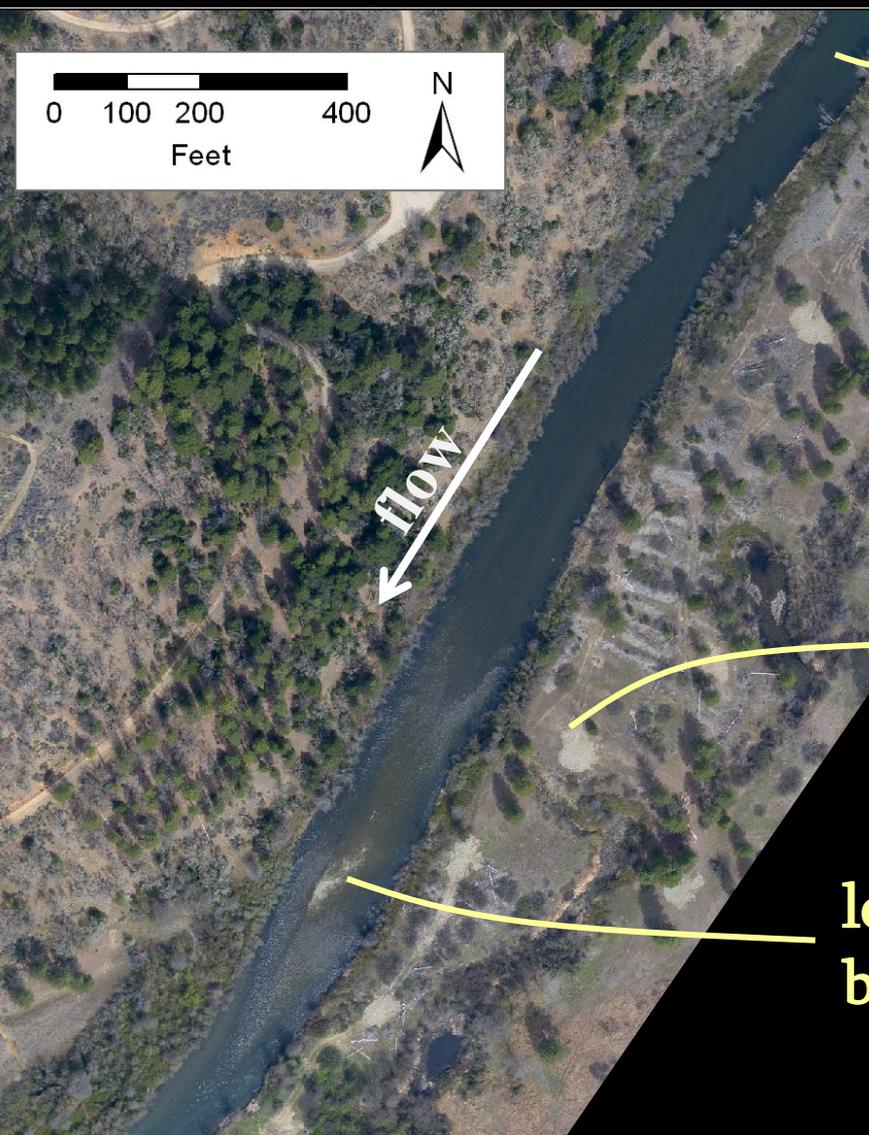
Inject gravel to build specific design features



NEW!

Gravel Augmentation Sites



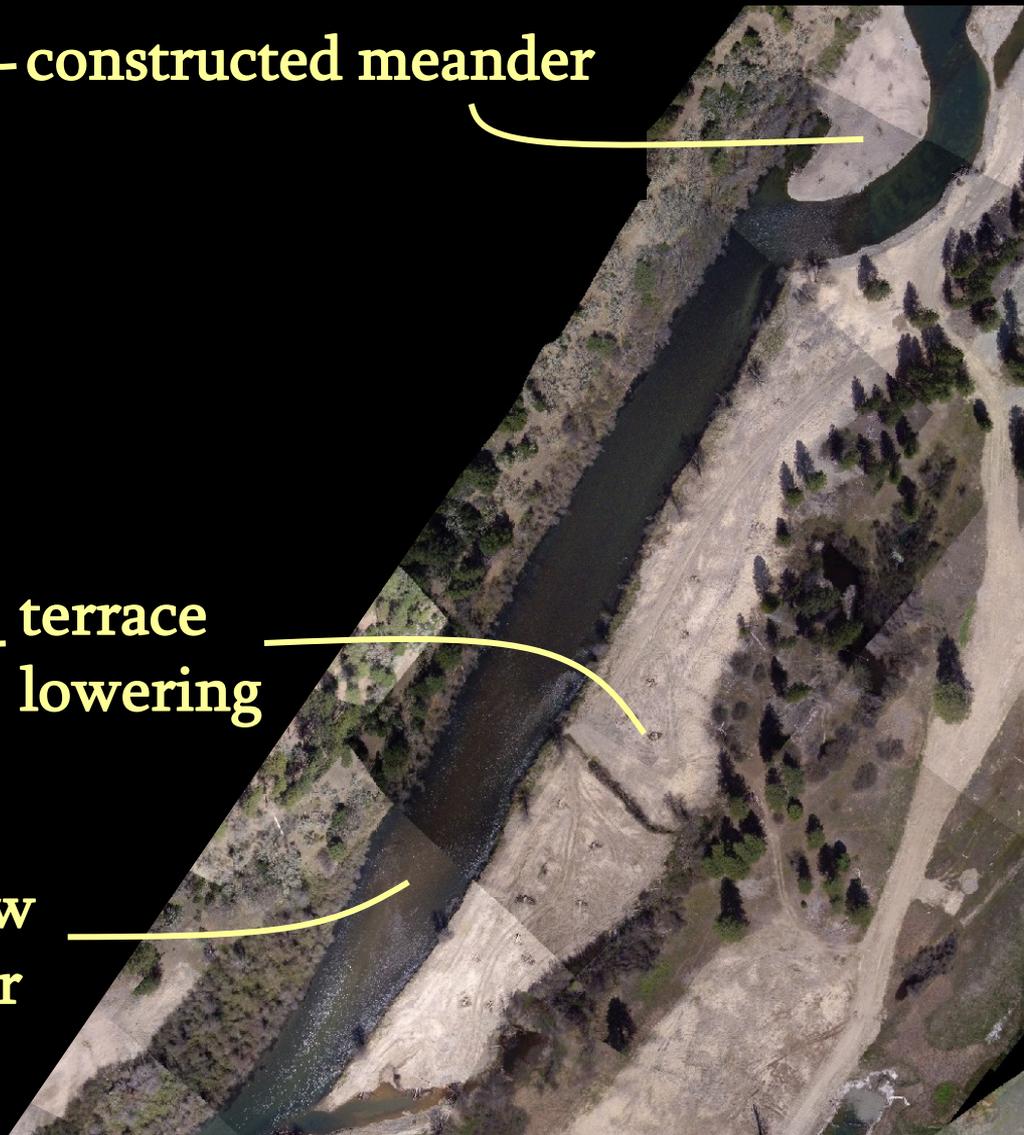


constructed meander

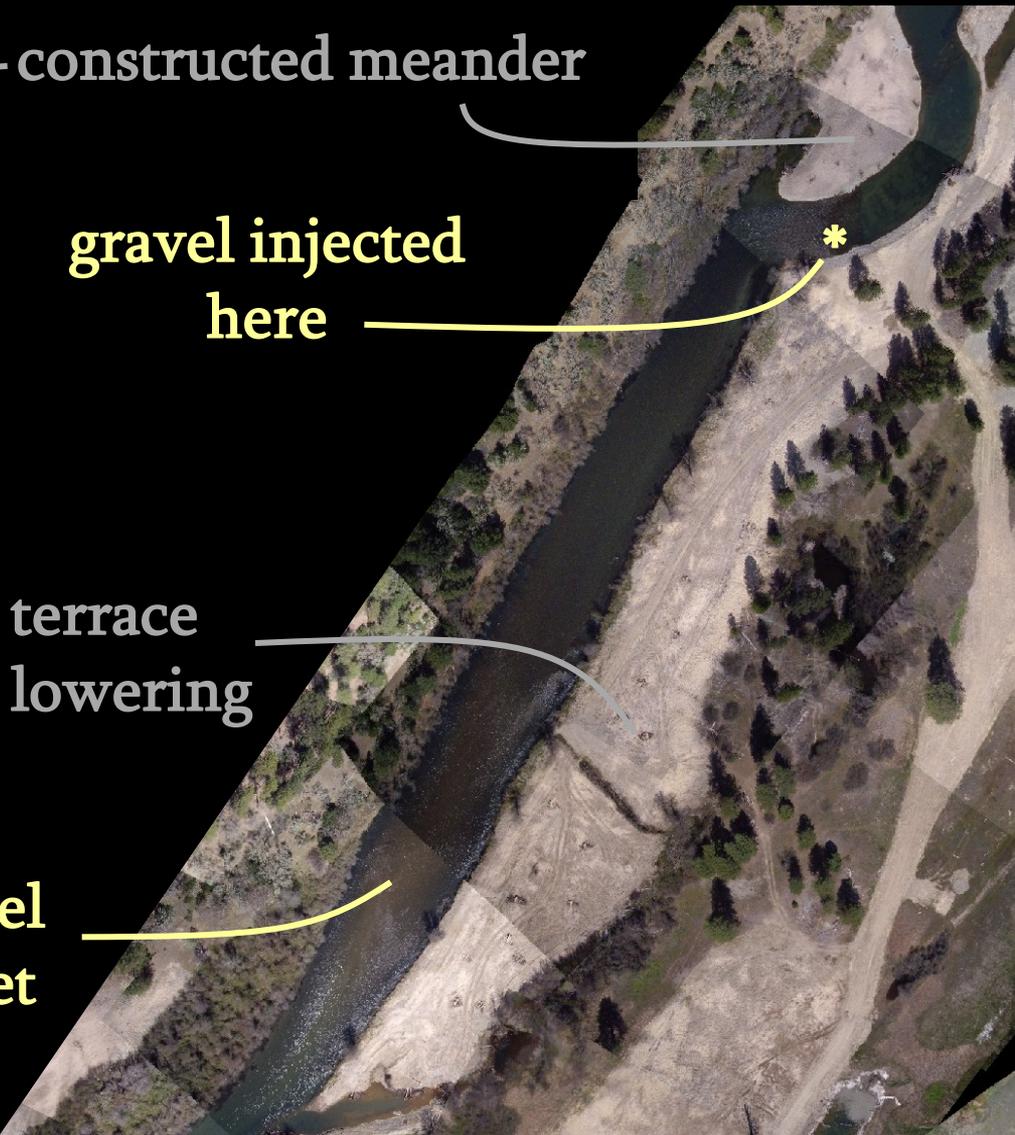
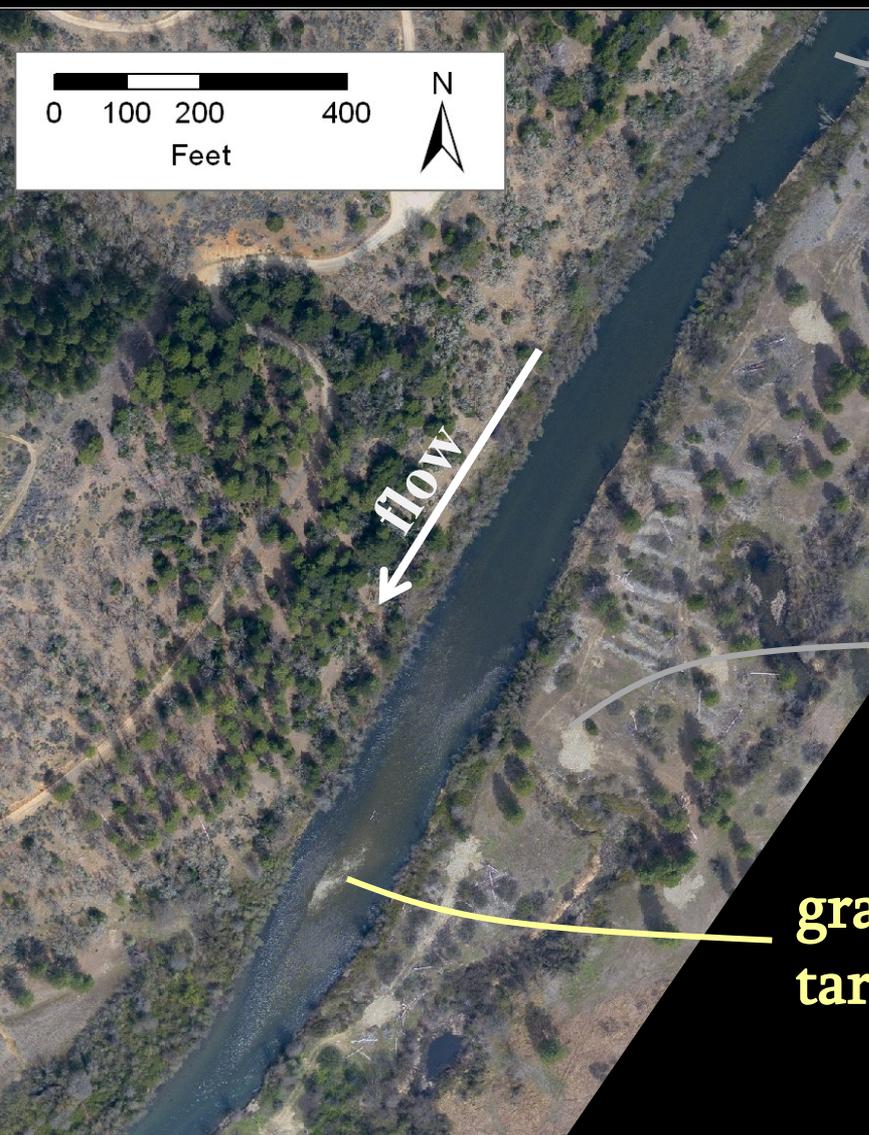
terrace lowering

low bar

2009: Pre-project



April 2011: As built, but before 2011 release and gravel injection



constructed meander

gravel injected here *

terrace lowering

gravel target

2009: Pre-project

April 2011: As built, but before 2011 release and gravel injection

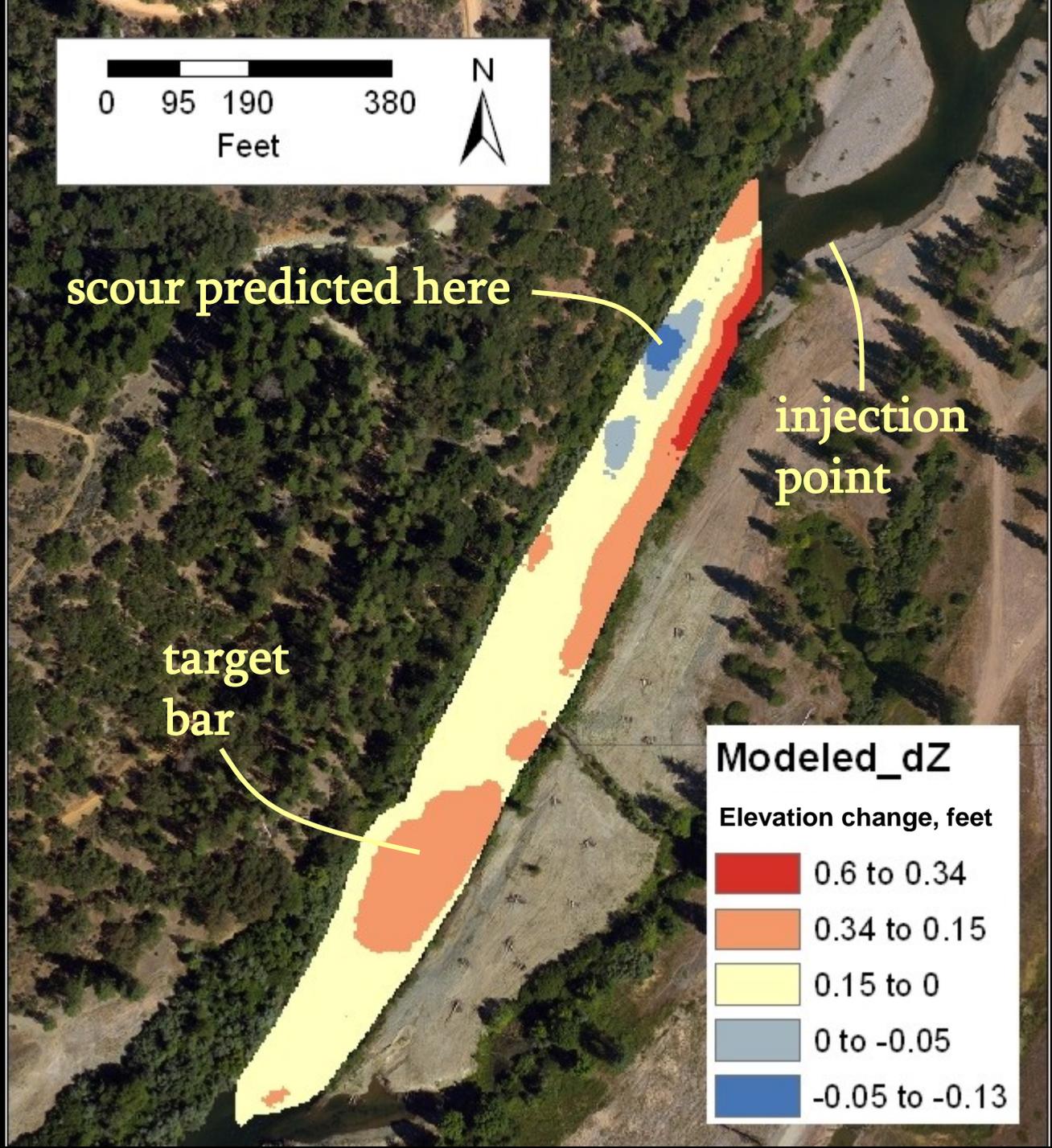
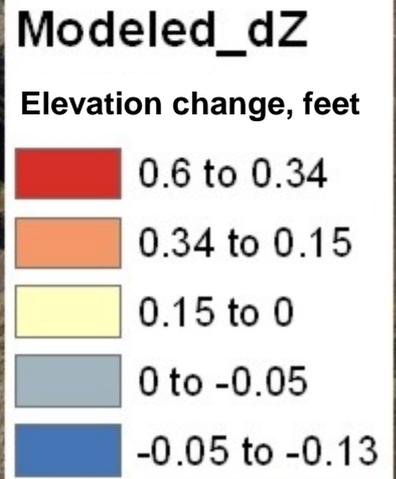
MODELED
change in bed
elevations after
injection of
2900 tons



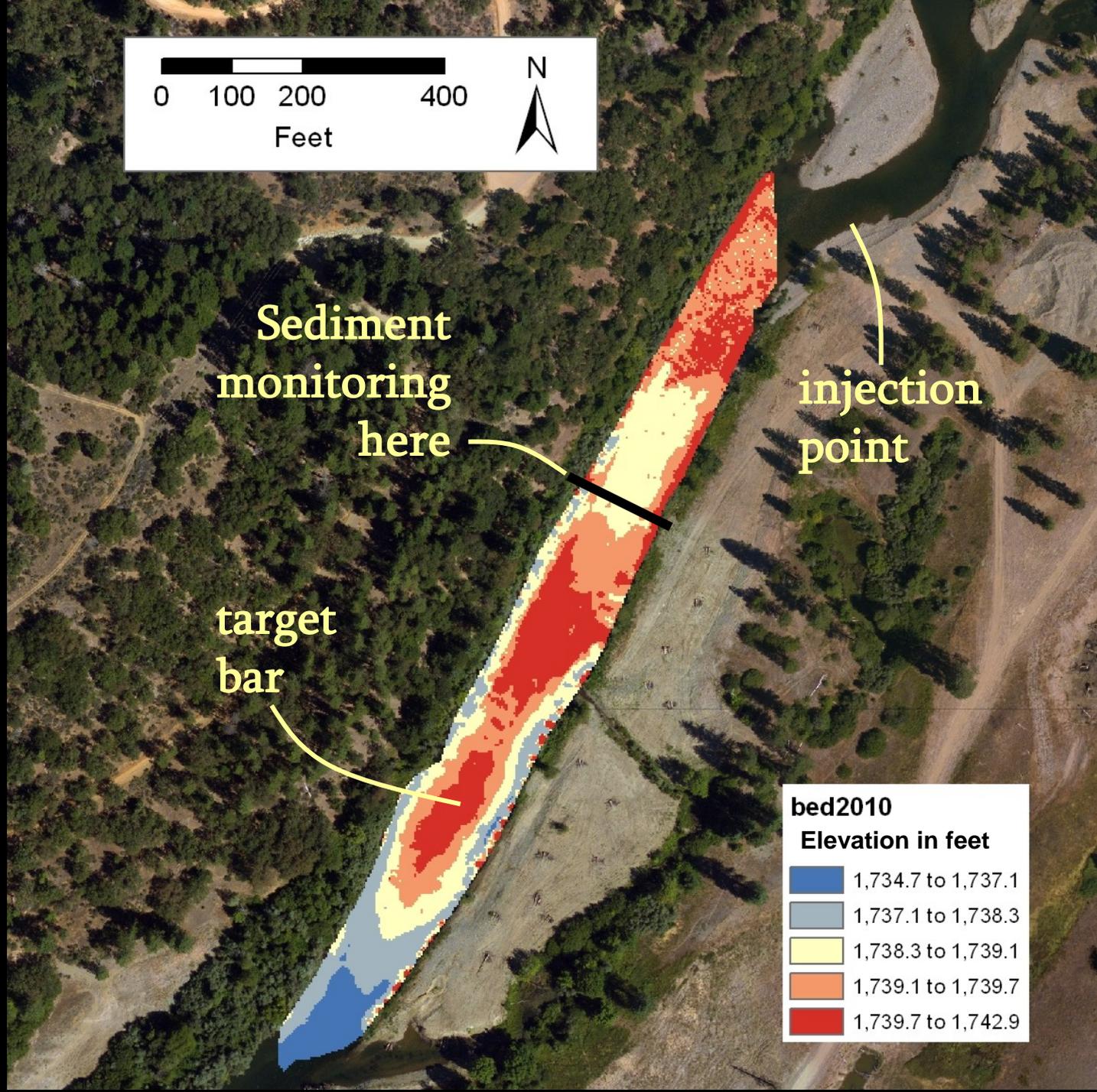
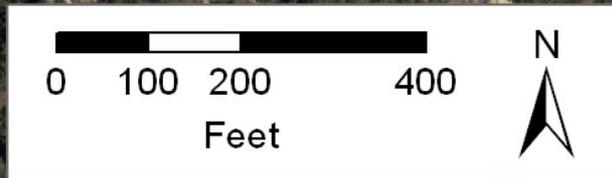
scour predicted here

injection
point

target
bar



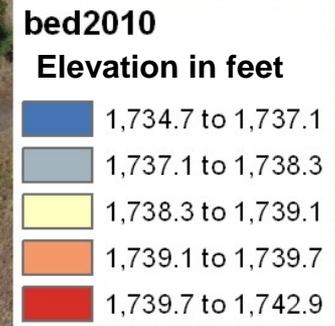
ACTUAL
bed elevations
BEFORE
injection
(summer 2010)



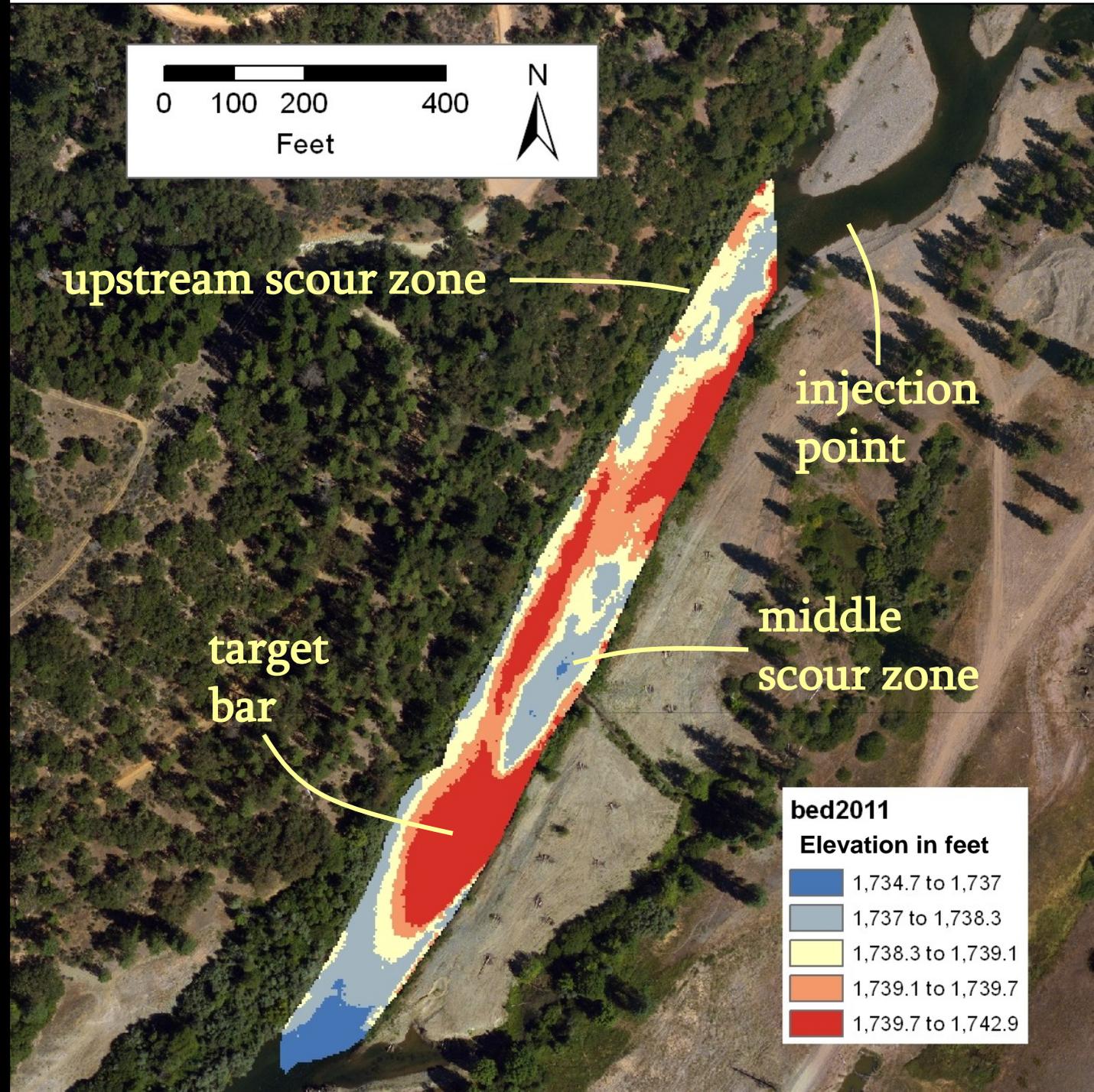
Sediment
monitoring
here

injection
point

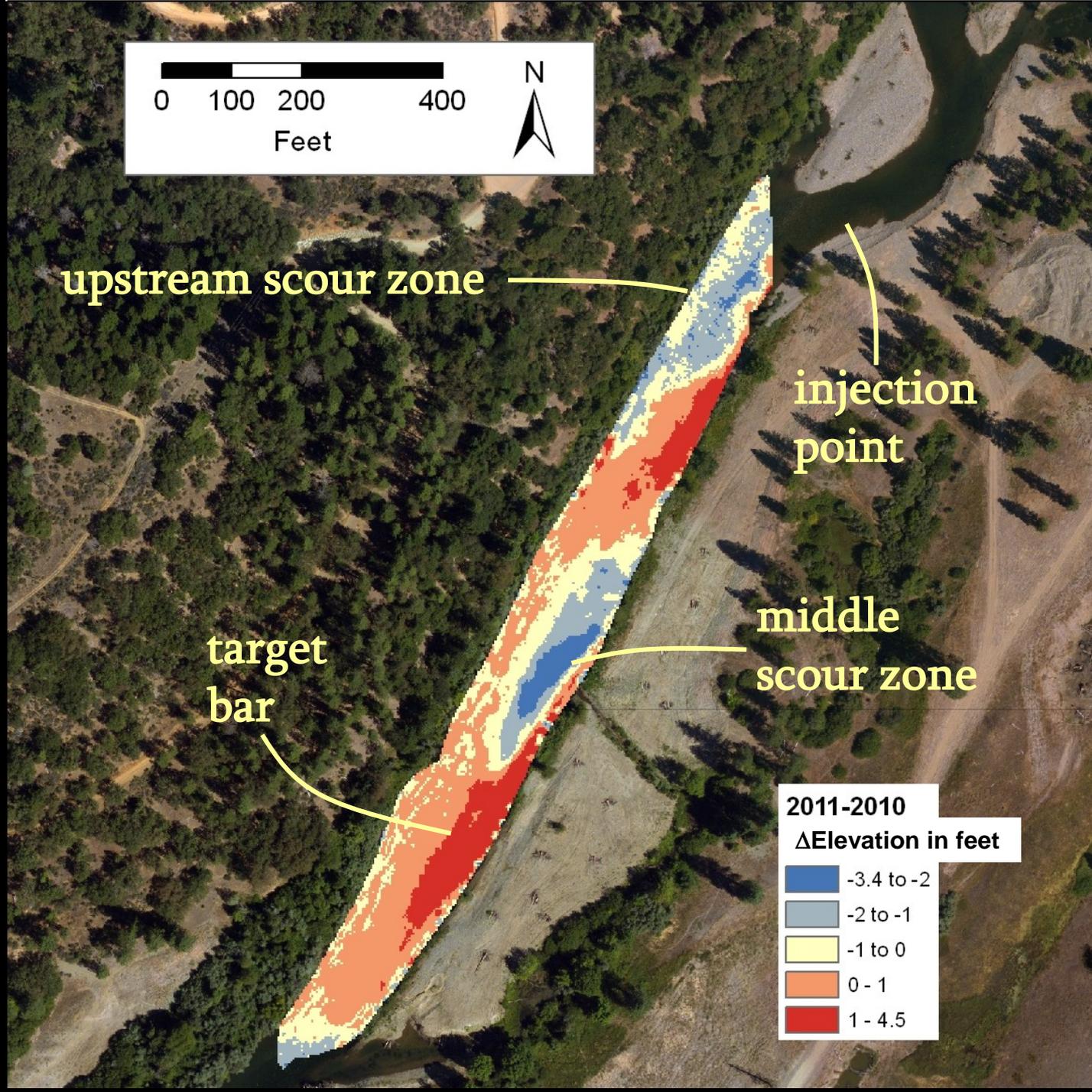
target
bar



ACTUAL
bed elevations
AFTER
injection
(summer 2011)

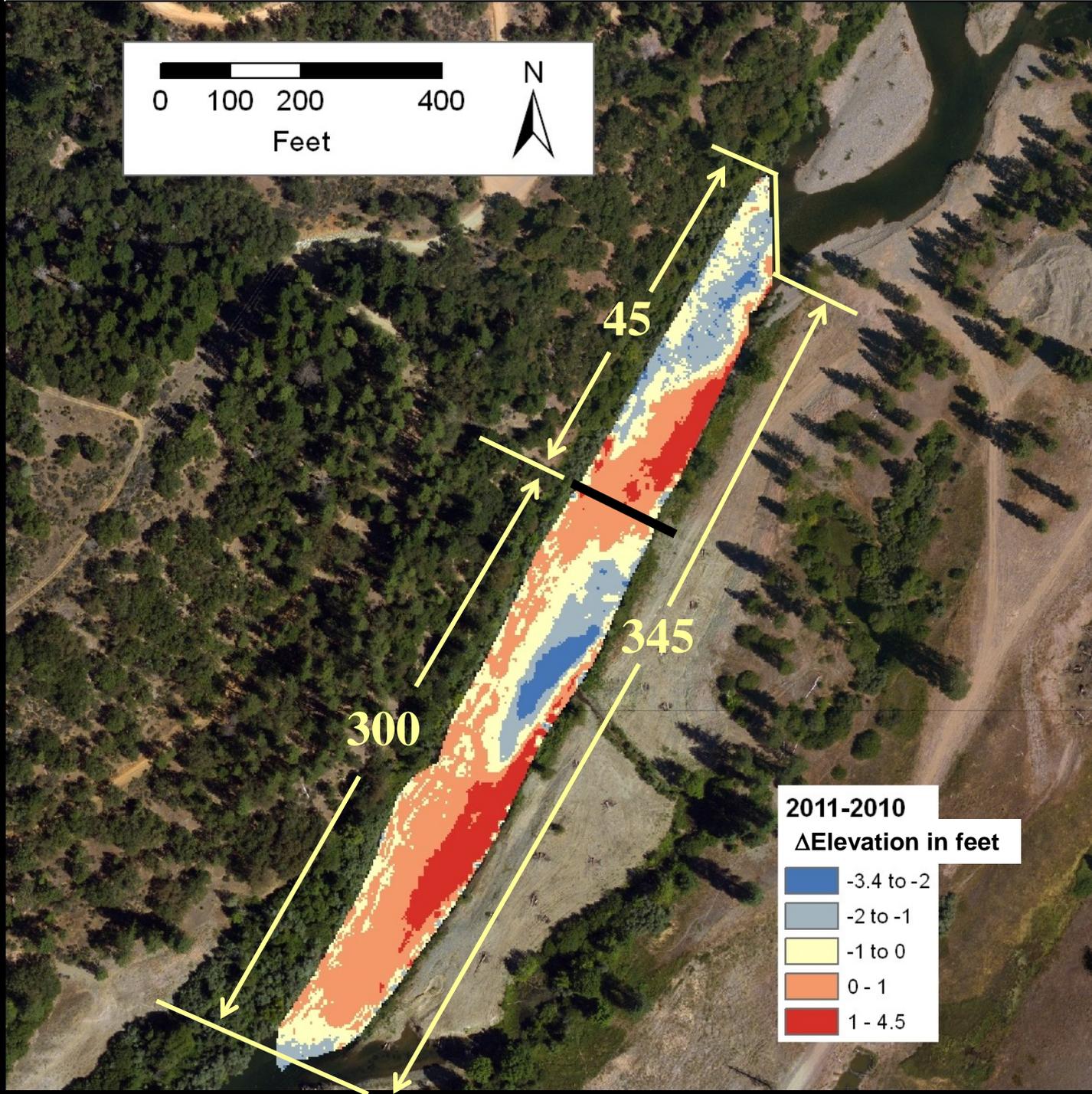


ACTUAL change in bed elevation, 2010-2011

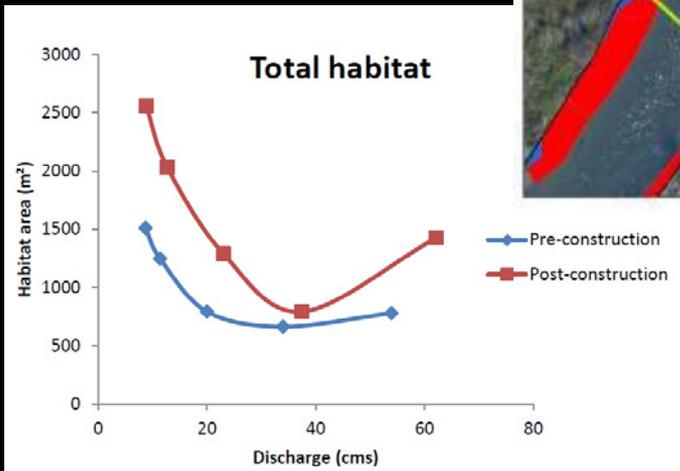
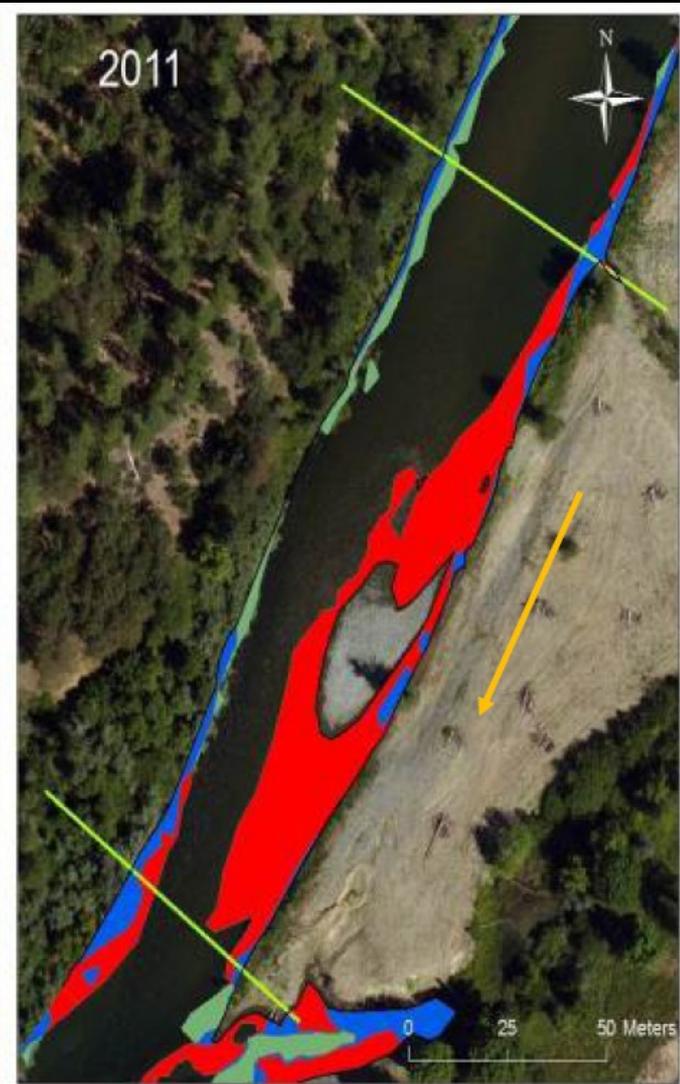




ACTUAL change in bed material storage (yd), 2010-2011

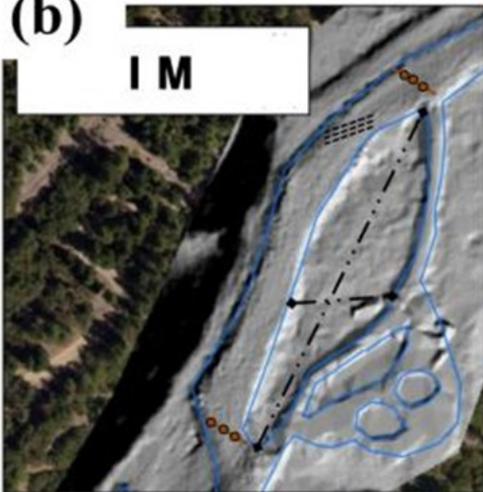


Lowden Ranch

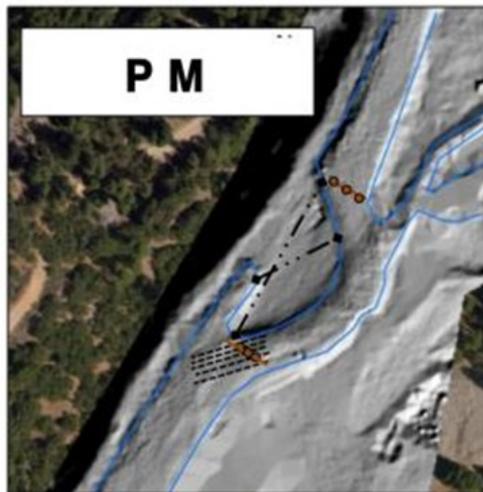


(b)

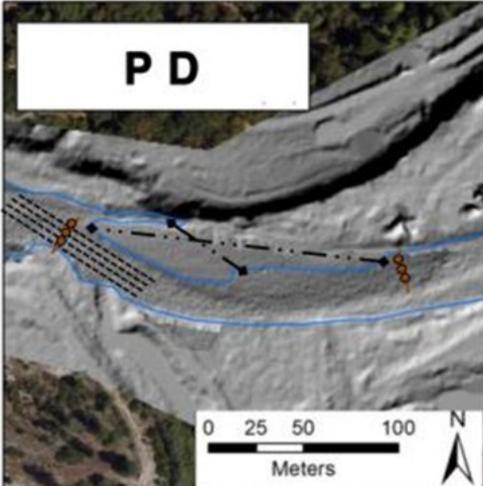
IM



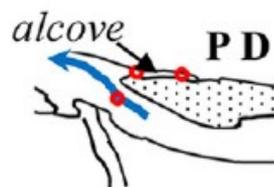
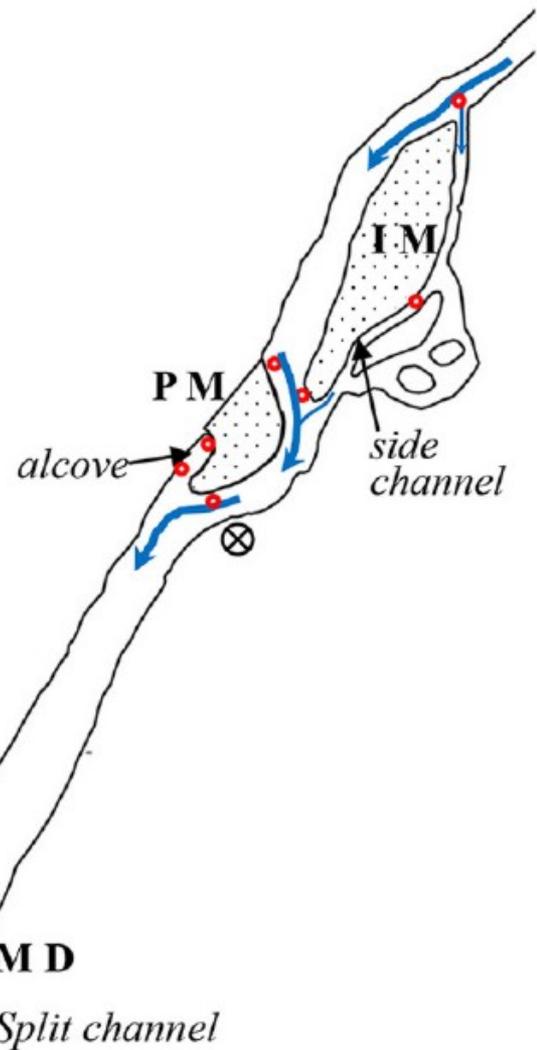
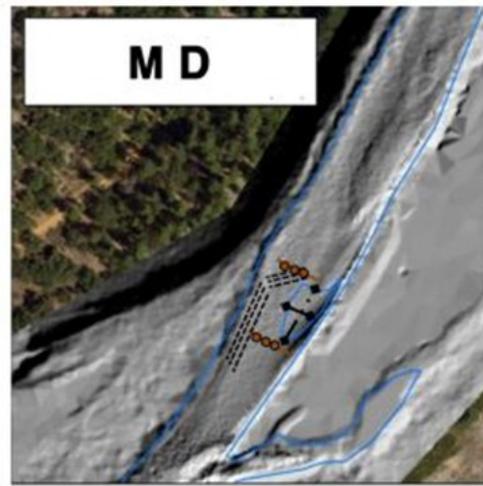
PM

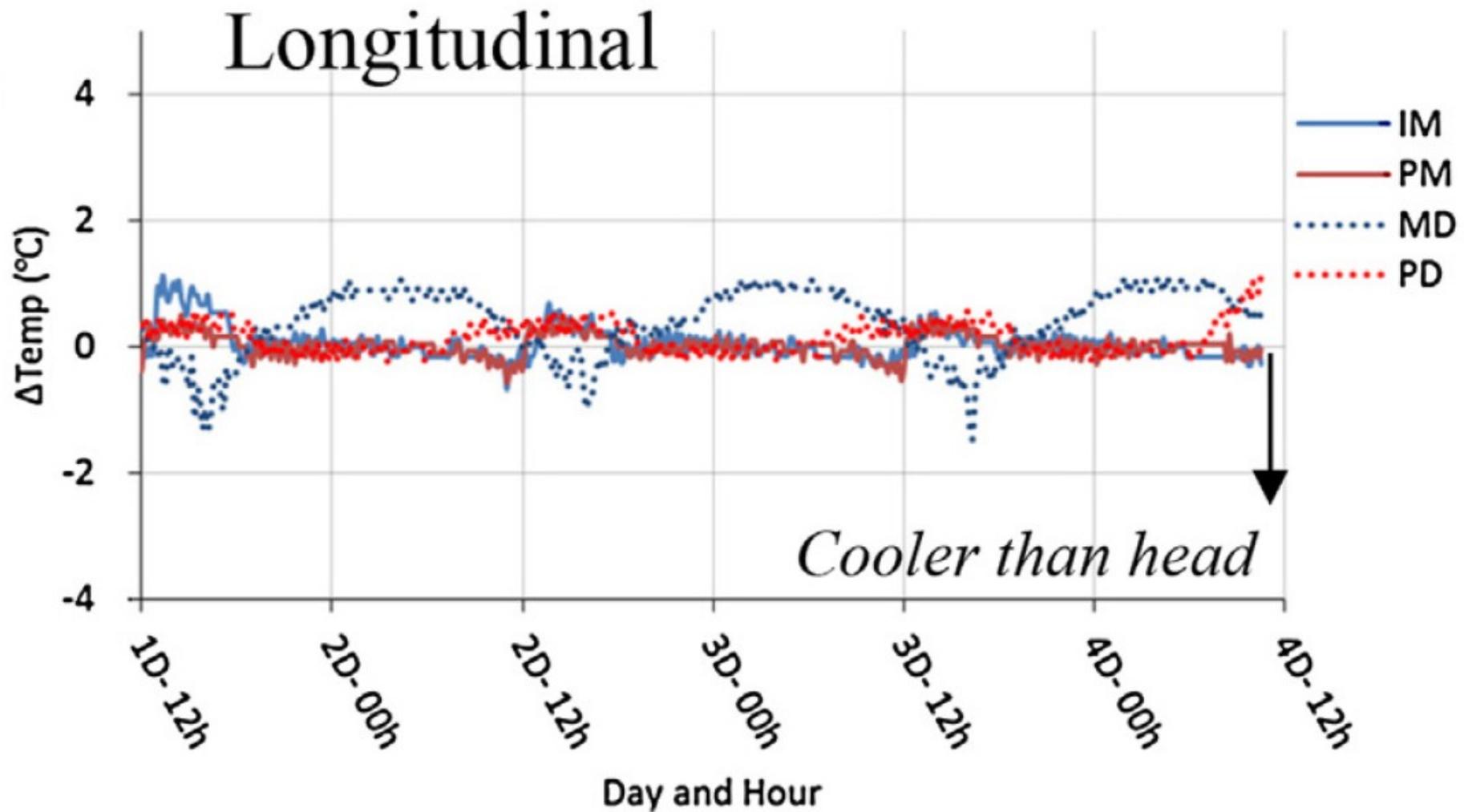


PD

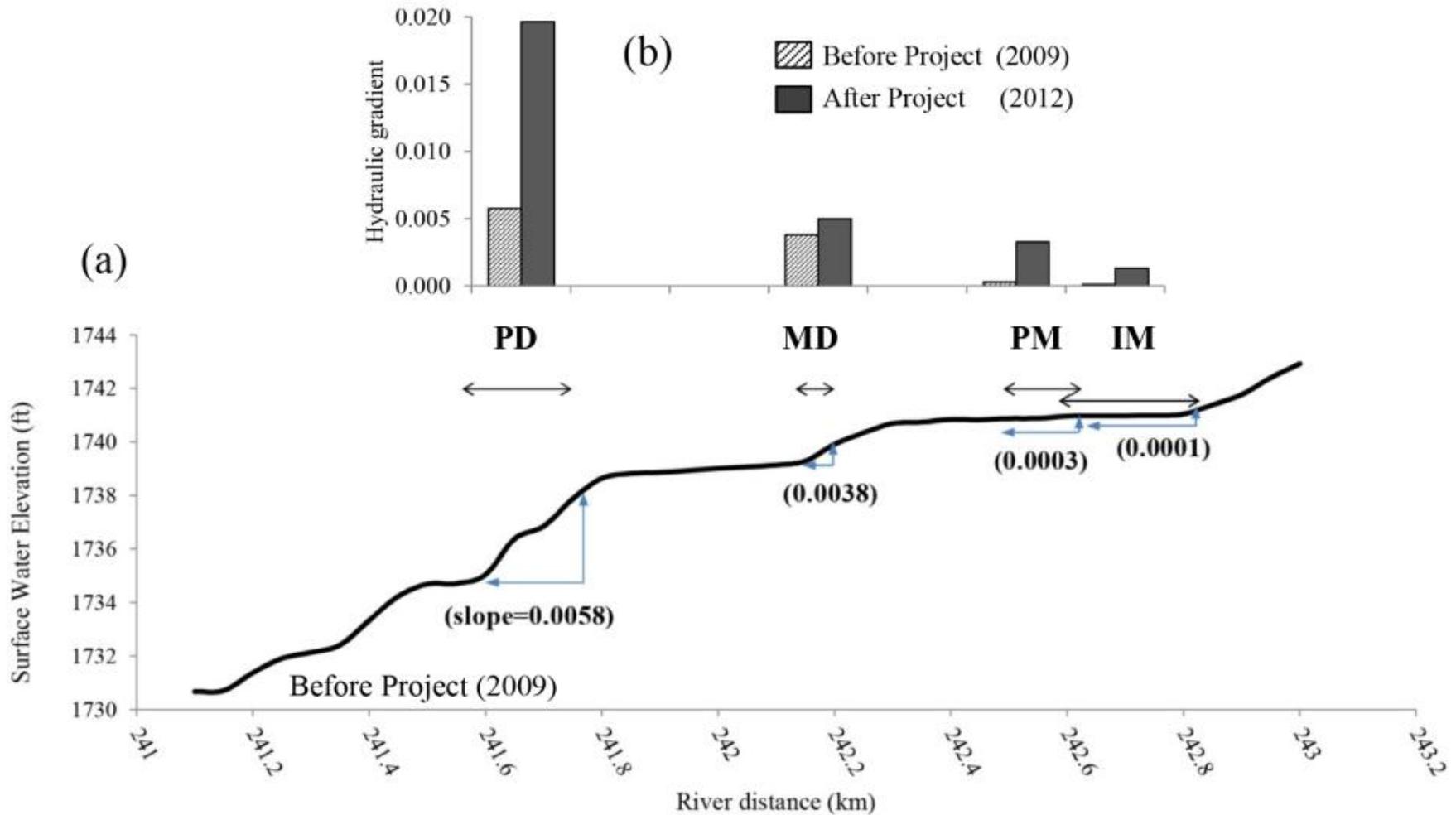


MD





Source: Ock, G., D. Gaeuman, J.M. McSloy, and G.M. Kondolf, 2015. Ecological function of restored gravel bars, the Trinity River, California. *Ecological Engineering* 83:49-60.



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Summary

Dynamic bar construction works:

- Height of the target bar increased by about 2 feet.

- Increased mainstem rearing habitat at baseflow

- Bed relief throughout response reach increased by 25-30%.

- A new alternate bar sequence was created.

Increases in bed complexity are the result of scour as well as deposition.

Fluvially-deposited bars are functionally superior to mechanically placed bars.

- Increased temperature modulation

- More POM retention

- Larger hydraulic gradients



Questions?





