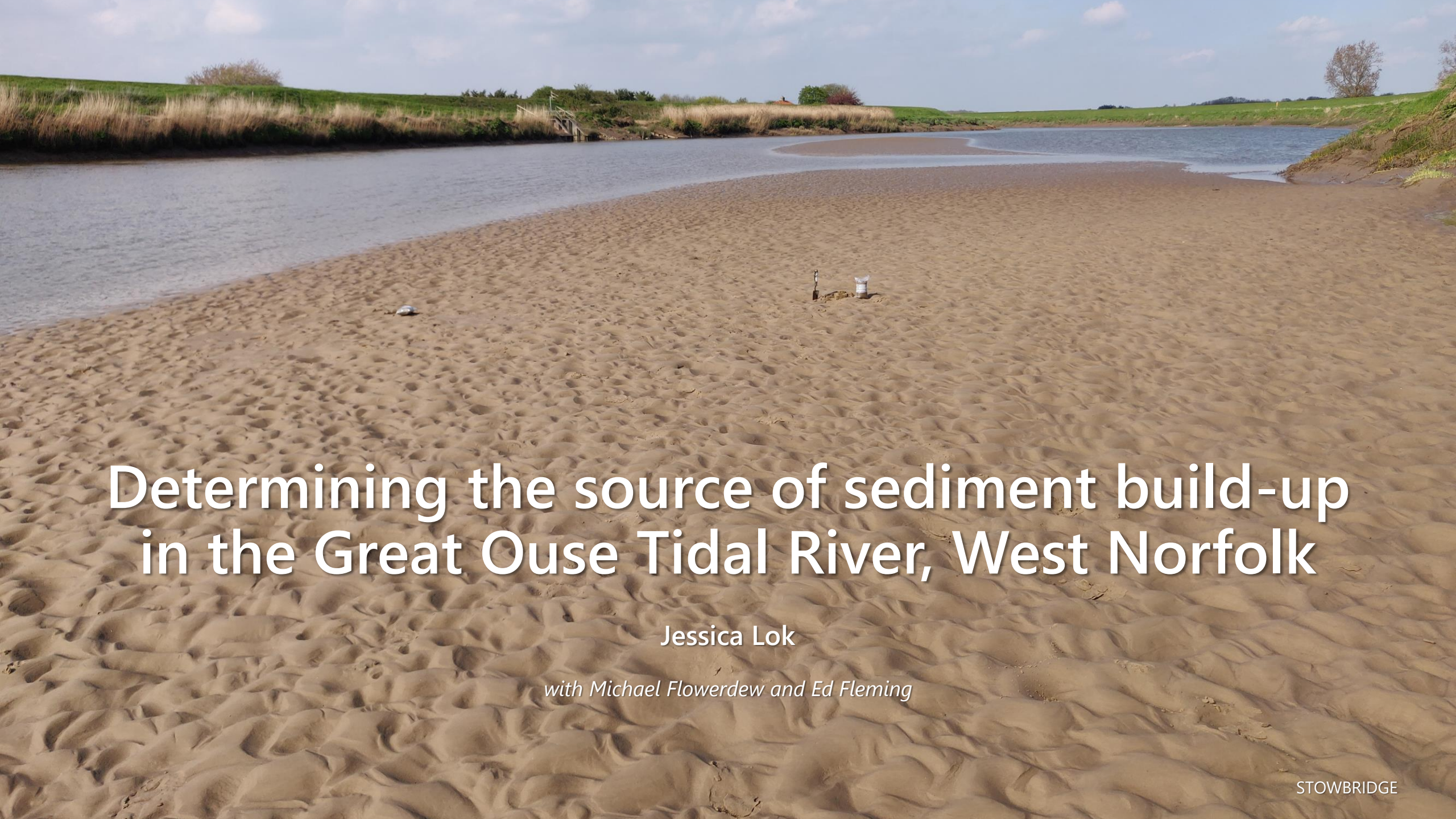


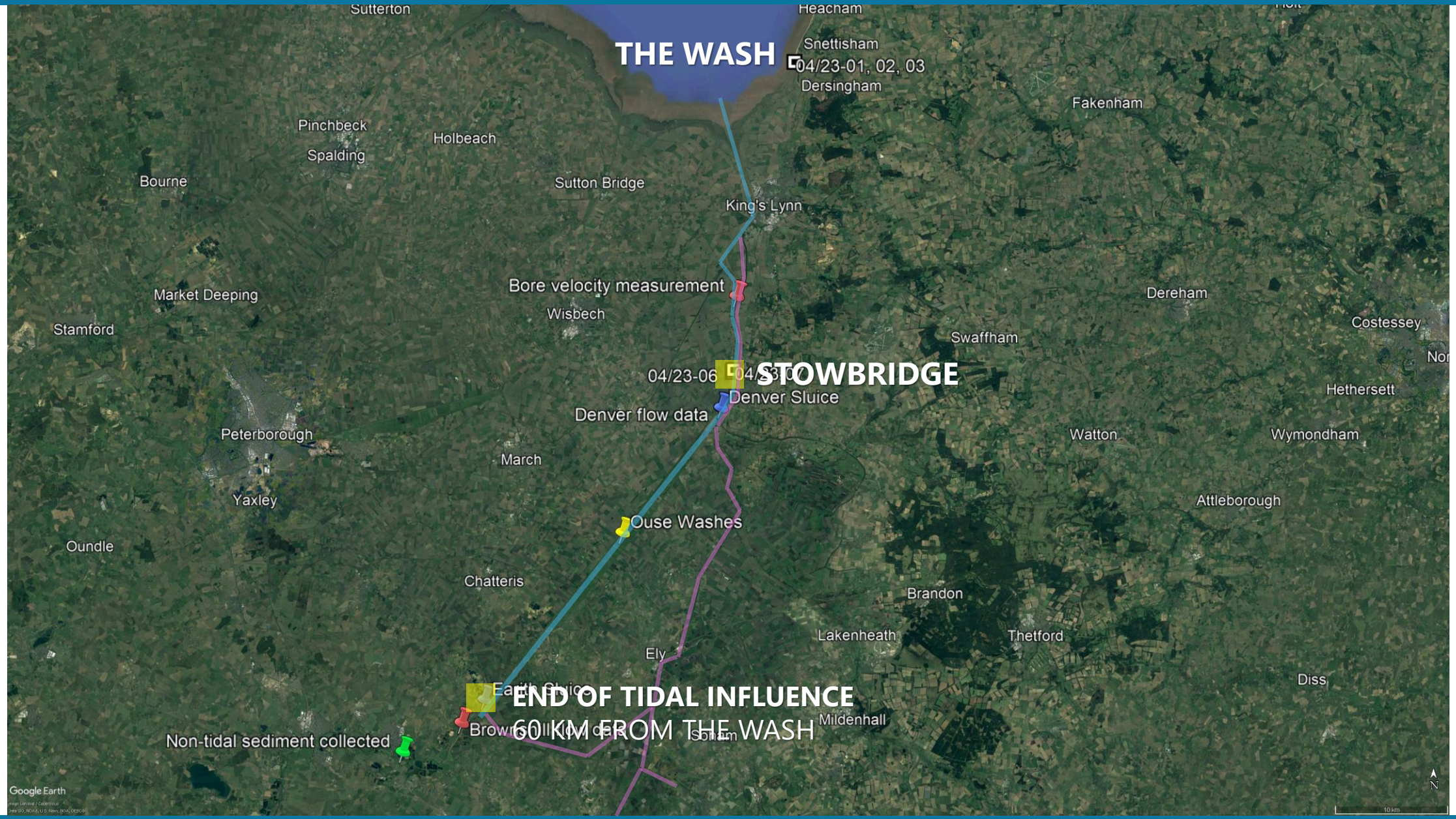
Determining the source of sediment build-up in the Great Ouse Tidal River, West Norfolk

Jessica Lok

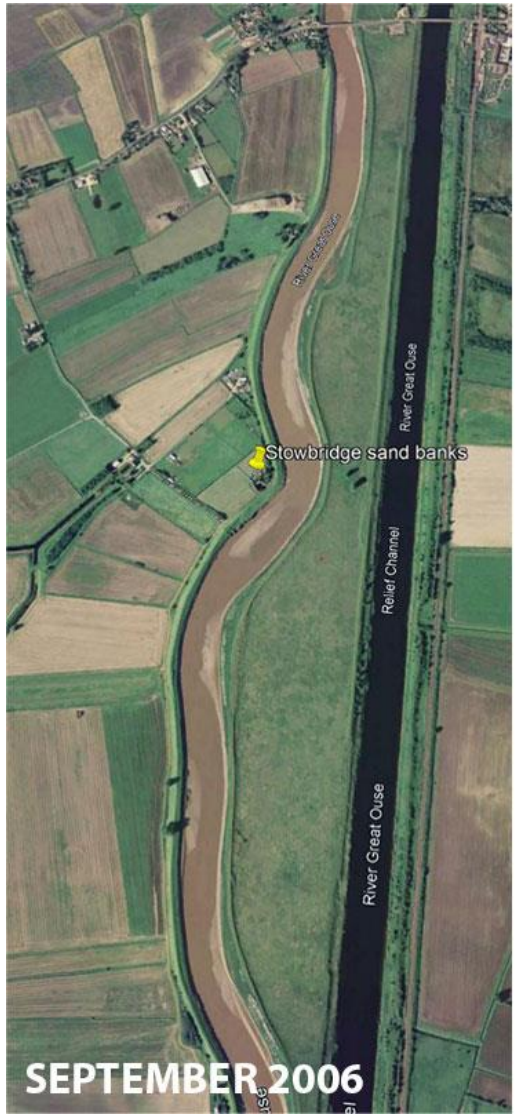
with Michael Flowerdew and Ed Fleming

STOWBRIDGE

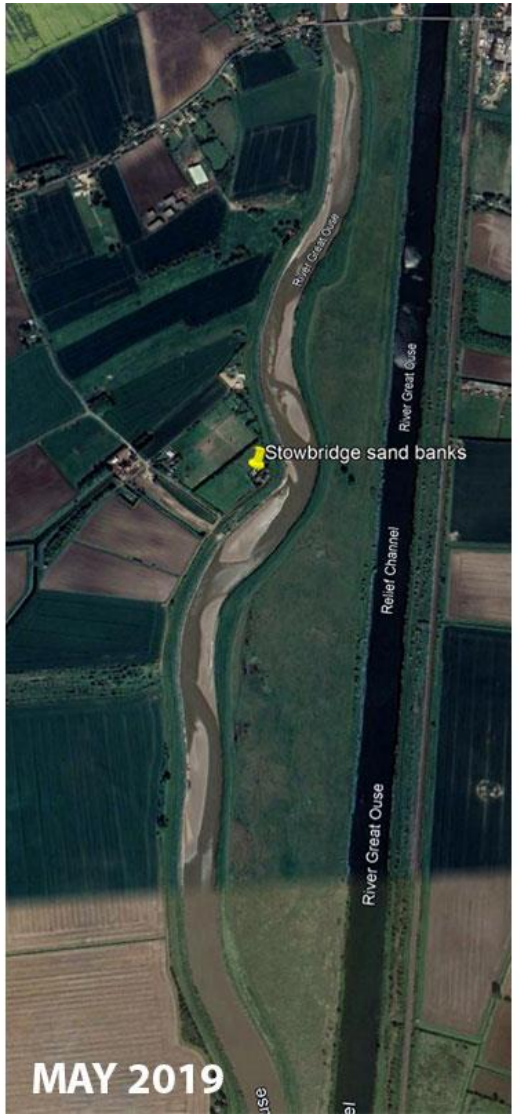
THE PROBLEM

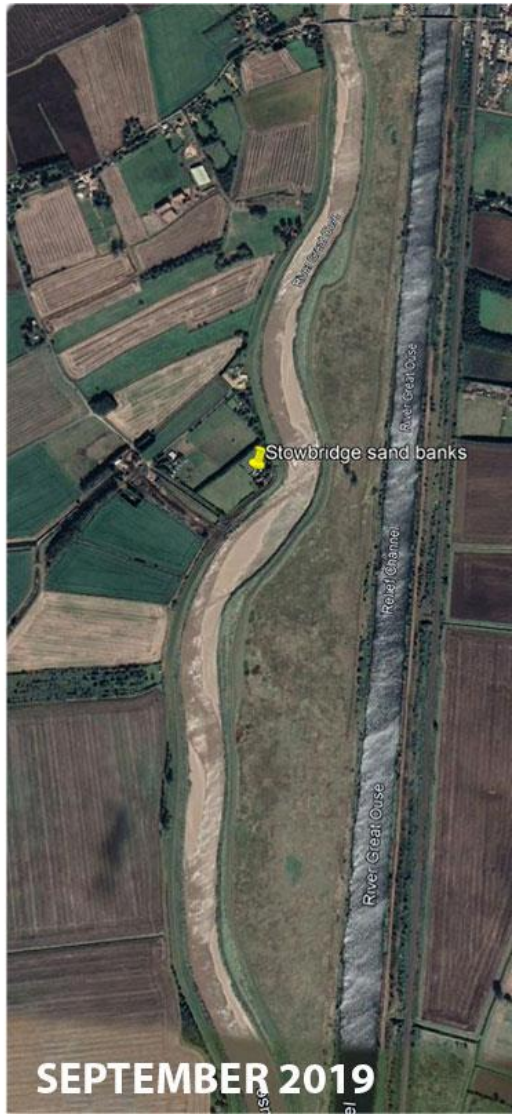

THE WASH
04/23-01, 02, 03
Sutterton
Heacham
Snettisham
Dersingham
Fakenham
Pinchbeck
Holbeach
Spalding
Bourne
Sutton Bridge
King's Lynn
Bore velocity measurement
Wisbech
Market Deeping
Stamford
Dereham
Costessey
Swaffham
04/23-06
STOWBRIDGE
Denver Sluice
Denver flow data
Hethersett
Peterborough
Watton
Wymondham
March
Yaxley
Attleborough
Ouse Washes
Oundle
Chatteris
Brandon
Lakenheath
Thetford
Ely
Diss
END OF TIDAL INFLUENCE
60 KM FROM THE WASH
Mildenhall
Non-tidal sediment collected
Google Earth

THE PROBLEM

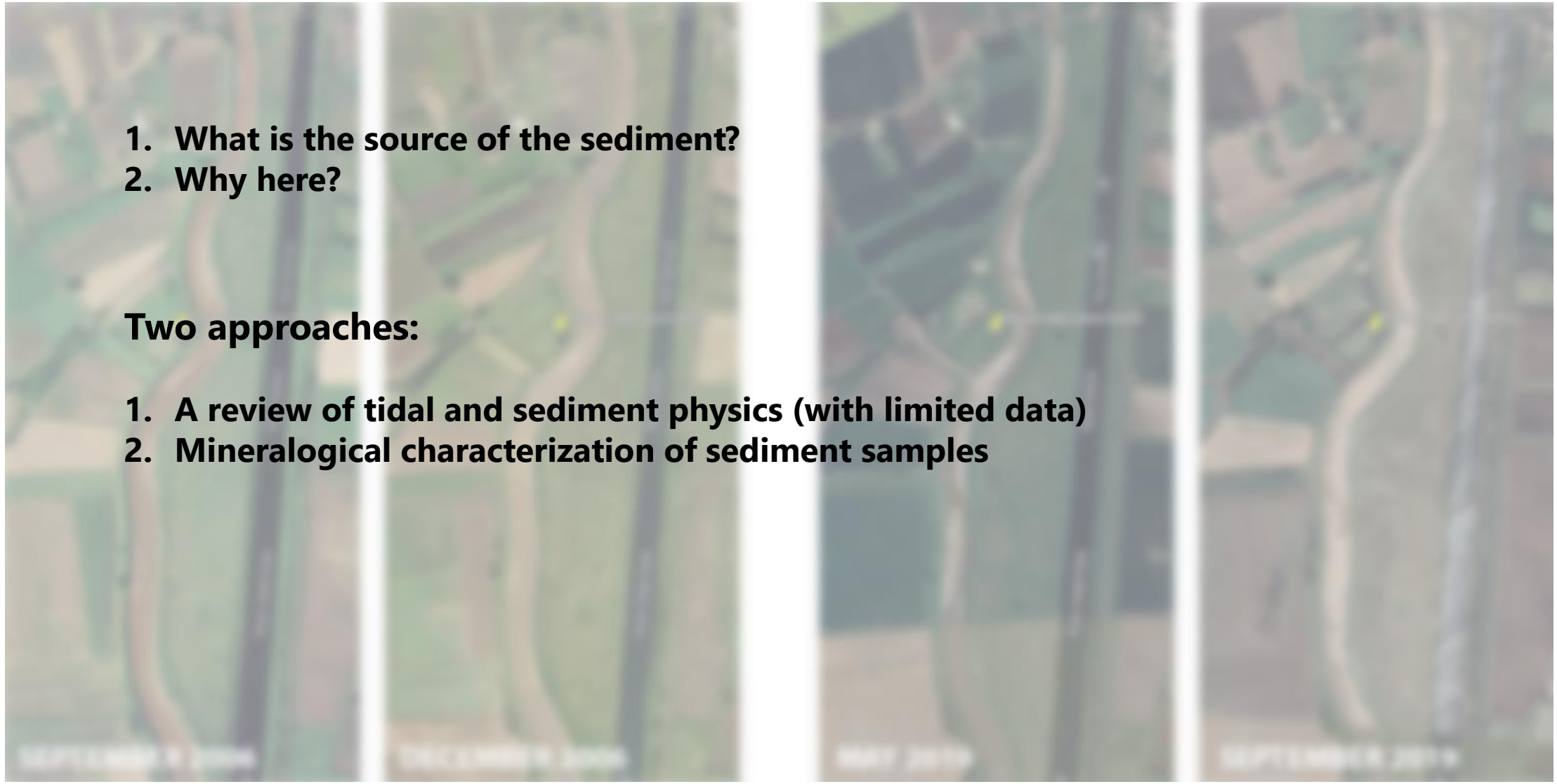

Stowbridge sand banks
River Great Ouse
Relief Channel
River Great Ouse
SEPTEMBER 2006


Stowbridge sand banks
River Great Ouse
Relief Channel
River Great Ouse
DECEMBER 2006


Stowbridge sand banks
River Great Ouse
Relief Channel
River Great Ouse
MAY 2019


Stowbridge sand banks
River Great Ouse
Relief Channel
River Great Ouse
SEPTEMBER 2019

THE PROBLEM

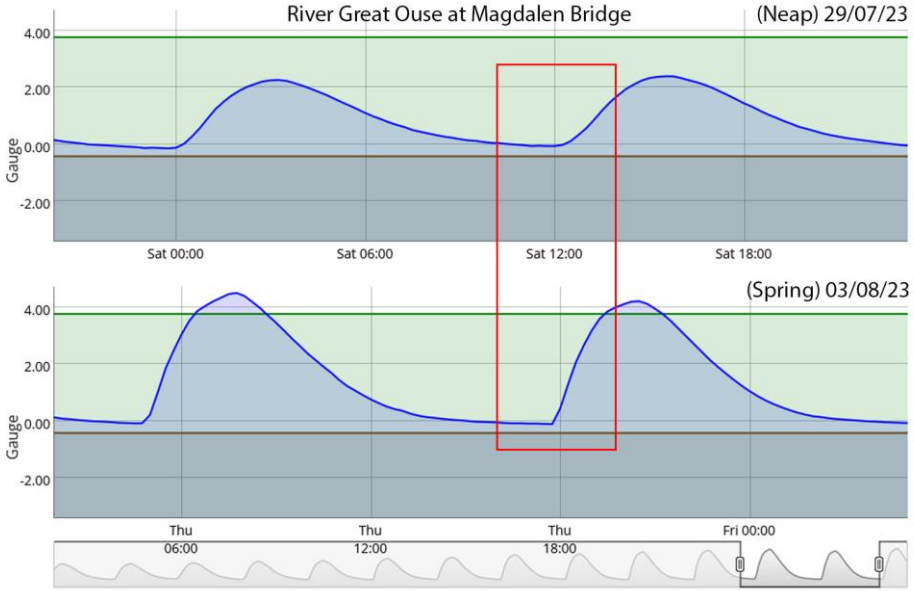


1. What is the source of the sediment?
2. Why here?

Two approaches:

1. A review of tidal and sediment physics (with limited data)
2. Mineralogical characterization of sediment samples

TIDAL EFFECTS



▲ Comparison of neap and spring tidal level time series at Magdalen Bridge, 14 km downstream of Stowbridge

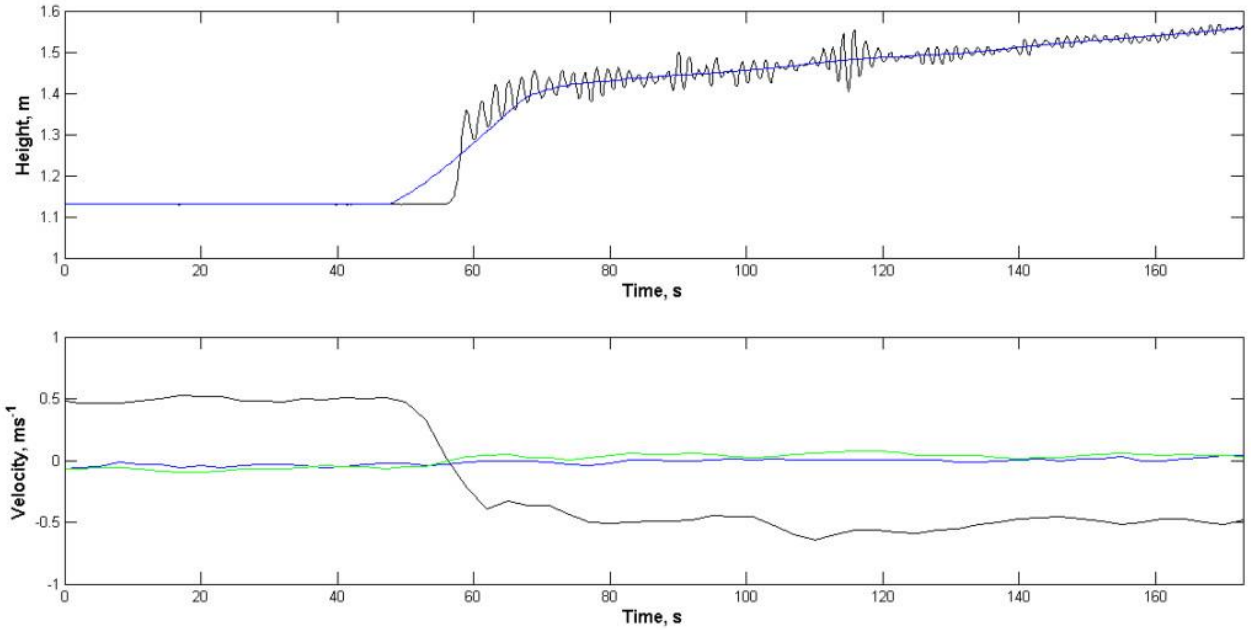
▼ Bore at Magdalen Bridge taken by Peter Sheehan in 2013

Factors controlling sediment influx

1. Tidal flow vs fluvial outflow
2. Grain properties (next slide!)

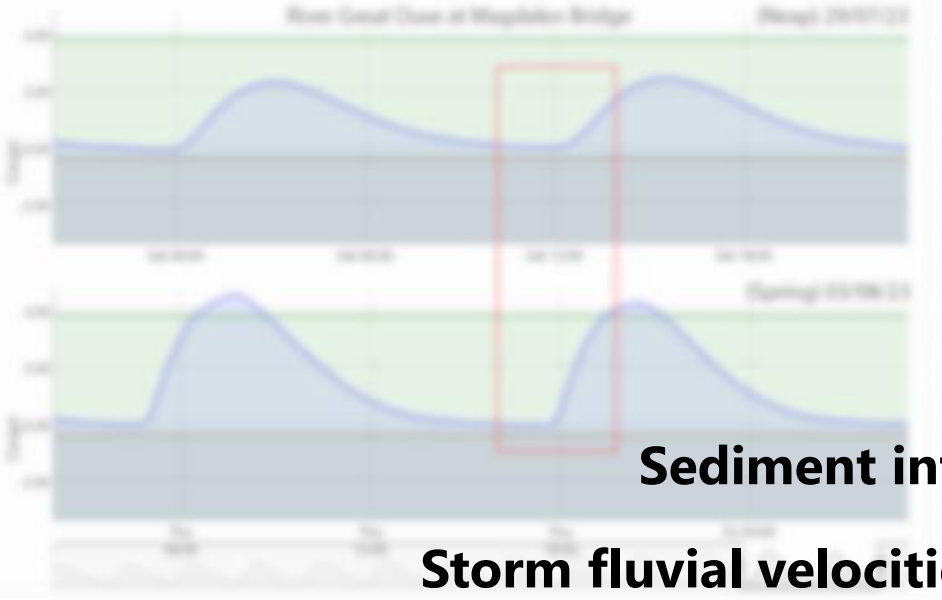
Main questions

1. What flow velocities do flood tides generate?
2. Are fluvial outflow velocities sufficient to move sediment downstream?



◄ Water height and velocity data by Rob Hall

TIDAL EFFECTS



▲ Comparison of neap and spring tidal level time series at Magdalen Bridge, 14 km down

▼ Bore at Magdalen Bridge taken by Peter Sheehan in 2013

Factors controlling sediment influx

1. Tidal flow vs fluvial outflow
2. Grain properties (next slide!)

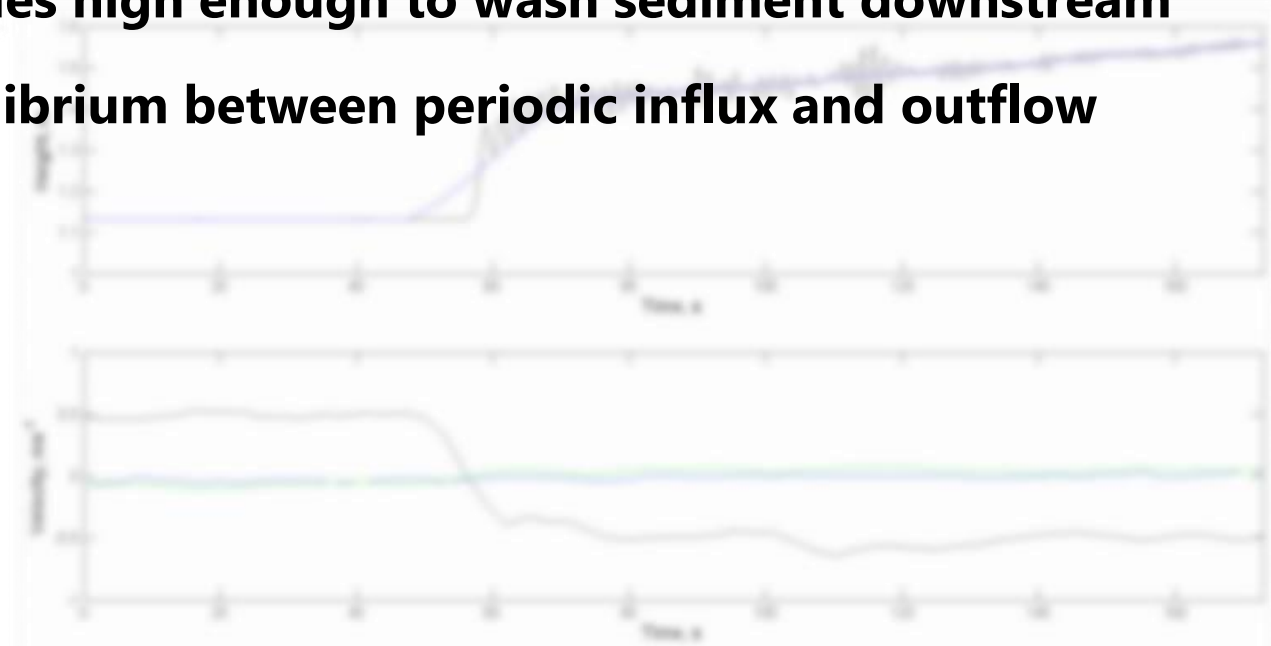
Main questions

1. What flow velocities do flood tides generate?
2. Are fluvial outflow velocities sufficient to move sediment downstream?

Sediment influx from the Wash during spring tide

Storm fluvial velocities high enough to wash sediment downstream

Stowbridge: equilibrium between periodic influx and outflow

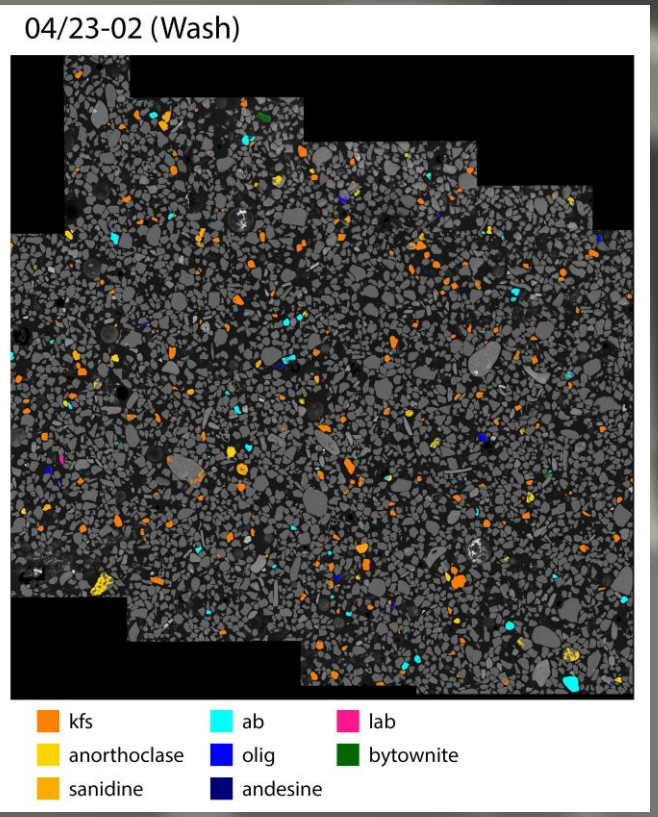


Water height and velocity data ◄ by Rob Hall

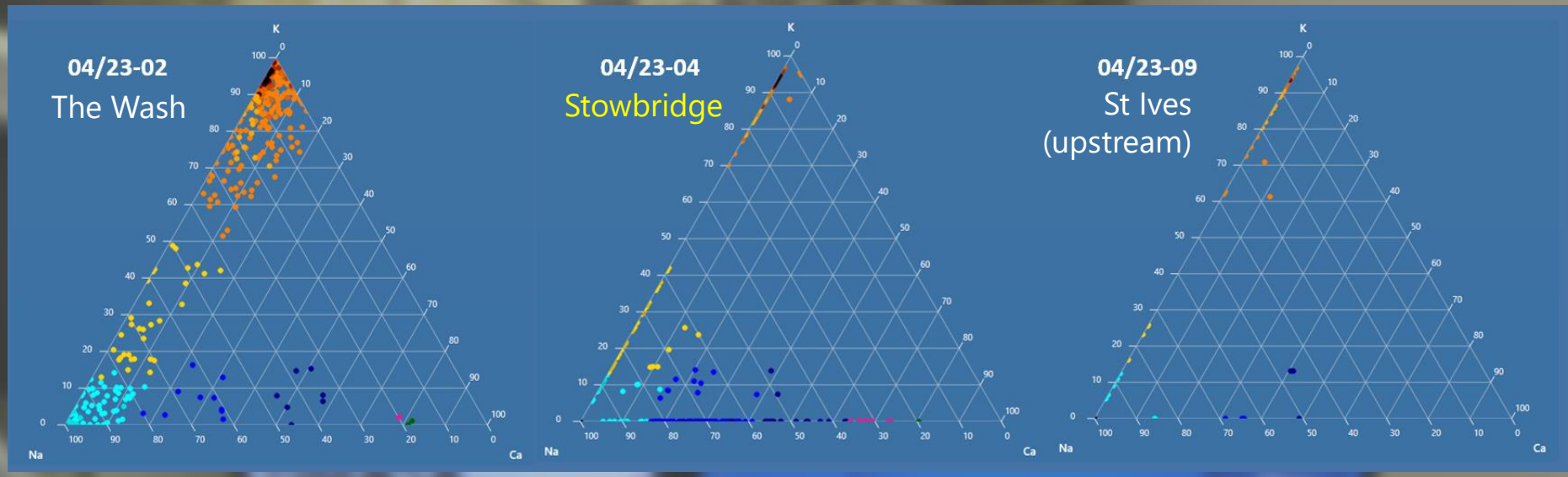
MINERALOGY OF COLLECTED SAMPLES

SEM FACILITY AT CASP

MINERALOGY OF COLLECTED SAMPLES



MONTAGED BSE IMAGE ▲
WITH FELDSPARS MARKED



▲ DISTRIBUTION OF FELDSPAR COMPOSITIONS

	% of total feature area		
Mineral group	*The Wash*	*Stowbridge*	*St Ives*
Quartz (silica)	79.7	82.1	78.7
K-feldspar	3.2	6.0	1.7
Plagioclase	1.1	3.6	0.2
Carbonates	8.5	3.9	8.3
Goethite FeO(OH)	0.0	0.0	2.9
Fsp/Qz ratio	0.06	0.11	0.02

	Mean clast length / μm		
Mineral group	*The Wash*	*Stowbridge*	*St Ives*
Quartz (silica)	210	160	260
Feldspars	200	130	180

Grain size falls between very fine to fine sand

Feldspar is mechanically weaker than quartz

CONCLUSIONS AND WHAT NEXT?

- Wash sediment is probably a significant contribution to sandbanks
- Need a lot more data, particularly of current velocities
- Spot analyses of feldspars for precise quantitative compositions
- Rule out possibilities of other sources (e.g. from Ely Ouse)
- Identify where the current reversal happens

Ripples in the sandbanks showing bimodal grain size ►