SEDflume Data for Better Site Characterization and Remedial Design

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Sediment Erodibility – So What?

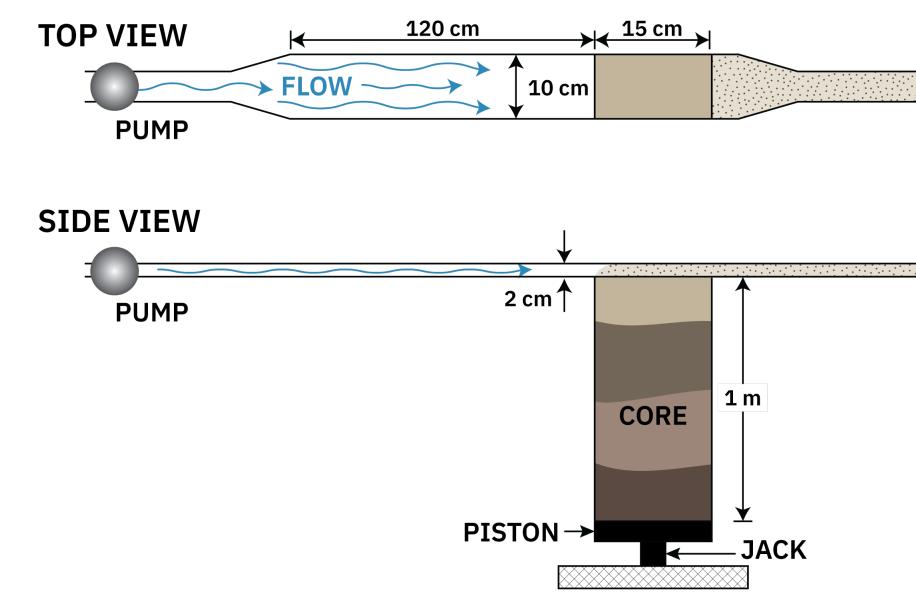
Sediment erodibility modulates fate and transport of associated contaminants

Sediment erodibility in cohesive sediment is

- Morphologic zone
- Depth and consolidation
- Mineralogy and sediment characteristics

AND does not have a well-characterized analytical or empirical representation.

SEDflume measures erosion rate in a lab setting



Erostion Rate Formula

$$=\frac{\Delta z}{T} \qquad E = A \tau^n \rho^m$$

E = erosion rate (cm/s)

- $\tau = \text{bed shear stress (Pa)}$
- ρ = sediment bulk density (g/cm3)

A, n, and m = constantsthat depend on sediment characteristics

The movement of sediment impacts:

- Contaminant fate and transport
- Remedial design
- Placed material stability

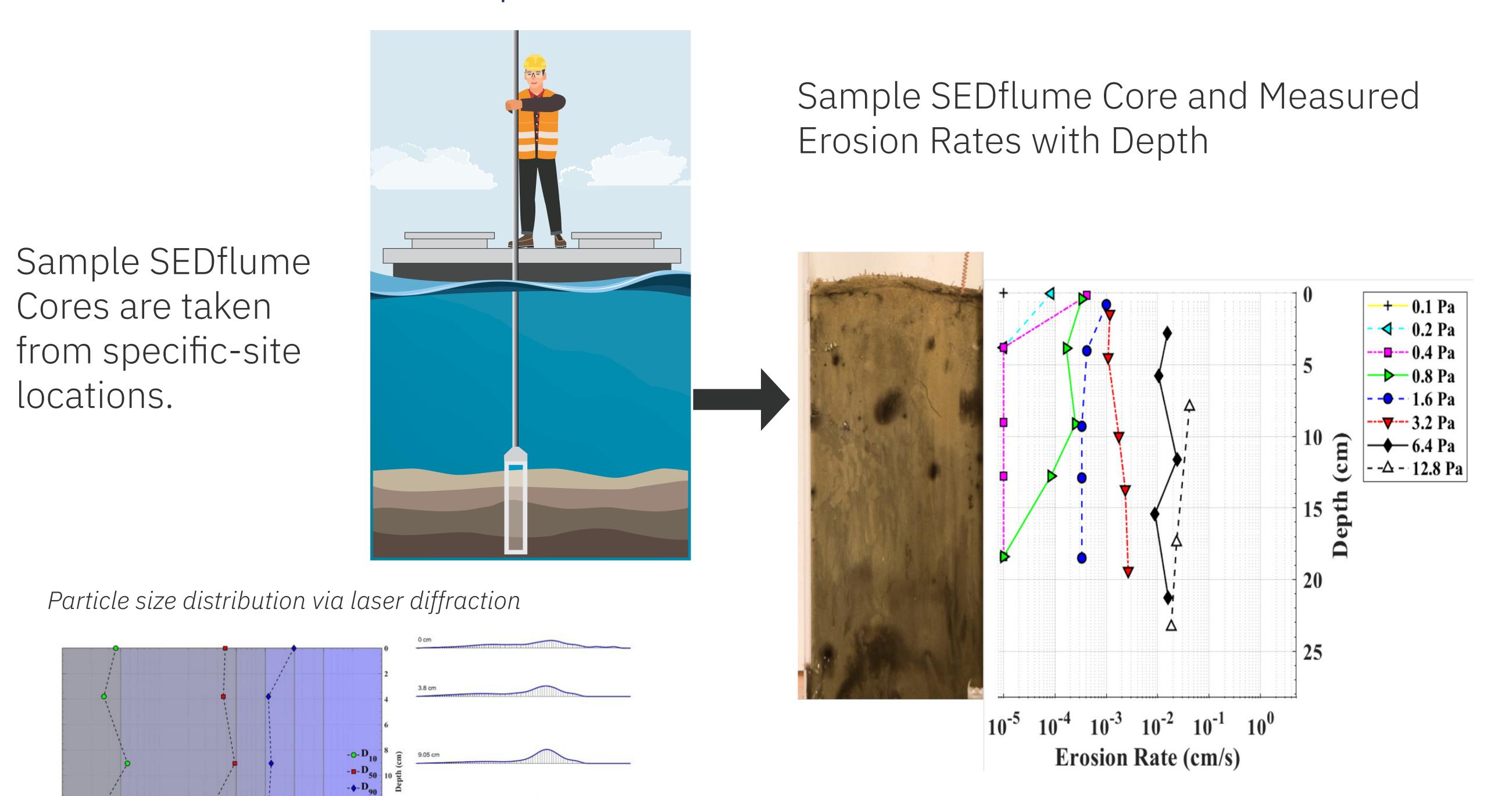
What is SEDflume and how does it help with sediment characterization?

Sedflume is a Laboratory instrument producing quantitative mobility parameters—including erosion rate and bed critical shear stress profiles with depth relative to applied bed shear stress.

- Quantifies how a sediment bed responds to environmental forces.
- Measures particle size distribution, density, and organic content for maximum data utility in site investigations.

How does it help you at a sediment site?

Inclusion of site-specific erodibility measurements provide ground-truthed data sets from which a representative sediment bed could be modeled.



More info on SEDflume



SEDflume Study Results Relative to Depth

locations.

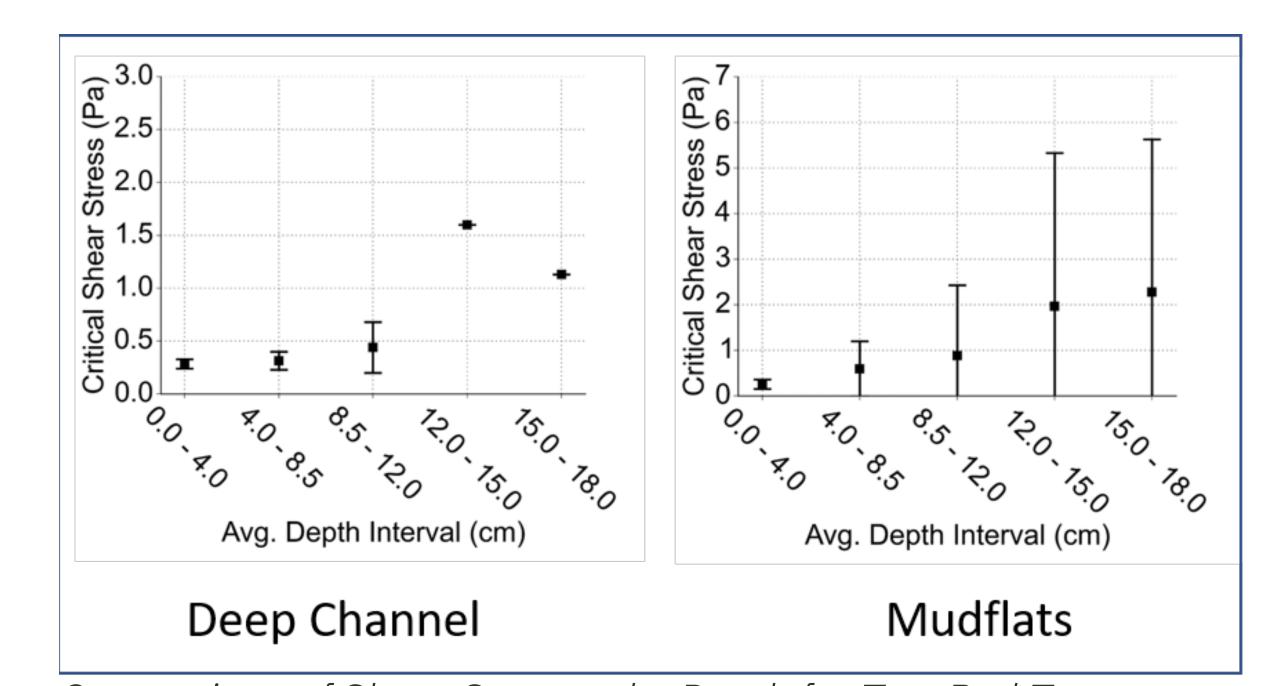
Sample Depth (cm)	Grain Size (um)	Wet Bulk Density (g/cm^3)	Dry Bulk Density (g/cm^3)	Loss on Ignition (%)	τno (Pa)	τfirst (Pa)	τCrit Linear (Pa)	τCrit Power (Pa)	Recommende Critical Shea (Pa)
0	48.17	1.34	0.61	4.80%	0.1	0.2	0.2	0.22	0.2
3.8	46.1	1.43	0.75	4.80%	0.4	0.8	0.64	0.7	0.7
9.05	60.56	1.49	0.84	3.80%	0.4	0.8	0.56	0.63	0.63
12.75	33.6	1.42	0.74	4.90%	0.4	0.8	0.8	0.83	0.8
18.4	54.59	1.56	0.96	3.60%	0.8	1.6	1.04	0.89	0.89
Mean	48.6	1.45	0.78	4.40%	0.42	0.84	0.65	0.65	0.64

Power Law Fit Parameters relating shear stress and erosion rate

Interval	Depth Start (cm)	Depth Finish (cm)	A	n	r2
1	0	3.8	3.72E-5	1.25	0.86
2	3.8	9.05	2.05E-6	2	0.98
3	9.05	12.75	2.23E-6	2.08	0.92
4	12.75	18.4	1.17E-6	2.1	0.99
5	18.4	24.3	8.05E-7	2.21	0.94

Key data points related to erosion rates can be used to model a more accurate site characterization.

Case Study: Sediment Erodiblity Characterization at Berry's Creek Study Area



Comparison of Shear Stresses by Depth for Two Bed Types

Values of Bed Critical Shear Stress

Sediment	Critical Shear Stress (Pa)								
Bed Layer	Sand	Deep Chan- nel	Channel	Mudflat and Tributary	Marsh				
1	0.5	0.05	0.05	0.26	0.33				
2	0.5	0.29	0.24	0.26	0.33				
3	0.5	0.32	0.72	0.6	0.73				
4	0.5	0.44	1.38	0.89	0.61				
5	0.5	1.6	0.8	1.97	2.02				

Conclusion

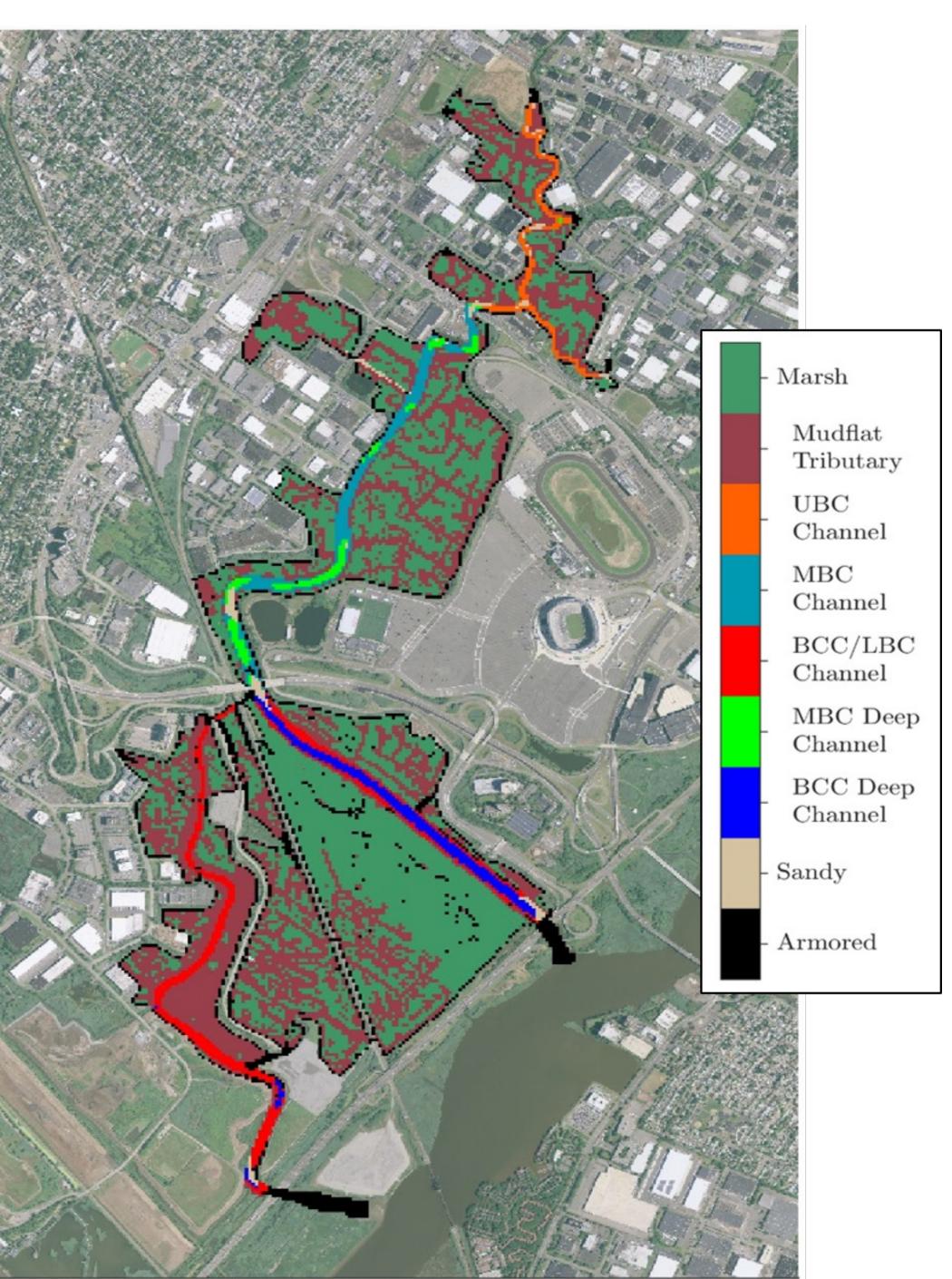
Alternatives to the use of site-specific erodibility data

- More assumptions
- Result in large uncertainties
- May not be applicable over all relevant scenarios

Inclusion of SEDflume measurements provide:

- Site-specific measurements of sediment mobility characteristics
- Spatial and depth dependent sediment transport model inputs
- Reference points for erosive forces for engineering and remedial design

13 cores were processed representing different morphologic regions. These cores produced data to characterize the regions seen below at multiple depth intervals. (see fig below and table on the left)



Sediment Bed Delineations by Morphologic Type in Berry's Creek Study Area

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