Sediment Management Techniques: TURBIDITY CURRENT VENTING

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Reservoir Sedimentation

- Dam construction alters the natural balance of sediment transport.
- Sediment accumulates until balance is reached again.

Unknown. Provided by G. Morris







Reservoir Sedimentation

Coarse sediment tends to settle faster at the entrance of the reservoir forming the *delta*.



Reservoir Sedimentation: Delta

Guavio Reservoir, Colombia Provided by G. Morris

Reservoir Sedimentation

Finer particles travel further downstream and, for the right conditions, could become *turbidity currents*.



Reservoir Sedimentation Turbidity Currents



Turbidity Currents

 Sediment-laden water enters a reservoir and plunges under the clear water.



Turbidity Currents

 Sediment-laden water enter clear water. under the

Unknown. Provided by G. Morris

Turbidity Currents

Generating and maintaining a turbidity current event depends on:

Hydrological events

- Sedimentological predispositions
- Topography of the reservoir



Turbidity Currents Venting

If it reaches the dam, opening the low-level outlets can reduce deposition significantly, by **turbidity current venting**.



Turbidity Currents Venting

It releases the turbid flow through the low-level outlets maintaining the storage pool levels by trying to *match the outflow volume at the low-level outlets with the turbid inflowing volume*.



Sediment Management Strategies

Reduce Sediment

- Basin erosion control
- Upstream sediment trapping

Route Sediment

- Off-stream reservoirs
- Drawdown
- Sediment bypass
- Turbidity currents venting

Remove Sediment

- Flushing
- Dredging
- Excavation





Sediment Routing Techniques



Sediment Routing Techniques



- Off-stream reservoirs
 - Drawdown



- Sediment bypass
 - **Turbidity currents venting**





Turbidity Currents Venting

It releases the turbid flow through the low-level outlets maintaining the storage pool levels by trying to *match the outflow volume at the low-level outlets with the turbid inflowing volume*.



Predicting Turbidity Current Venting

Effectiveness of turbidity currents venting depends on:

- Topographic features of a reservoir
- Length of the reservoir
- Magnitude of the incoming flood peak
- Inflow sediment characteristics
- Water level in the reservoir during the period of venting
- Outlet elevation in relation to the reservoir bottom
- Discharge capacity of the outlets
- Mode of operation of reservoir





Advantage of Turbidity Current Venting

- Desired reduction of sediment deposition
- No effect on the pool storage or elevation
- Preserves the natural sediment-transport characteristics of the river
- More ecological justifiable way to release sediments out of a reservoir









Historical Data

Main countries: Asia, America, Africa

- Earliest record: July 1919 (Elephant Butte Reservoir, NM)
 - General documented efficiency: 23% 80%



Morris & Fan, 1998



Density Current Venting Physical Model



"If water is life, rivers are its arteries. Dams regulate or divert the flow through these arteries, affecting the life-blood of humanity." - World Commission on Dams, 2000 (p. 3)





