

MARSEILLE
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2022



ICOLD
27TH CONGRESS
90TH ANNUAL
MEETING



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Committee J – Reservoir Sedimentation
Workshop « SEDIMENT BYPASSING AND TRANSFER »

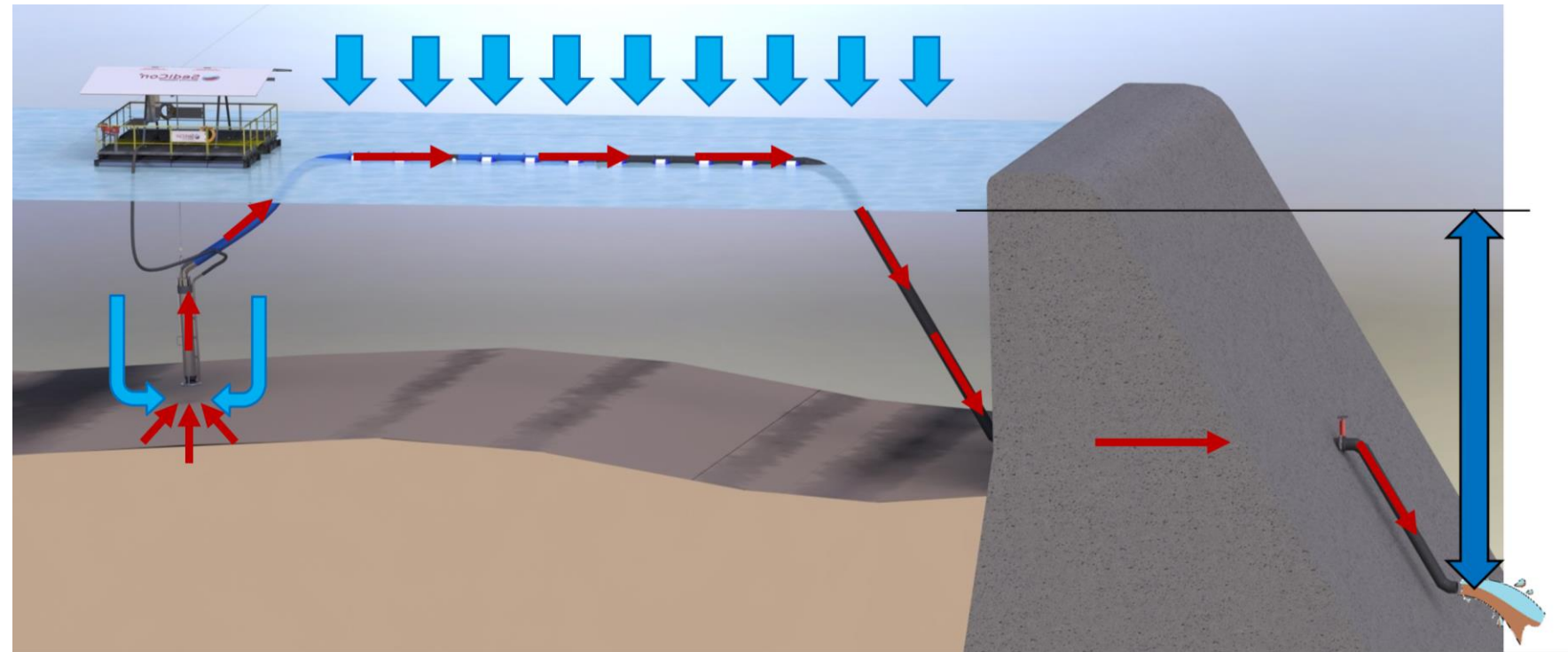
Chapter 5

Hydrosuction and sediment transport capacity of pipelines

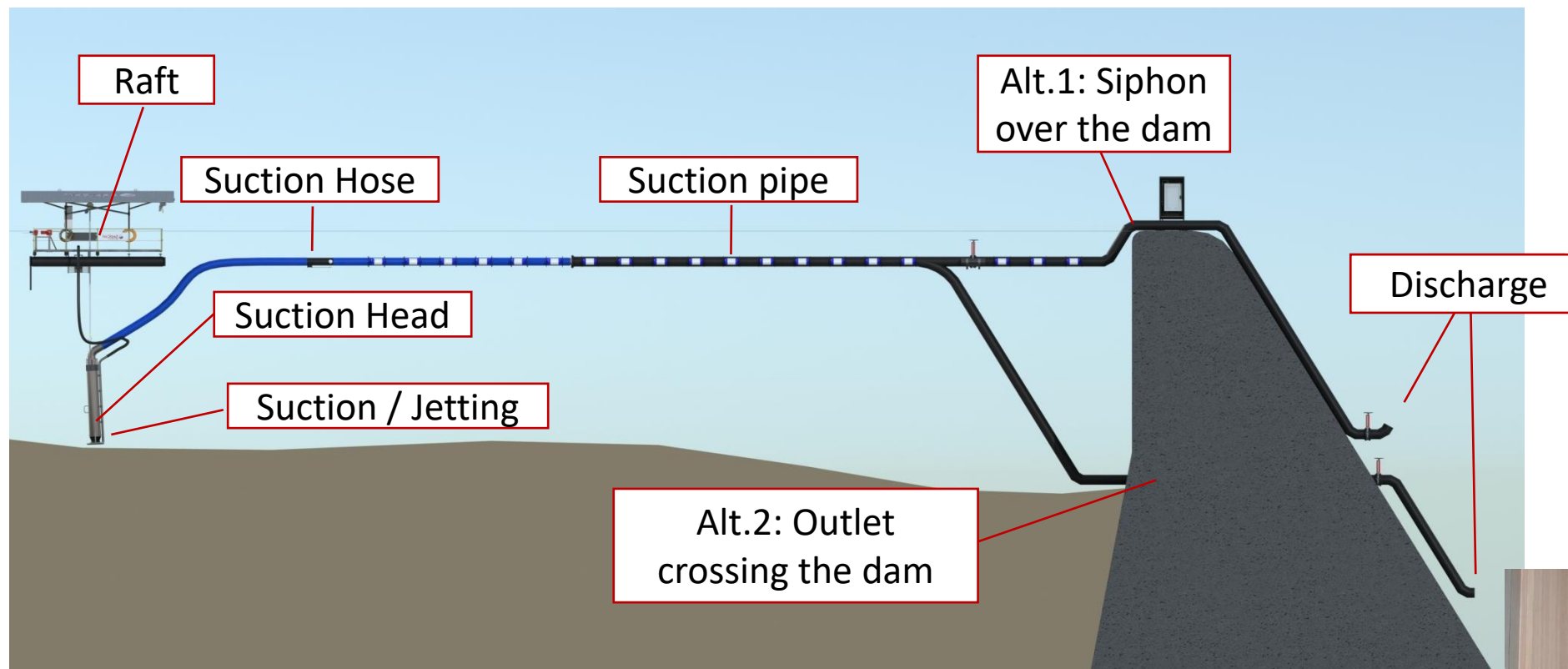
Tom Jacobsen
SediCon AS



The hydrosuction principle



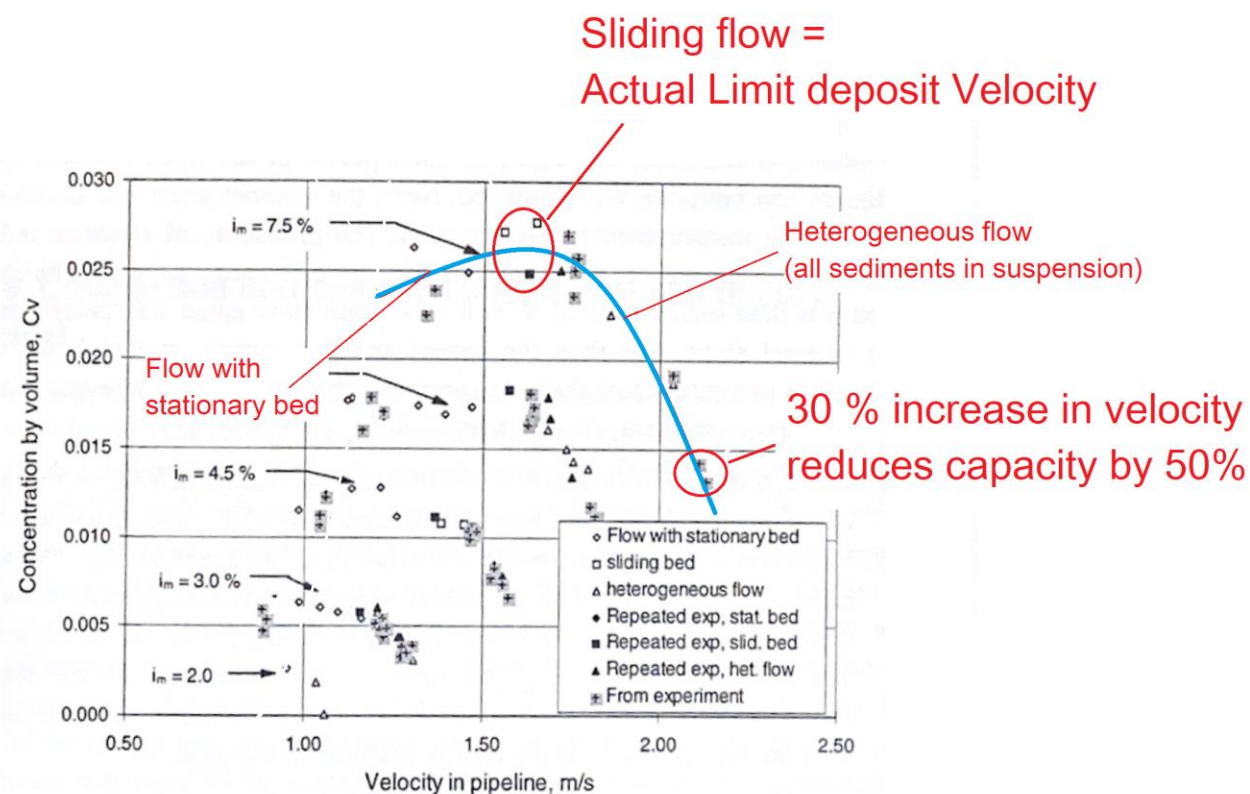
Hydrosuction dredge components



Ideal velocity in pipelines

Own results from own PhD in 1997:

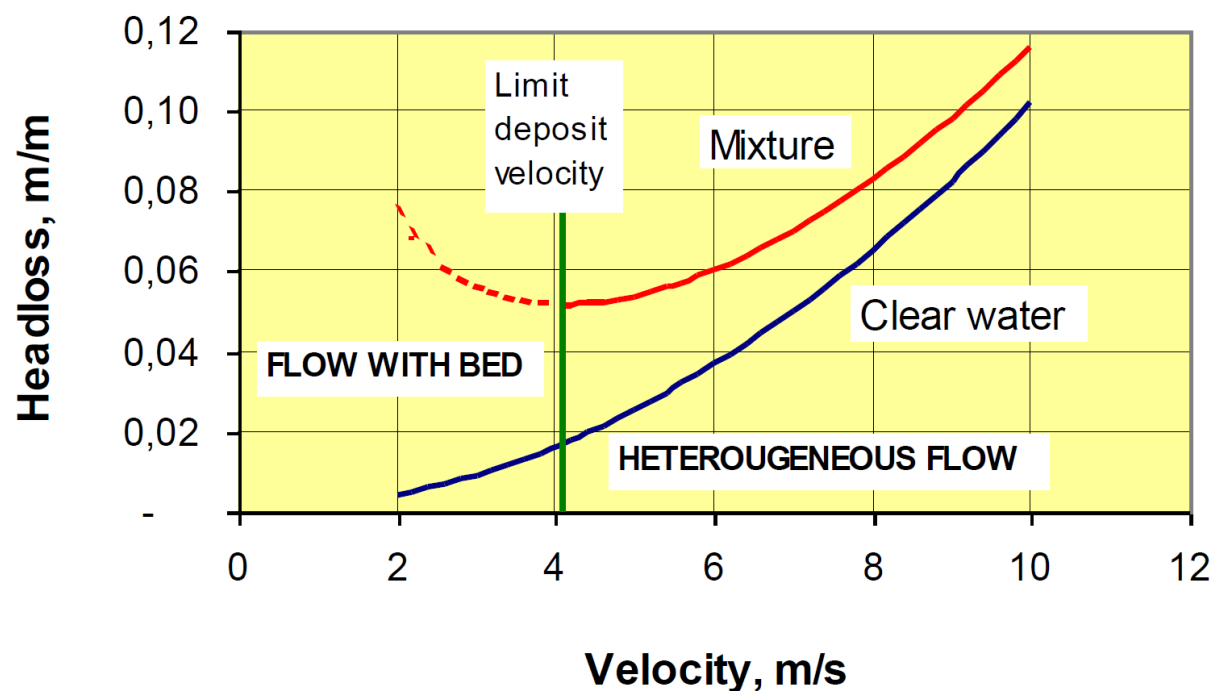
1. Concentration drops quickly when velocity increase
2. Ideal velocity in the transition range between sliding and heterogeneous flow



Results from Sediment problems in reservoir, PhD, Tom Jacobsen



Capacity of pipelines



Energy gradient (length, head)

- Doubling of gradient more than doubles capacity

Pipeline diameter

- Capacity increases with $D^{2.5-3}$

Sediment properties (d_{50})

- Fine sand/silt : 100%
- Coarse sand 10%
- Gravel and stones 1%



Case study: El Canada, Guatemala

Before 2012: Inflow of +100.000 m³ sediments annually
Inadequate removal, loss storage and turbine wear



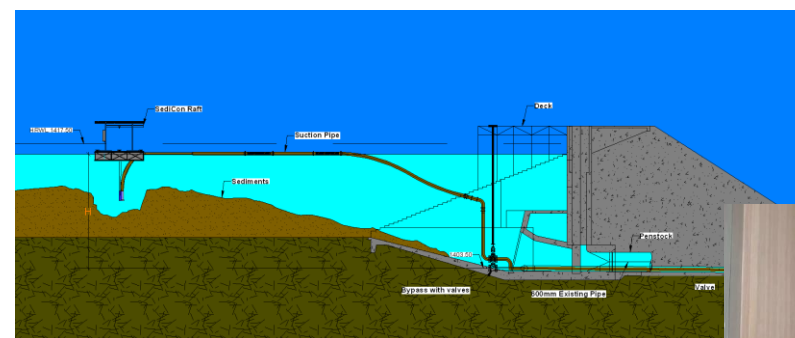
- Commissioned 2003
- Owned by ENEL
- 187.000 m³ reservoir, off-stream / for peaking
- 48 MW capacity
- 187 GWh
- 400 m head



El Canada, hydrosuction dredge since 2012



- Commissioned January 2012
- 250 mm suction hose / 300 mm pipe
- 14 m driving head
- 75 kW jetting for disintegration
- Measured capacity > 100 m³ sediments per hour



El Canada, Hydrosuction dredge results



- > 1 million m³ sediments removed between 2012 and 2018
- 99 % availability
- Possible upgrade to remote / automatic operation
- Hydrosuction dredge vs conventional diesel dredge have saved 7.000 ton CO2 since 2012
- Maintaining reservoir volume have saved 60.000 ton CO2 since 2012



Hydrosuction, removal of rock



- Ulvik Hydropower plant in western Norway, owned by Eviny
- Research project under HydroCen
- The boulder excluder remove boulders up to one meter in size
- Fully autonomous, as it starts and stops automatically
- Uses only surplus water during floods



Hydrosuction, removal of sand



- Indrawati, 7 MW, Nepal
- Desander which often fills overnight
- SediCon Sluicer is operated only by opening a valve
- Measured capacity 1450 ton sand per hour
- Sediment concentration $> 500 \text{ kg / m}^3$



Thank you for your attention!

