Vibracore Sediment Acquisition Monitoring

for Remediation Dredging Design
Portland Harbor Superfund Site, Portland OR

2021 WEDA Virtual Dredging Summit
June 15-17, 2021
Zoom

Paul Fuglevand
Dalton, Olmsted & Fuglevand, Inc.

DOF DALTON OLMSTED FUGLEVAND

Topics

- Conventional Vibrocoring
- Vibracore with Sediment Acquisition Monitoring (V-SAM)

Conventional Vibracoring

»

Vibracoring

EQUIPMENT
- Aluminum or plastic tubes
- 5’ – 20’ long
- Vibrating head attached to top of tube
- Core catcher at bottom of tube

METHOD
- Position tube on sediment bed
- Activate vibratory head
- Advance core tube into sediment
- Retract tube and process

SDI VibeCore D

Core Recovery Parameters – %R

Only 2 data points to interpret results

Drive Length = L_{DT}

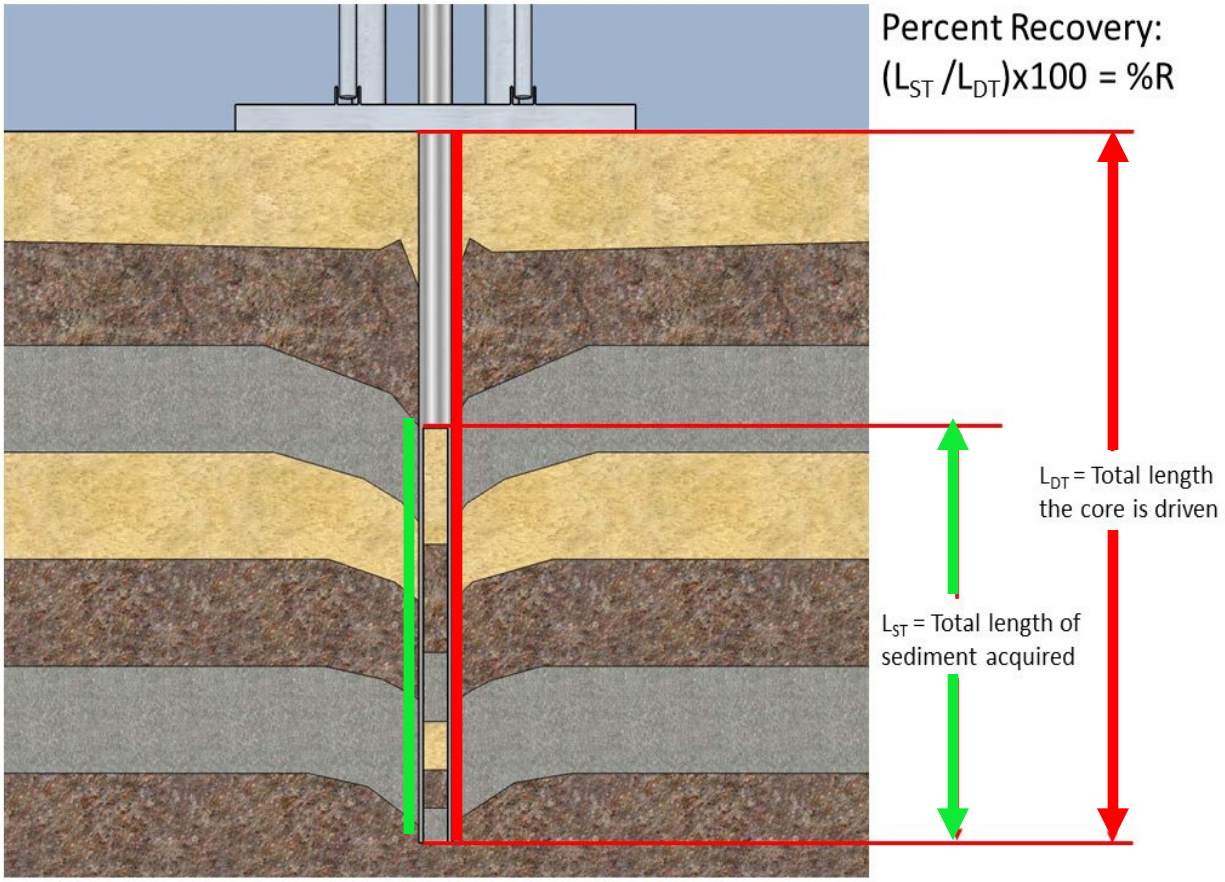
Recovered Length = L_{ST}

Percent Recovery
%R = (L_{ST}/L_{DT})x100

%R = 6'/10' = 60%

Range of %R
<50% to >100%

- Material type
- Methods
- Equipment



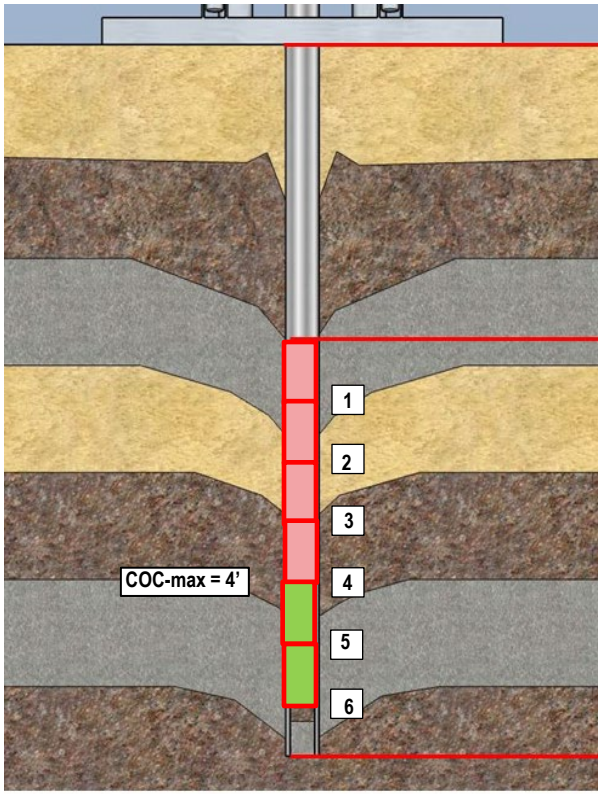
Collecting Samples from Core Tube

- Collect samples every foot in core tube
- Analyze for target compounds
  - Exceeds contamination criteria
  - Passes contamination criteria

- Determine COCmax.
  - Deepest contamination in core tube.

From lab data

COC_{max} = 4 feet.



Estimating In-Situ DOC for Dredging Design

From lab data

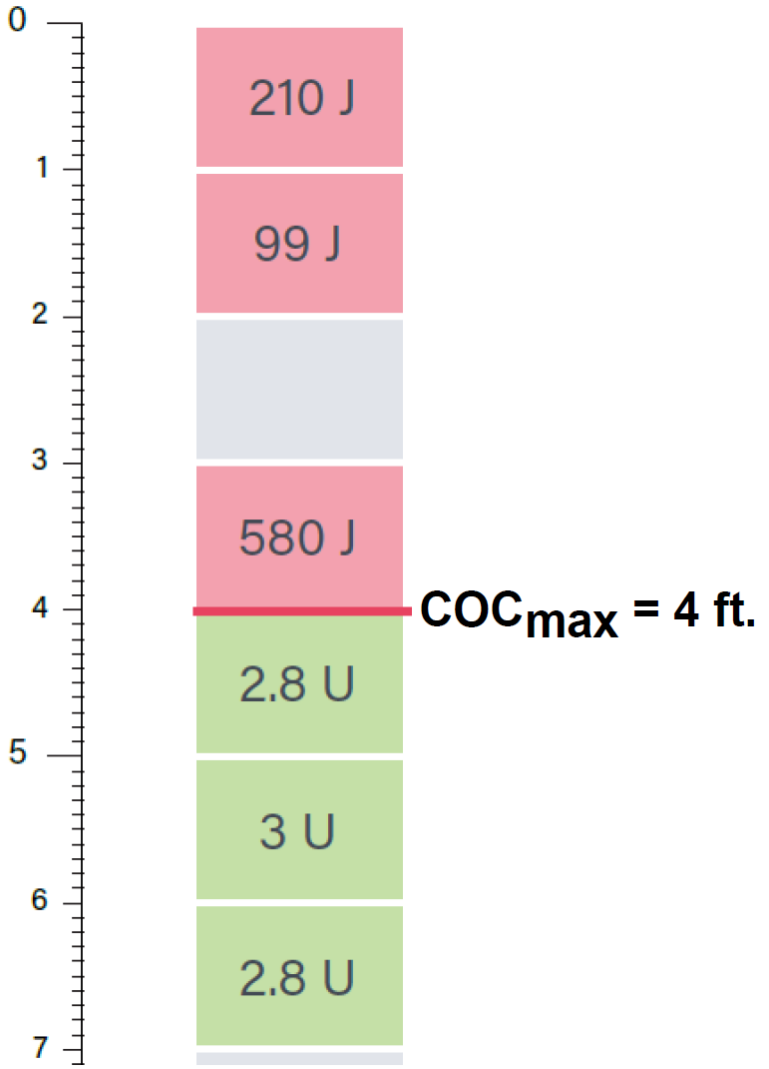
COC_{max} = Deepest contamination in core tube.

Convert **COC_{max}** to **DOC**
For dredging design

DOC = Estimated **In-Situ** Depth of Contamination

using

Straight method
Stretch method



Convert Core tube depths to In-Situ depth below mudline

Straight Method – "1:1"

Assume difference between L_{DT} and L_{ST} is due to loss out the bottom of the tube during retrieval

- **1-ft. in core tube = 1-ft. in-situ depth below mudline**
- **4 ft COC_{max} in core tube = 4 ft in-situ DOC**

Stretch Method – "stretch the core" linear interpolation.

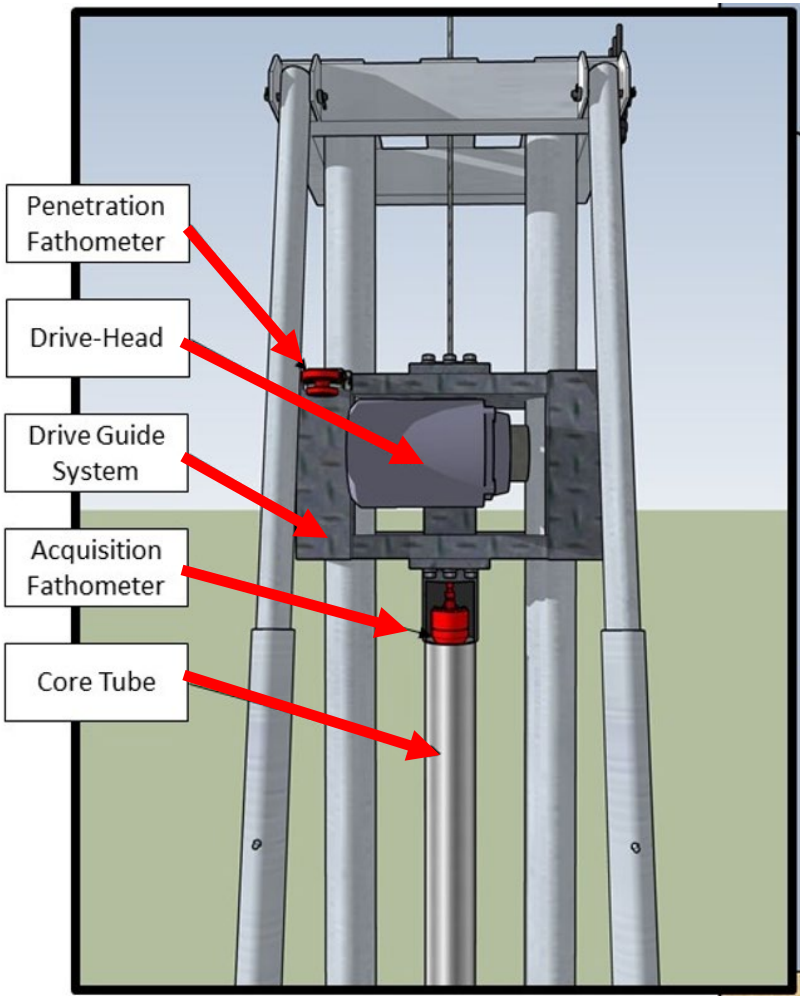
Assume difference between L_{DT} and L_{ST} is due to

- uniform compaction during drive
- Uniform partial recovery during drive
- **1-ft. in core tube = (1/%R) in situ depth below mudline**
  - **For 60% R**
  - **4 ft COC_{max} in core tube = (4/0.60) = 6.7 ft in-situ DOC**

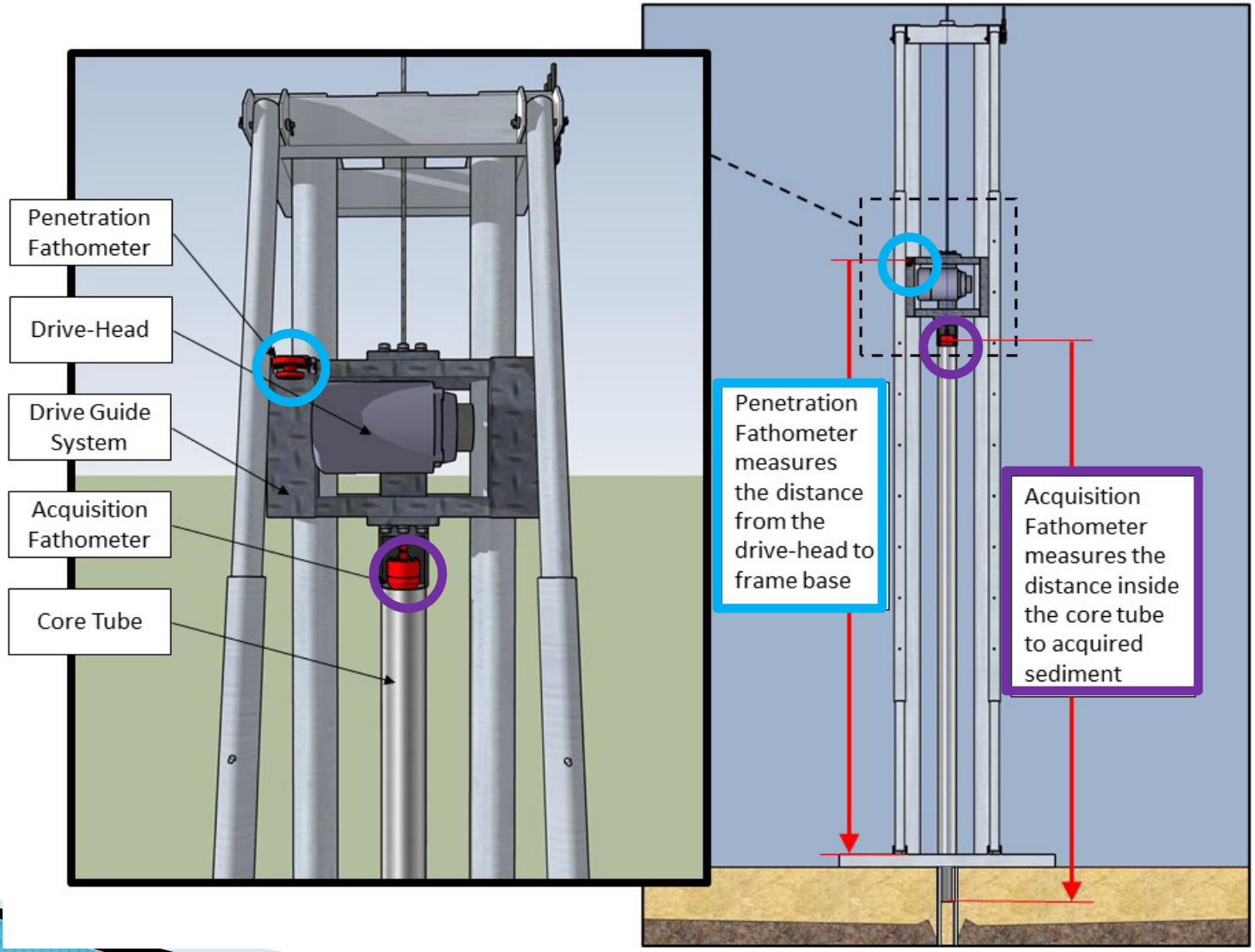
Vibracoring with V-SAM

- Sediment Acquisition Monitoring (V-SAM)

V-SAM Equipment

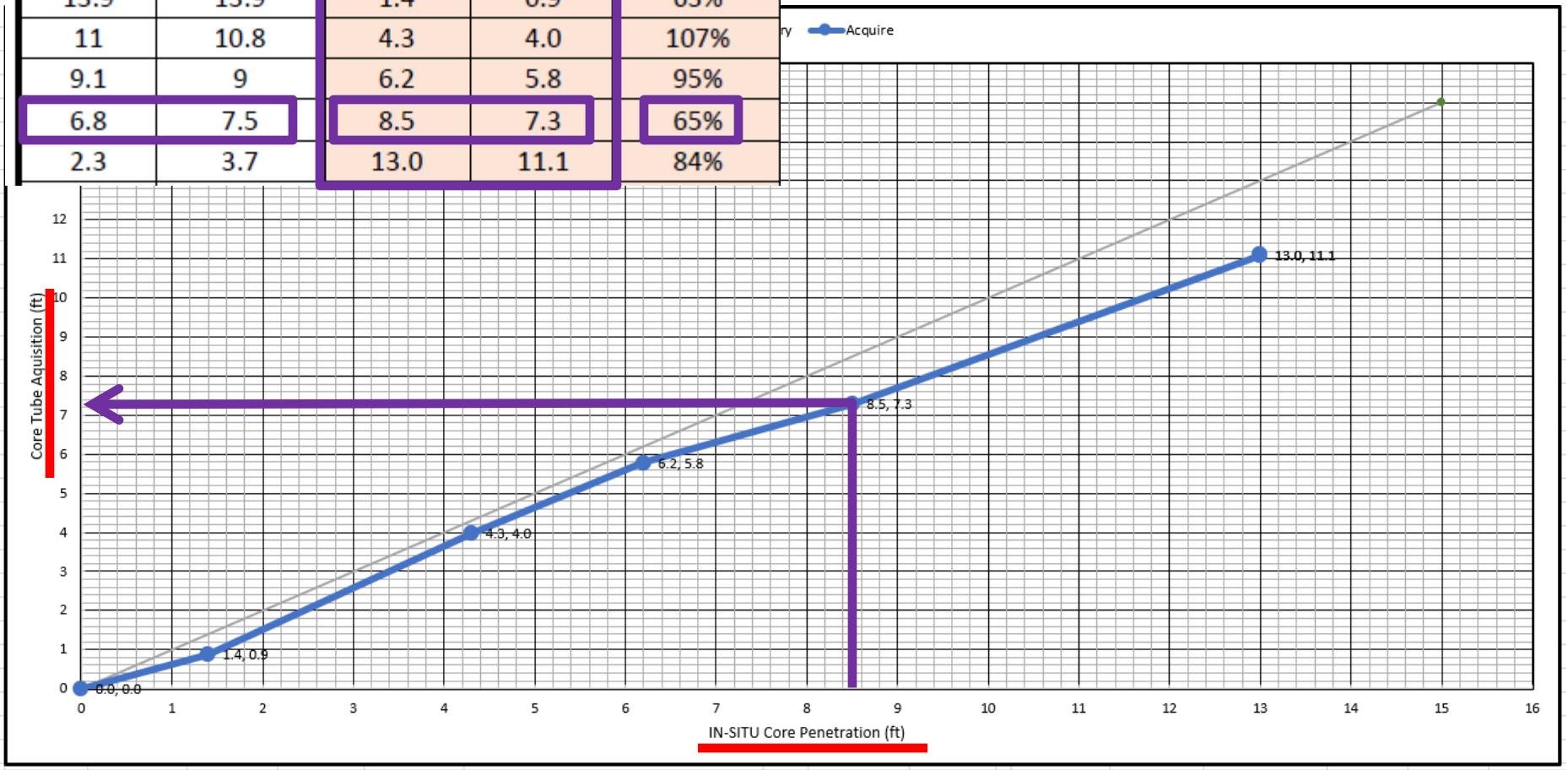


V-SAM Equipment



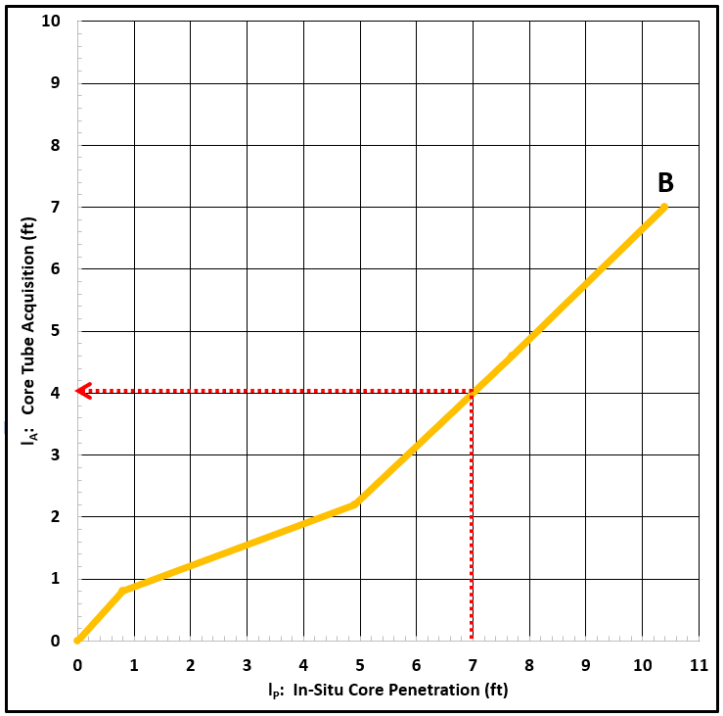
Core Acquisition Curve

Fathometer Readings		TUBE (ft.)		Increment
Drive	Acquire	Drive	Acquire	% Recover
15.3	14.78	0.0	0.0	
13.9	13.9	1.4	0.9	63%
11	10.8	4.3	4.0	107%
9.1	9	6.2	5.8	95%
6.8	7.5	8.5	7.3	65%
2.3	3.7	13.0	11.1	84%



Process Core Tubes wit V-SAM

Acquisition Curve for samples



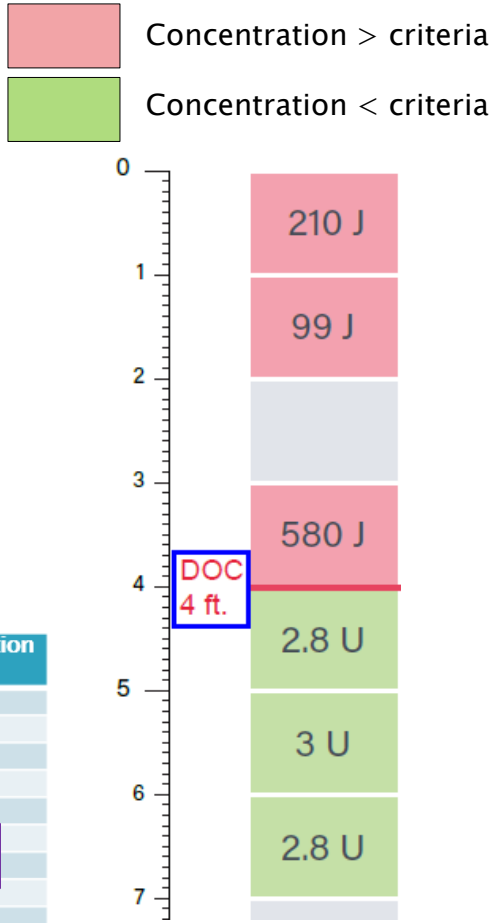
Core Tube Sampling Plan

Core Segment	Target In-Situ bml (ft)	Core Tube Location (ft)
A	1	0.8
	2	1.2
	3	1.6
	4	1.9
	5	2.3
	6	3.2
	7	4.0
	CUT	4.0
B	7	4.0
	8	4.8
	9	5.8
	10	6.6

Depth of Contamination (DOC)

- Collect a sample every in-situ foot increment of core
- Send samples to lab to test for target chemicals
- DOC – "Depth of Contamination" is deepest sample above criteria

Core Segment	Target In-Situ bml (ft)	Core Tube Location (ft)
A	1	0.8
	2	1.2
	3	1.6
	4	1.9
	5	2.3
	6	3.2
	7	4.0
	CUT	4.0
B	7	4.0
	8	4.8
	9	5.8
	10	6.6



V-SAM and DOC Variations

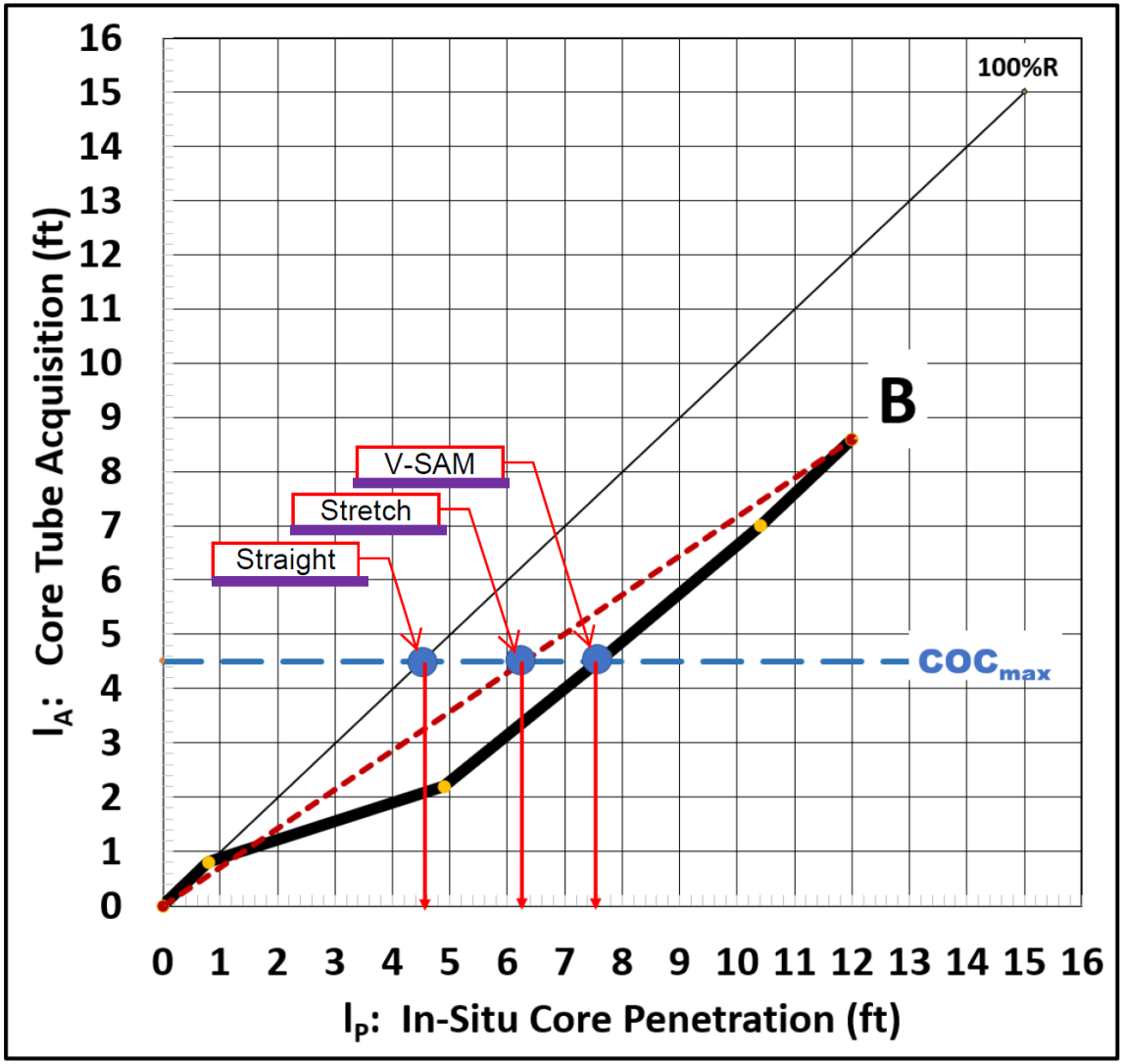
EXAMPLE DOC Calculation

COC_{max} = 4.5 ft.

Estimate DOC by methods:

- Straight: DOC= 4.5’
- Stretch: DOC= 6.2’
- V-SAM DOC= 7.5’

Range of DOC estimates:
4.5’ to 7.5’



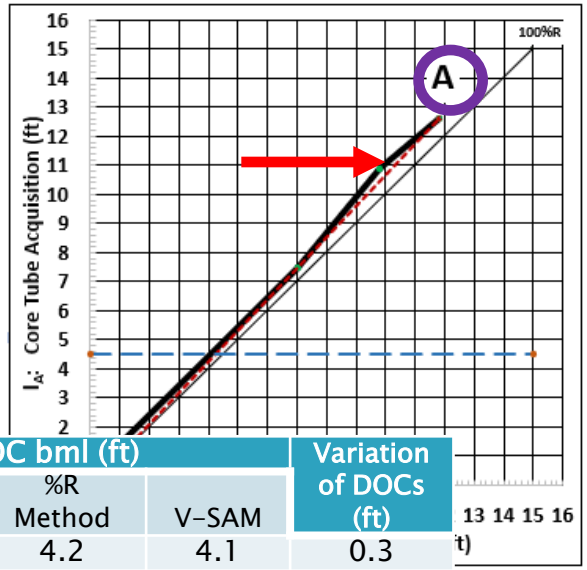
EXAMPLE DOC Calculation

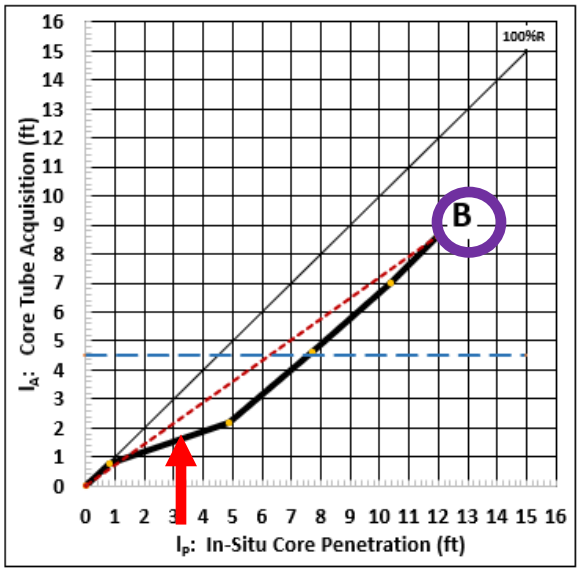
COC_{max} = 4.5 ft.

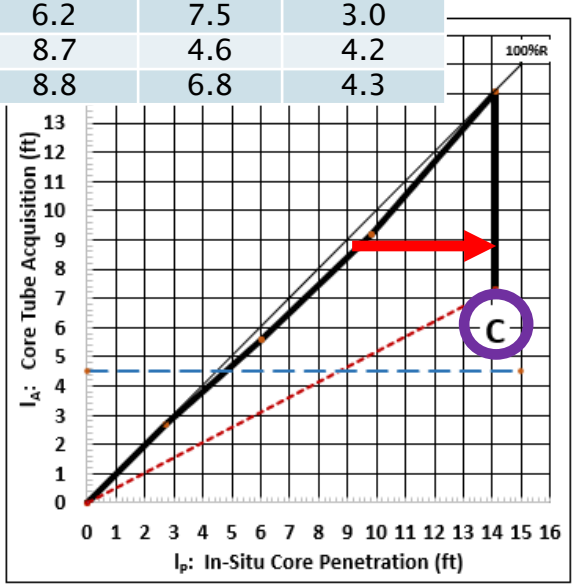
DOC by methods:

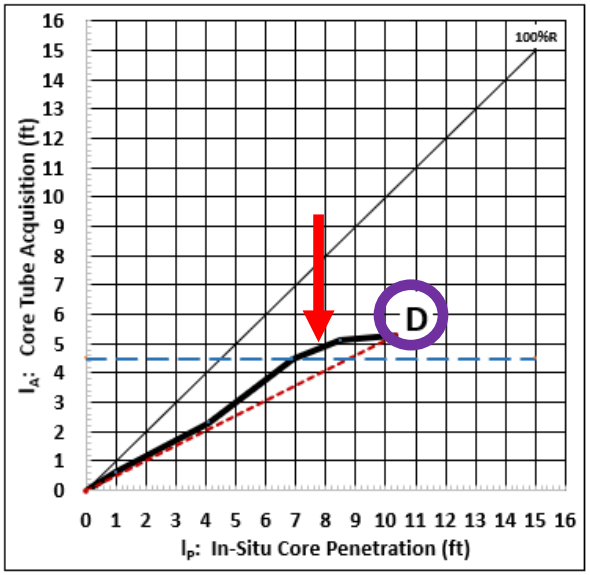
- Straight
- Stretch
- V-SAM

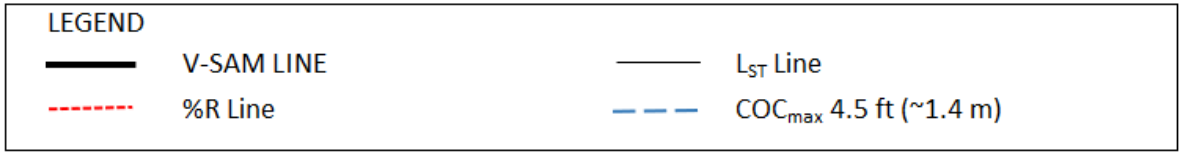
Acquisition Curve	%R	COC_{max} (ft)	DOC bml (ft)			Variation of DOCs (ft)
			L_{ST} Method	%R Method	V-SAM	
A	111%	4.5	4.5	4.2	4.1	0.3
B	72%	4.5	4.5	6.2	7.5	3.0
C	52%	4.5	4.5	8.7	4.6	4.2
D	51%	4.5	4.5	8.8	6.8	4.3











Limitations of V-SAM

New Technology. V-SAM Challenges encountered in past year

- Not in shallow water when fathometers not submerged
- Off-gassing of organic sediment – methane bubbles blind fathometer
- Floating debris/wood in tube can blind fathometer
- Fathometer at top of core tube – can't use piston for improved recovery
- Added labor and reduced production compared to conventional

CITATION

Fuglevand, P.F., Lamb, C., Browning, D., and Jaworski, B. 2021. "Vibrocore Sediment Acquisition Monitoring (V-SAM) for remediation dredging design at the Portland Harbor Superfund site." *Proceedings WEDA Dredging Summit & Expo '21*, June 15-17, 2021. Virtual conference.