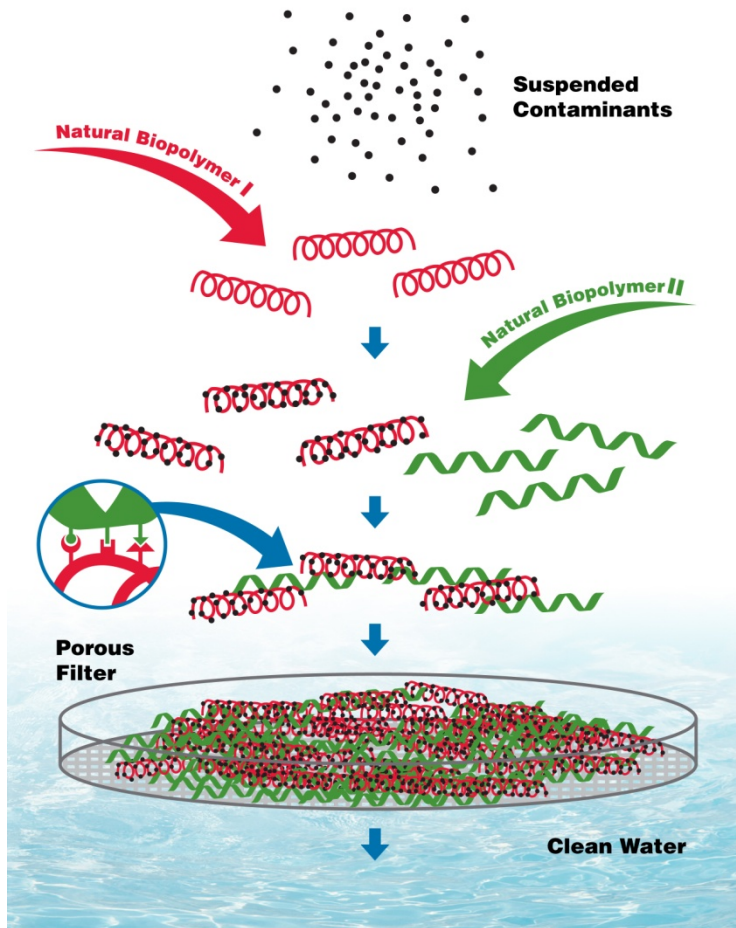


Biopolymer flocculants for sediment control in effluent from tunnel excavation in an ecologically sensitive environment

F. Kneib¹, N. Araujo², A. Saborío Rojas³, J. I. Santiago¹, y J. F. Williams¹



A discovery: Biopolymer interactions cause 'unexpected' aggregations



Trapped contaminants in fibrillar masses can be :

- Suspended solids/sediment
- Microorganisms (ie.bacteria, cysts, viruses)
- Microalgae
- Coal fines, mining tailings
- Metal oxides
- PAC-bound hydrocarbons, PCB's, hydrophobic organics

Putting the discovery to work: Proyecto Hidroeléctrico Balsa Inferior (Aerial View and Location of PHBI)



Pititoy Solitaria
(Tringa solitaria)
 Laguna artificial del Polvorín.



Ranita de vidrio
(Cochranella granulosa)
 Humedal Remanente



Orquídeas.
 Casa Maquinas.

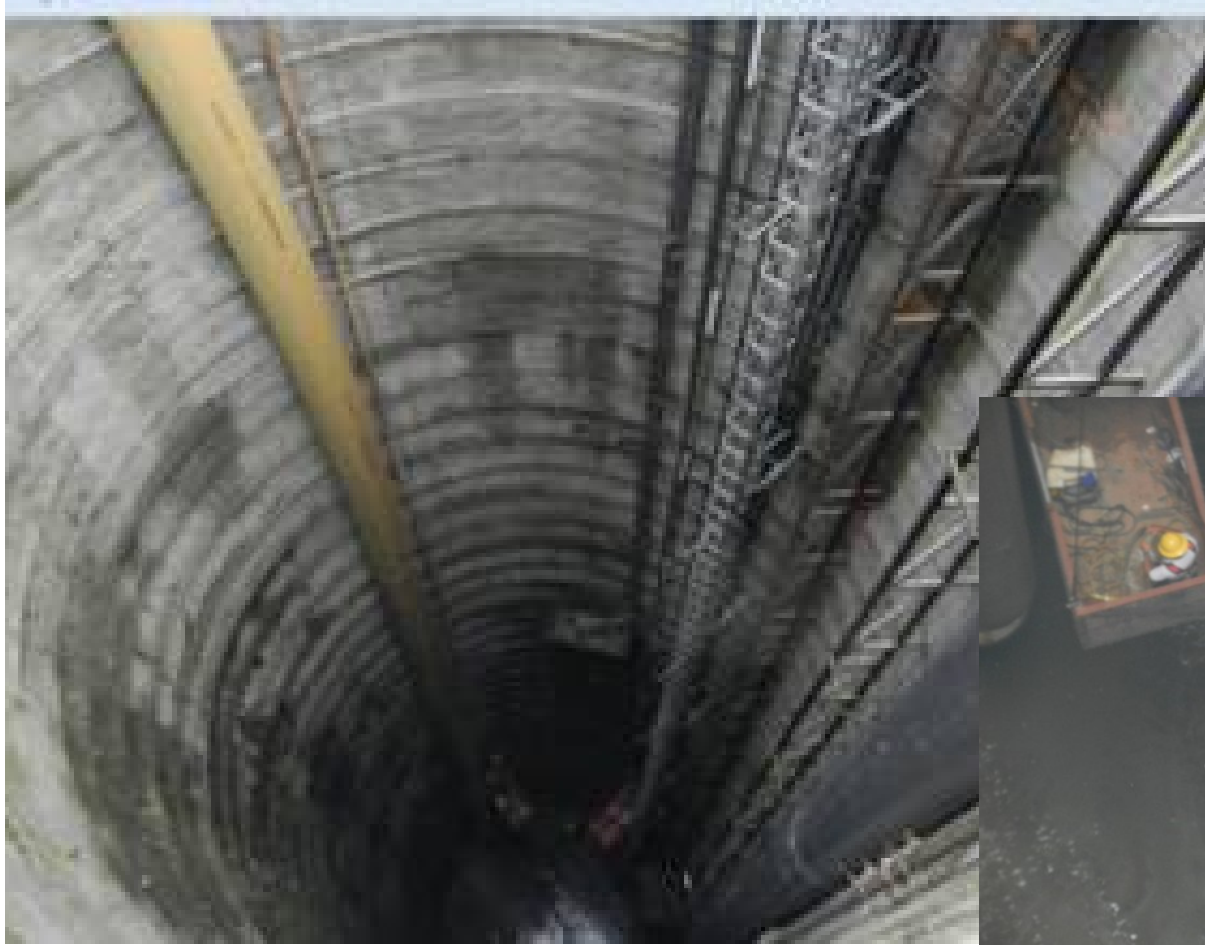


Tortuga negra
(Rhinoclemmys funerea)
 Quebrada la Cangreja.

Central Construction Site PHBI, Costa Rica



Tunneling Operations



- Solids
- Storm/Ground Water





Traditional Sedimentation Control System



Routine Sediment Control System Maintenance with Large Pumps and Dump Trucks

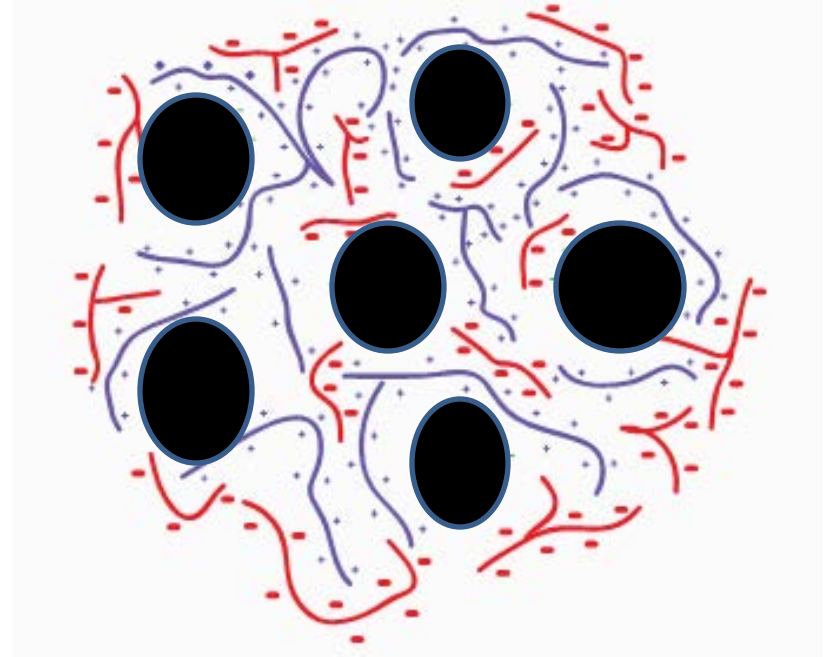
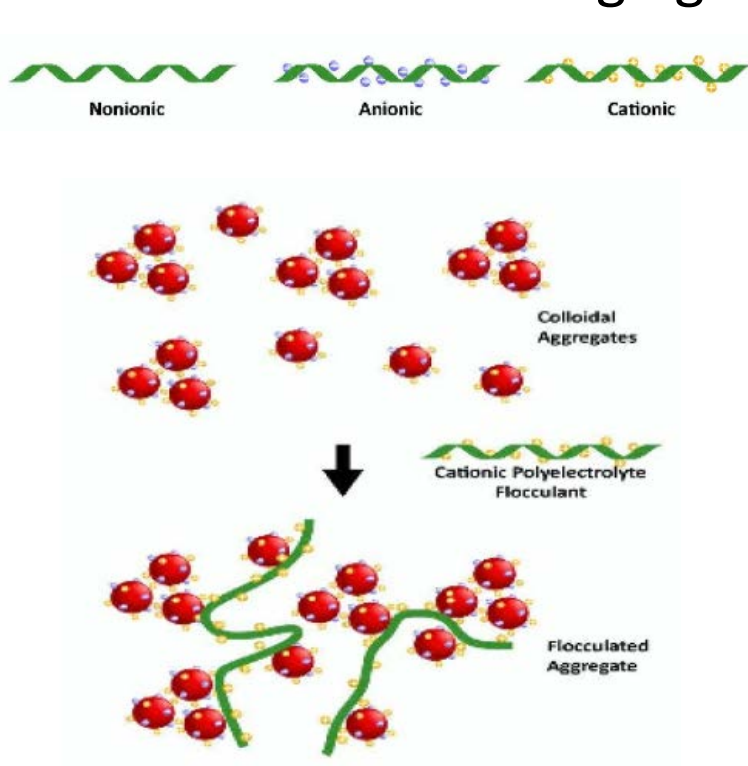


Environmental Discharge: Traditional Sediment Control System

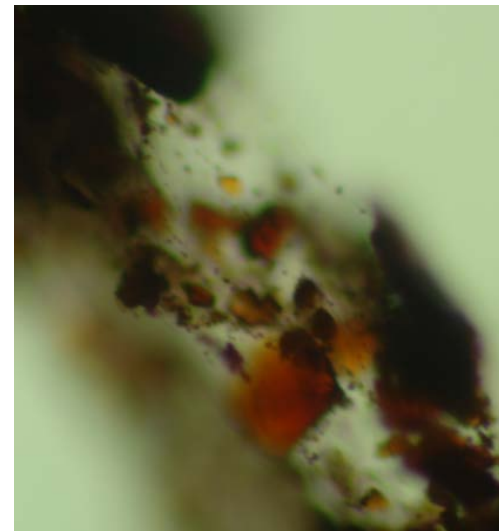


Complementary biopolymer flocculants:

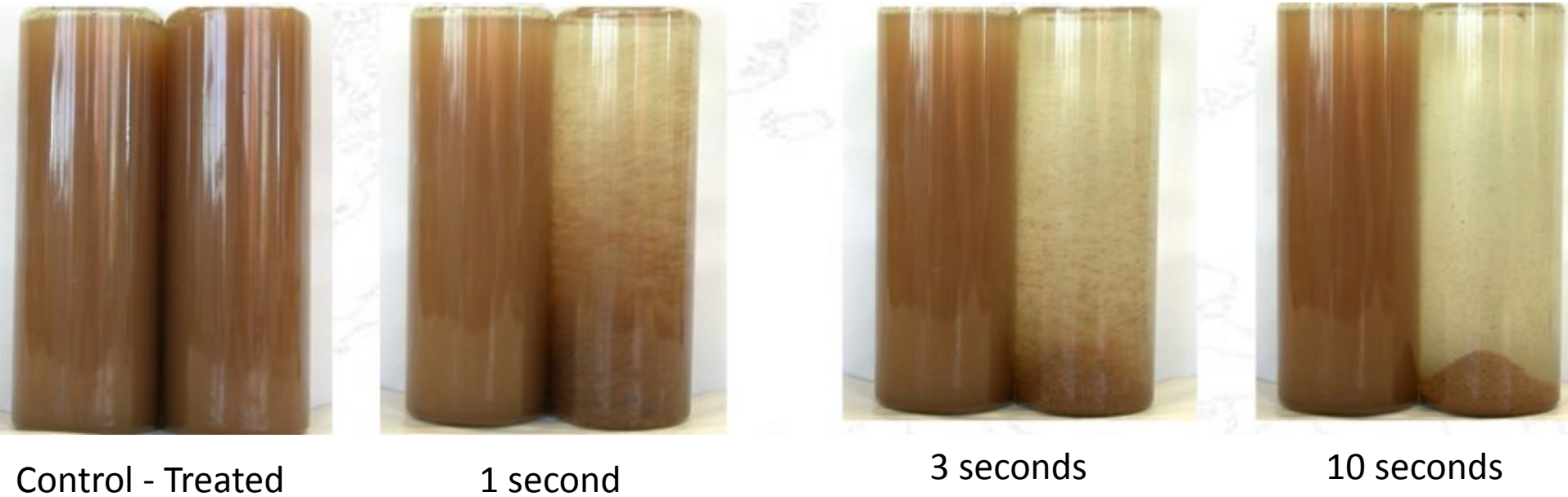
turbo charging the aggregative efficacy



High mag microscopic view
of fibrillar aggregates and
trapped particles



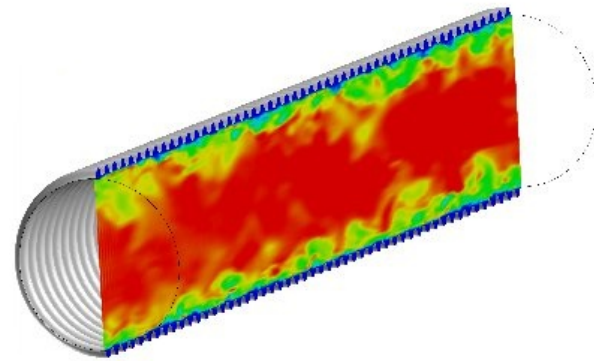
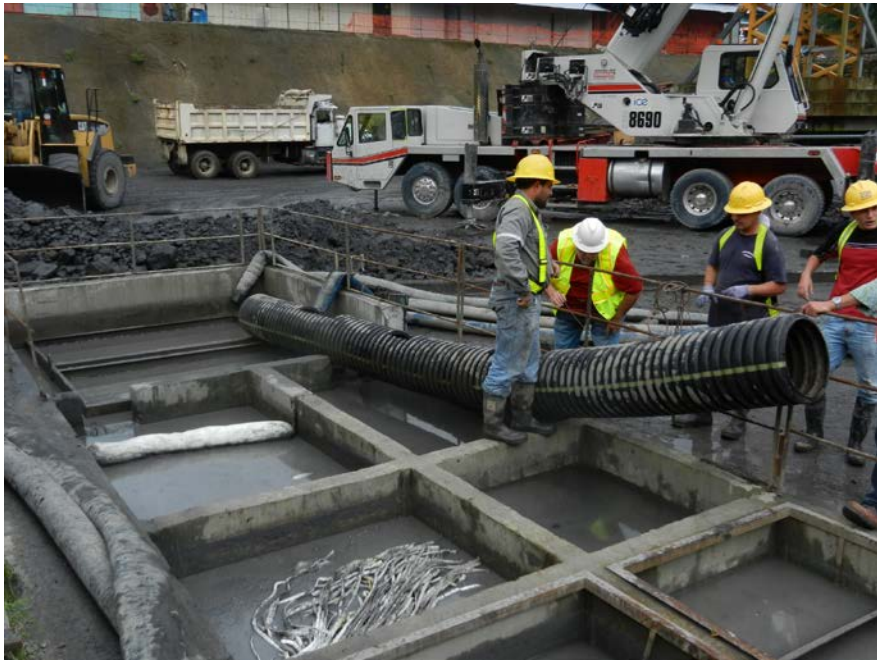
Faster Sedimentation Rate of Suspended Solids



Sediment Control Systems



Passive Sediment Control Systems : options

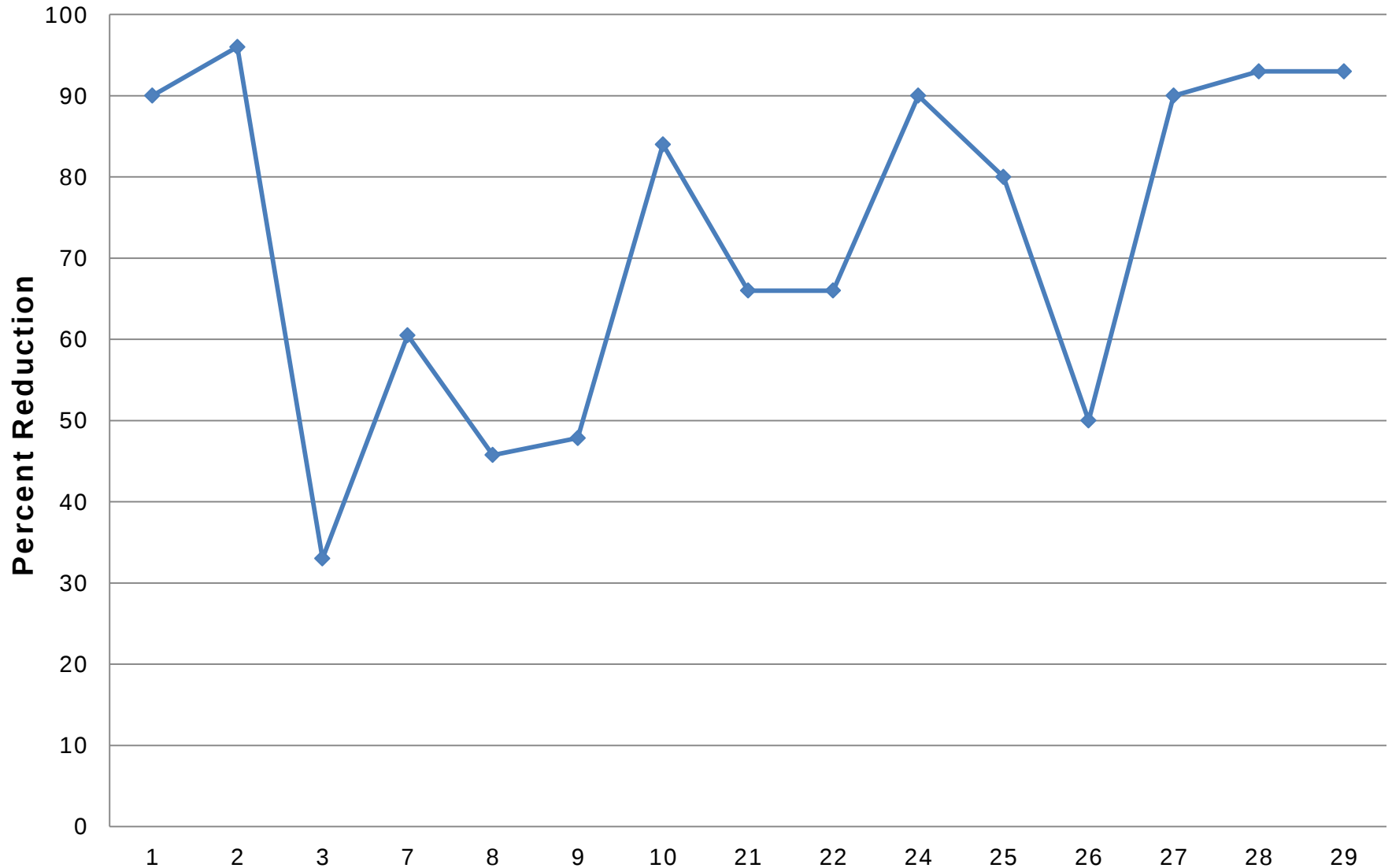


Turbulent Flow in Corrugated Pipe

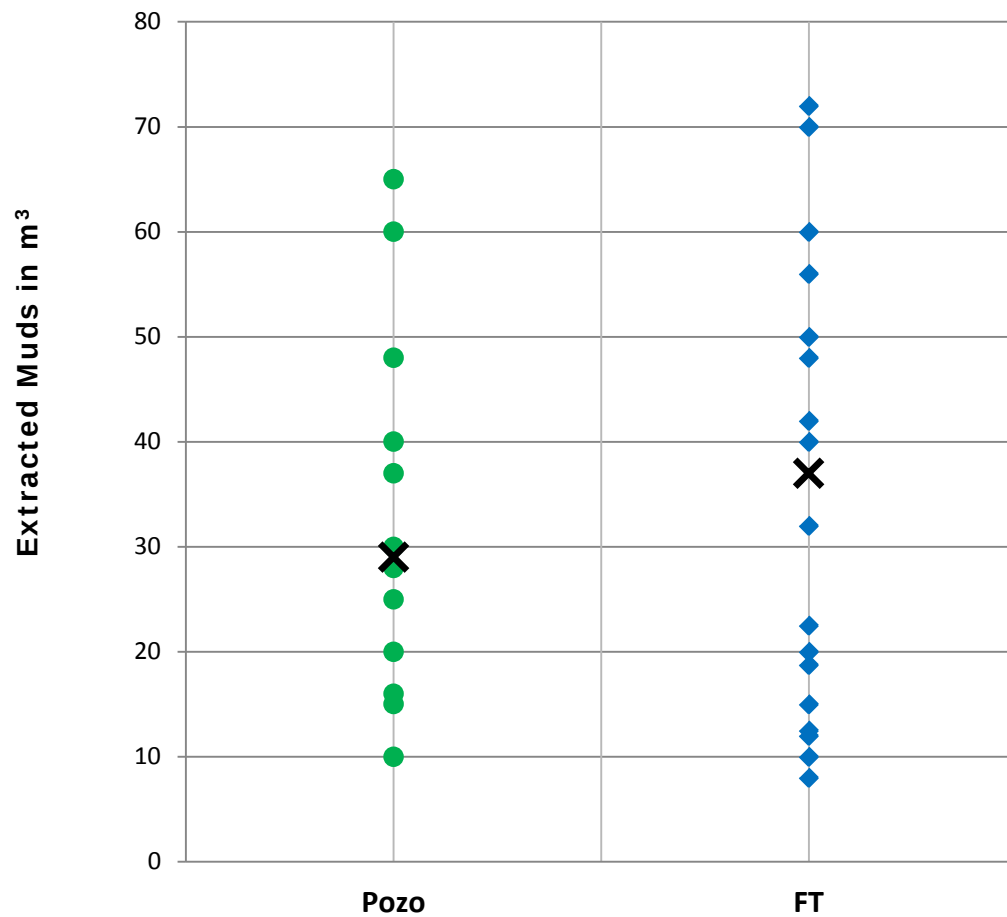
Daily TSS Reduction of Sediment Control System #1

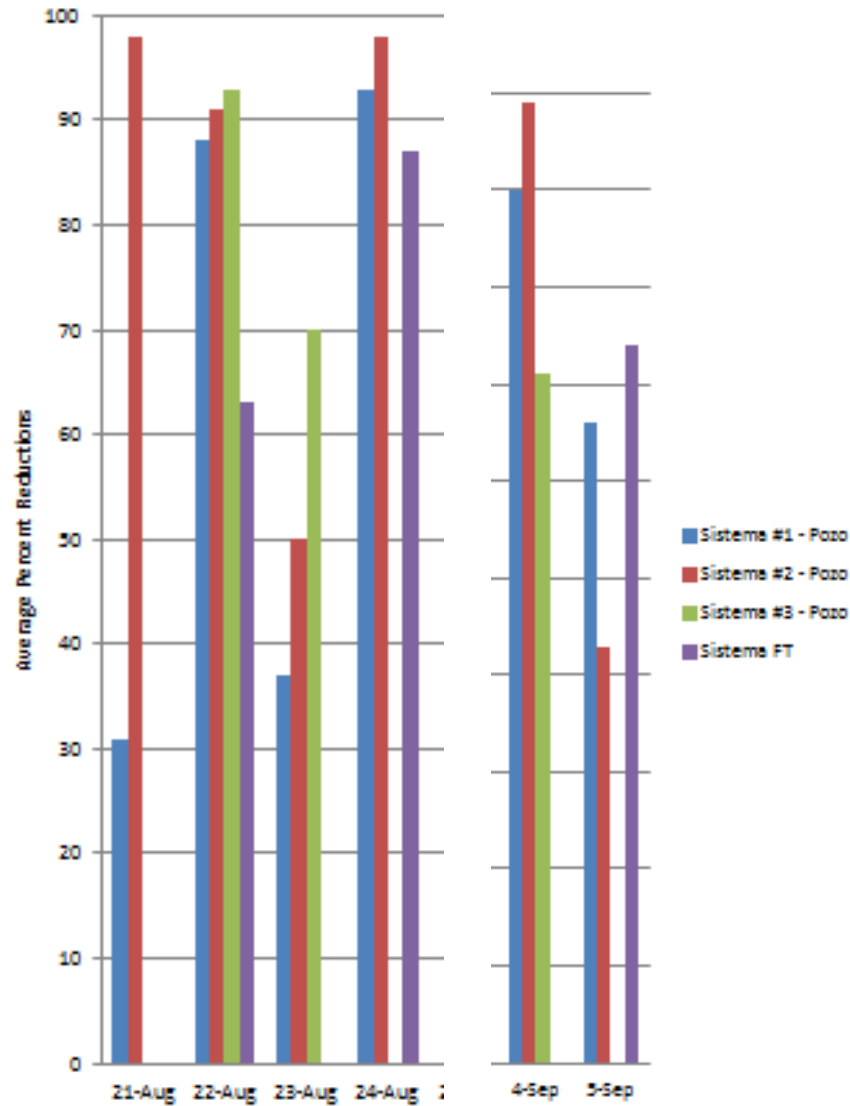
February 2012

(Inhoff Cones)



Sediment Control Systems Maintenance/Cleanup Central & End of Tunnel





TSS Reductions on PHBI Waste Streams August- September 2012

Evaluation @ PHBI



BMP Improvements



- Employee Training
- Daily Maintenance
- Data Collection:
 - pH
 - Temperature
 - Conductivity
 - TSS Reduction
 - Cleanup Volume
- Systems' Optimization

Rio Balsa now

