

Tailings Management in Guyana



Kamwatta Creek, downstream from Eyelash Landing, NWD



Arakaka Creek, NWD

**SOCIO-ENVIRONMENTAL ISSUES in
SMALL to MEDIUM SCALE
GOLD & DIAMOND MINING**

*By Chris Curnow [2002]
GGDMA Miners' Environmental Officer*

Tailings Management

- 1. Introduction:** What are we trying to do?
- 2. The Reality:** Common Constraints
- 3. Modes of Mining**
- 4. Mercury Rising**
- 5. Options for Minimising Impacts**
- 6. Where to from here?**



**What Are We
Trying To Do?**





Clean Water

Turbidity 10 NTU, Arakaka Creek, upstream from dredging, NWD



Healthy Communities



Turbidity 180 NTU, Barima River, Arakaka Village, NWD

Maintain Production



Gold production, Kamwatta Creek, NWD



What Are We Dealing With?

**Common Constraints:
The Reality**



*Shifting location, Kamwatta Creek, downstream from Eyelash Landing, NWD
INSET: Forever breaking down: On-site repairs*



Subsistence Mining

Zero Mine Site Planning



Mining from Ridge to Ridge
Where did the creek go?

Kamwatta Creek flows from one old pit to the next, downstream from Eyelash Landing, NWD

Highly Transient Community

Hard to plan for Tailings Management when those responsible shift camp so readily.

***“When the gold aint showin’
you pack up and go!”***

Temporary accommodations, Powisparu backdam, Five Star, NWD

Modes of Mining



Land Dredging



GGMC Engineer, Peter Hutson, observes a seriously clogged Arakaka Creek, NWD: Turbidity +3000 NTU

Even with the backfilling of old pits the tailings invariably end up in the creek.



Land Dredging



Flooded work pit from a rising Mazaruni, Upper Mazaruni

Mining **too** close to the river bank.

Breaches caused by illegal river dredging activity or through excavations made to transport dredges inland, cause problems for both production and the environment: **lost time & escape of tailings.**

River bank **stability** is crucial for maintaining **water quality**

Land Dredging

Hydraulic mining
generates enormous
quantities of tailings.



Jet operators working through old tailings overburden, Arakaka Ck, NWD

In Kamwatta and Arakaka Creeks, **gravel** lies below an average of **2.5 metres** of overburden, which consists of clay loams, sandy loams, sands and, in some instances, old tailings.



Hydraulic mining of exposed gravel layer, Kamwatta Ck, NWD

River Dredging

Illegal dredging into river **banks** is problematic for maintaining water quality standards



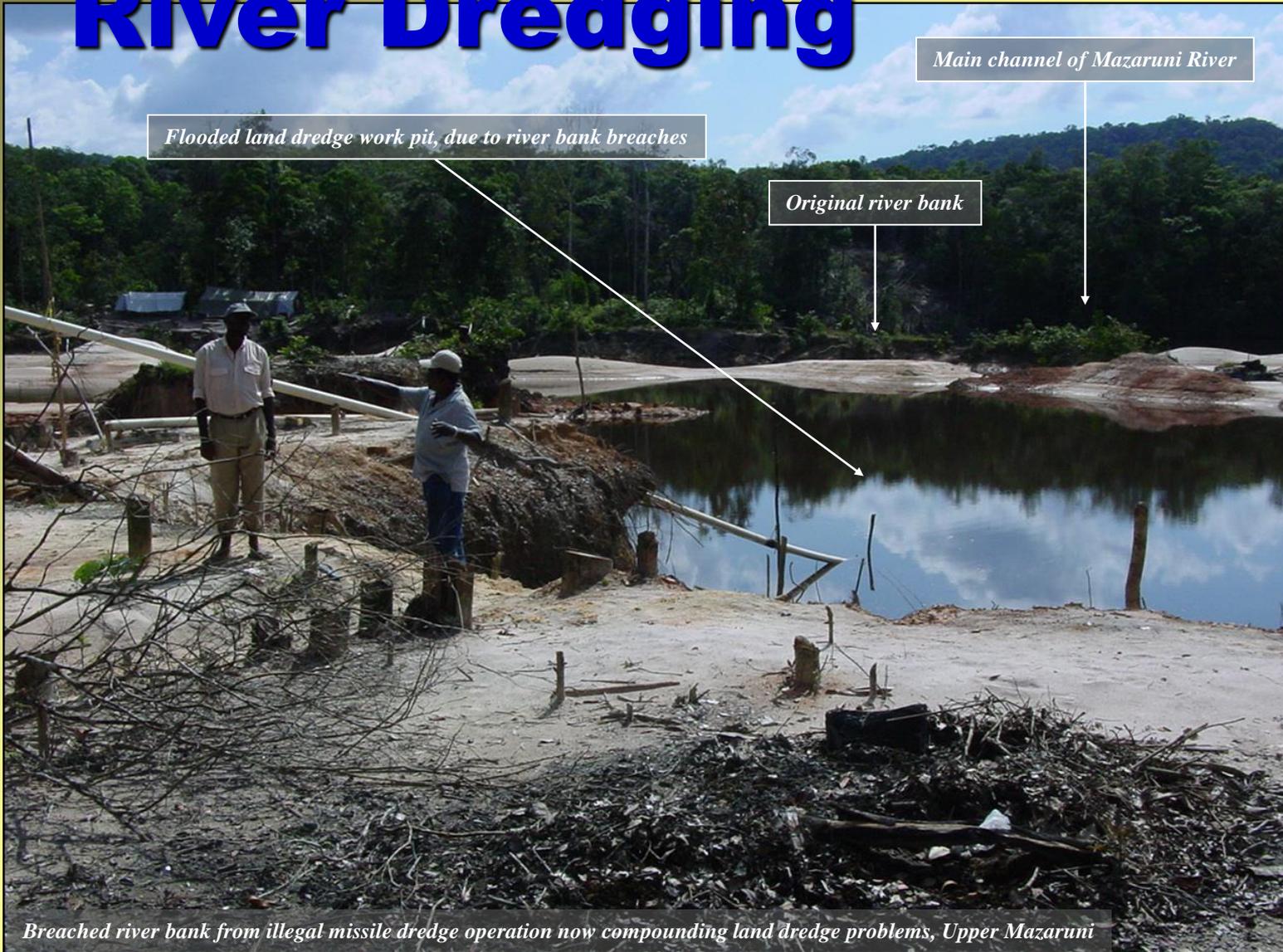
Breached river bank with missile dredge inside, Upper Mazaruni

While the river bed is typically more **scarce in clay and silt**, the river bank however, is defined by its higher proportions of fine material, the type that remains in **suspension** longer and creates turbidity problems.



Breached river bank with missile dredge inside, Upper Mazaruni

River Dredging



Flooded land dredge work pit, due to river bank breaches

Main channel of Mazaruni River

Original river bank

Breached river bank from illegal missile dredge operation now compounding land dredge problems, Upper Mazaruni



River Dredging



Cutter suction dredge, Upper Mazaruni, below Kamarang

These cutter-suction river dredges have tailings management issues of a different nature.



Cutter suction dredge, Upper Mazaruni, below Kamarang

Excavator with Land Dredge



Excavator, having removed overburden, stockpiles gravel for wash down, Tiger Creek, NWD

Excavator with Land Dredge



Excavated pits being backfilled, Tiger Creek, NWD



Excavator with Ground Sluice



Excavator stockpiling ore-bearing ridge topsoil for jetting down, Kamwatta Ck, above Eyelash landing, NWD

Excavator with Ground Sluice



Ground sluice discharging into Kamwatta Ck, above Eyelash landing, NWD

Working on the ridge slopes with an excavator and ground sluice receiving gravity fed slurry, eliminates the need for the suction dredge motor. In this scenario, only one engine is employed, that of the water pump supplying the jets.

Rock Crusher with Ground Sluice



Un-reinforced shafts, 10-Mile backdam, NWD

Underground mining with un-reinforced shafts for the extraction of **gold-bearing quartz veins in hard rock and saprolite. This material is then put through the crusher.**



Manual winching of ore, 10-Mile backdam, NWD

Rock Crusher with Ground Sluice



Discharge from crusher passes over mercury-filled baffle and mercury-plate before running unchecked down slope to creek, Kamwatta Ck, above Eyelash landing, NWD

Rock Crusher with Ground Sluice



Mercury-filled baffle steps on crusher, Kamwatta Ck, above Eyelash landing, NWD

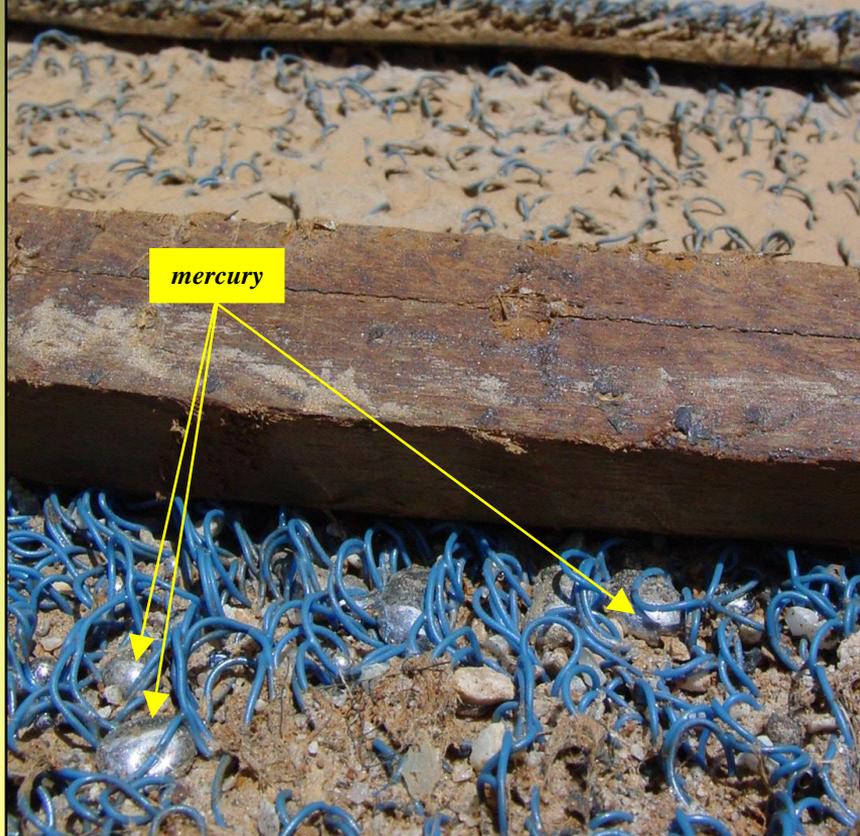
Special structures fitted to the discharge point of the rock crusher are designed to increase gold recovery:
mercury-filled baffle steps
and mercury plate



Mercury-plate on crusher, Kamwatta Ck, above Eyelash landing, NWD

Mercury in sluice box mats, Kamwatta Ck, NWD

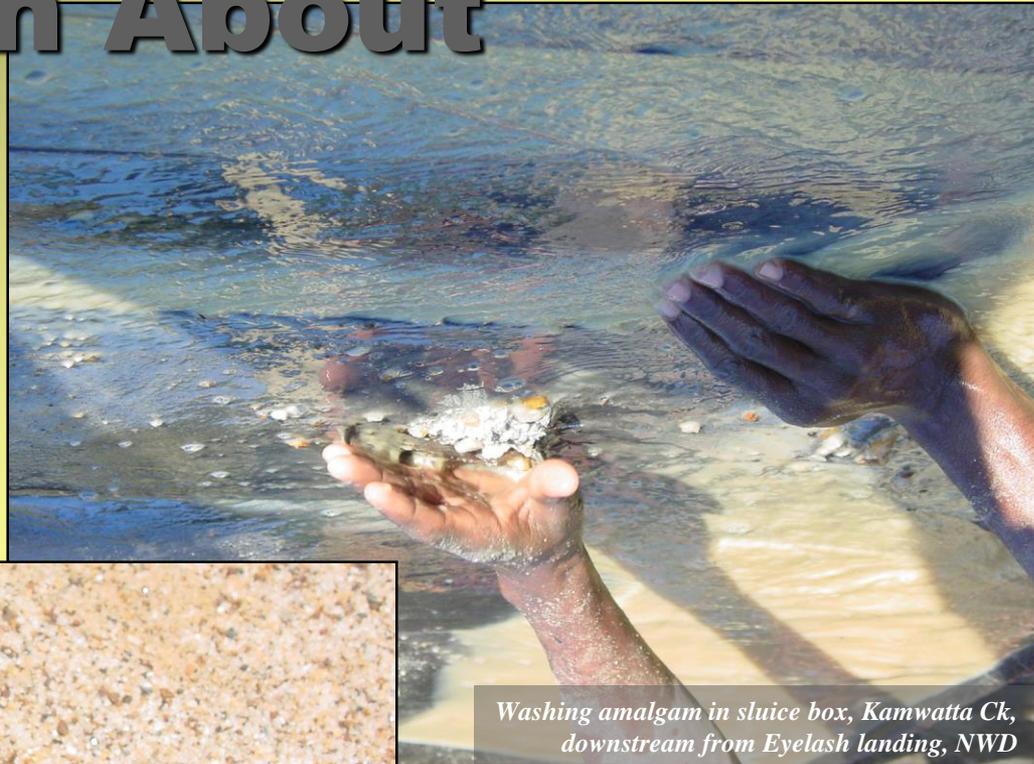
Mercury Rising



Mercury in sluice box mats, Kamwatta Ck, NWD



The Truth About Mercury



Washing amalgam in sluice box, Kamwatta Ck, downstream from Eyelash landing, NWD



Mercury on bare soil, Kamwatta Ck, downstream from Eyelash landing, NWD



Options for Minimising Impacts

- 1. Do Nothing**
- 2. Complete Shutdown**
- 3. Partial Shutdown**
- 4. Remedial Work in Selected Cases**
- 5. Tailings Management Workshops:**
Sensitisation of Concepts & Technical Advice
for Compliance
- 6. Regulating New Operations**



Remedial Works

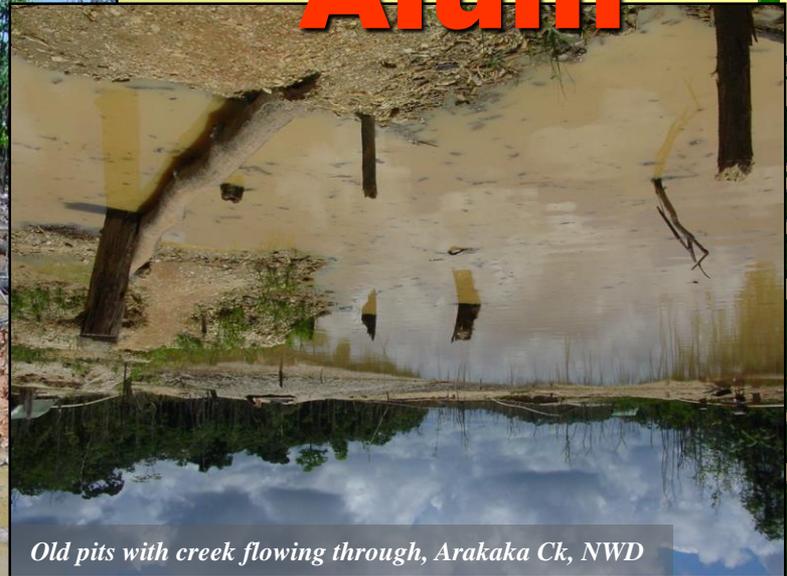
- 1. Large Containment Dams**
- 2. Alum**
- 3. Ravine Dams**
- 4. River Bank Breach Dams**
- 5. Backfilling**
- 6. Diversions**



Alum



**RESULTS
PENDING**



Old pits with creek flowing through, Arakaka Ck, NWD



Isolated old pit with non-settling tailing, Arakaka Ck, NWD



Isolated old pit with natural settlement, Kamwatta Creek, NWD

Ravine Dams



Poorly maintained primary ravine dam, Upper Mazaruni



Secondary ravine dam with discharge pipes, Upper Mazaruni

The damming of **ravines** is a short term solution. Initial results with primary and secondary dams in the same ravine, showed immediate reductions in turbid discharge to river (*pers.comm.* P. Hutson).

Ravine Dams



Secondary ravine dam filled beyond capacity, Upper Mazaruni



Primary ravine dam completely covered with tailings. The hydraulic profile of the ravine has been completely altered, Upper Mazaruni

However, tailings **generation far exceeds volume capacities** of ravine dams, and without regard for de-commissioning of dams, they quickly fill to beyond capacity and become **obsolete**. They remain a threat to future water quality through their inevitable failure and the **subsequent release** of tons of tailings **en masse**.

River Bank Breach Dams

Sand bagging of breach to contain tailings, Upper Mazaruni



**RESULTS
PENDING**



Using local materials plus imported sand bags a large breach to the river is dammed. The idea is that **coarse tailings** will accumulate further back from the dam wall with the aid of **silt fences**. Suspended material in the water (**fine tailings**) held back by the dam will then have time to settle before discharging to river.

Backfilling



Backfilling large old pit, Kamwatta Ck, NWD

With minimal mine site planning and old pits receiving the constant flow of the creek, the practice of backfilling without water recycling in a closed circuit system, brings **little change in water quality.**

Diversions



Block-off to isolate work pit from creek, Arakaka Ck, NWD



*Excavated creek diversion,
Tiger Creek, NWD*

**Mainly constructed
for **water management**
purposes and not
especially for
environmental
reasons.**

Tailings Management Workshops

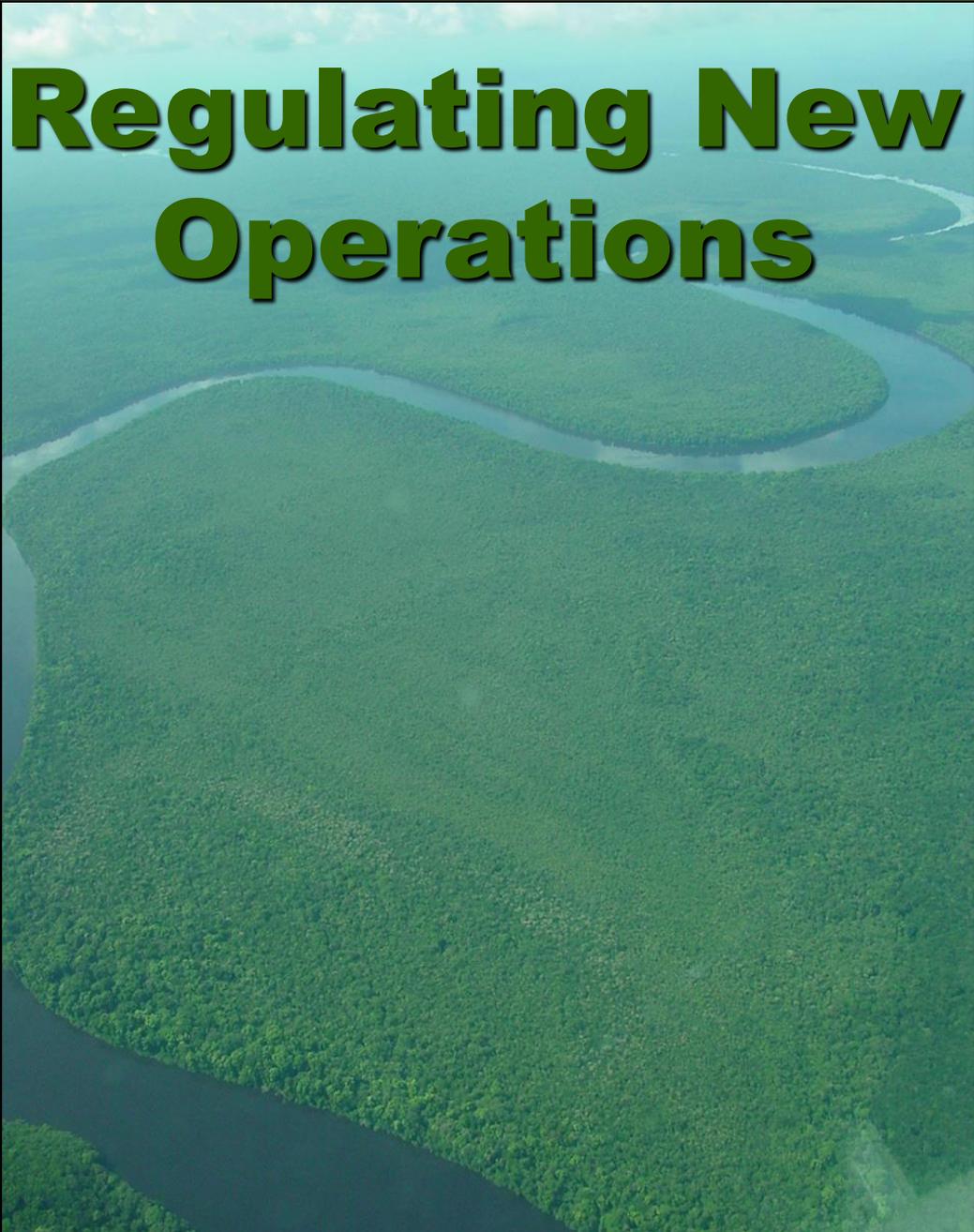


One-to-one discussions between GGMC/GGDMA staff & miners in the back dam re tailings management, Kamwatta Ck, NWD



Evening workshop in the backdam, Powisparu backdam, Five Star, Barima River, NWD

Regulating New Operations

An aerial photograph showing a wide, meandering river flowing through a vast, dense green forest. The river's path is highly irregular, forming several large loops and curves. The forest appears thick and continuous, with varying shades of green. The sky is visible at the top, showing a light blue color with some white clouds. The overall scene is a natural, undisturbed landscape.

Meandering section between Oranapai and Kamakusa, Middle Mazaruni River, Region 7

A vertical strip of green leaves and branches is positioned on the right side of the slide, extending from the top to the bottom. The leaves are small and pointed, with a vibrant green color. They are arranged in a way that suggests a branch hanging down.

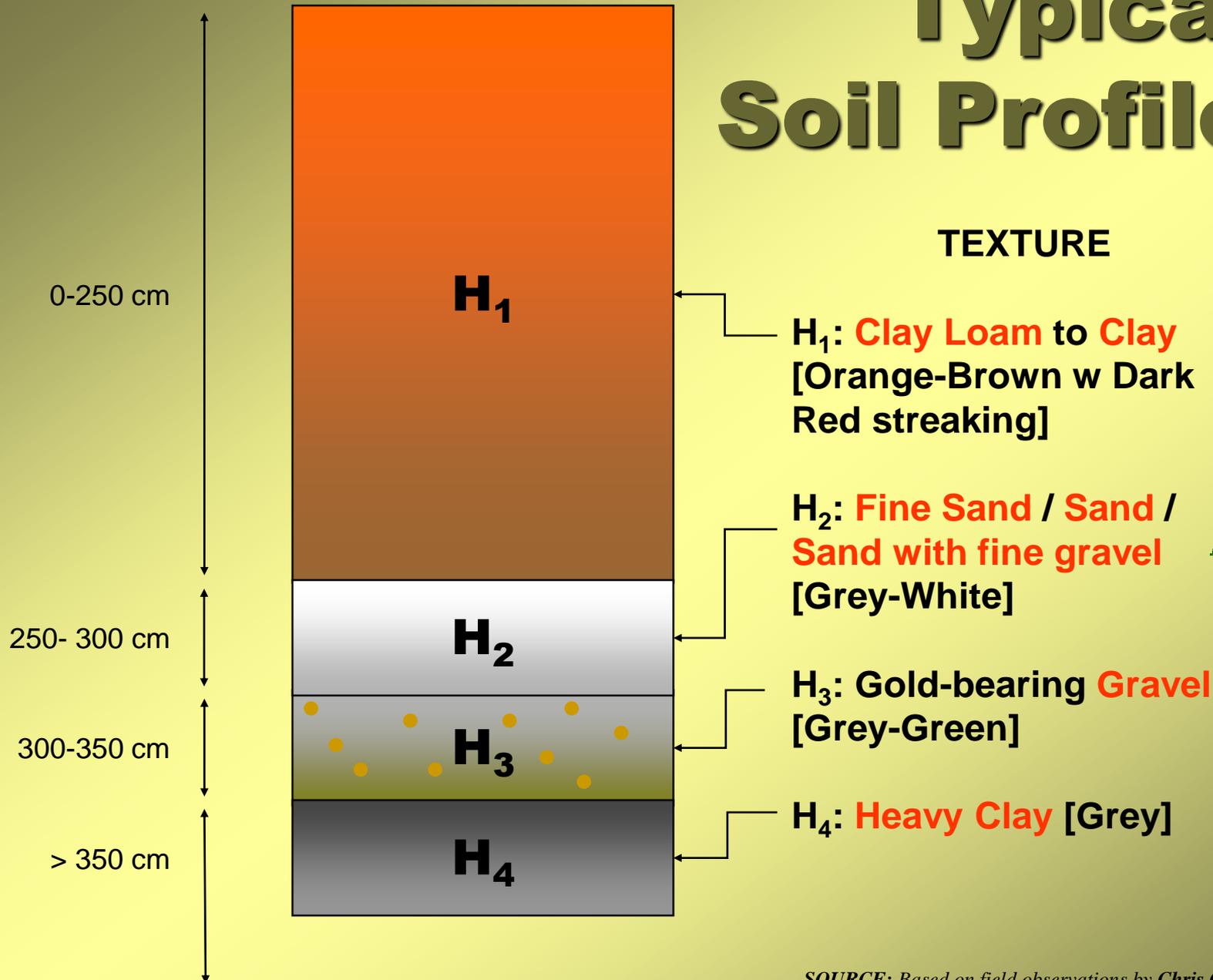
A Way Forward

1. **Improved exploration** techniques
2. **Developing capacity** in mine site planning
3. **Tailings reduction** through alternative overburden removal
4. **Closed Circuit System** with creek isolated/diverted and all water recycled



Typical Soil Profile

TEXTURE



SOURCE: Based on field observations by Chris Curnow and Kierion Husbands in Eyelash & Arakaka backdams.

Tailings Reduction

A move to toward **dry mining** will be part of the solution for managing tailings in tropical Guyana

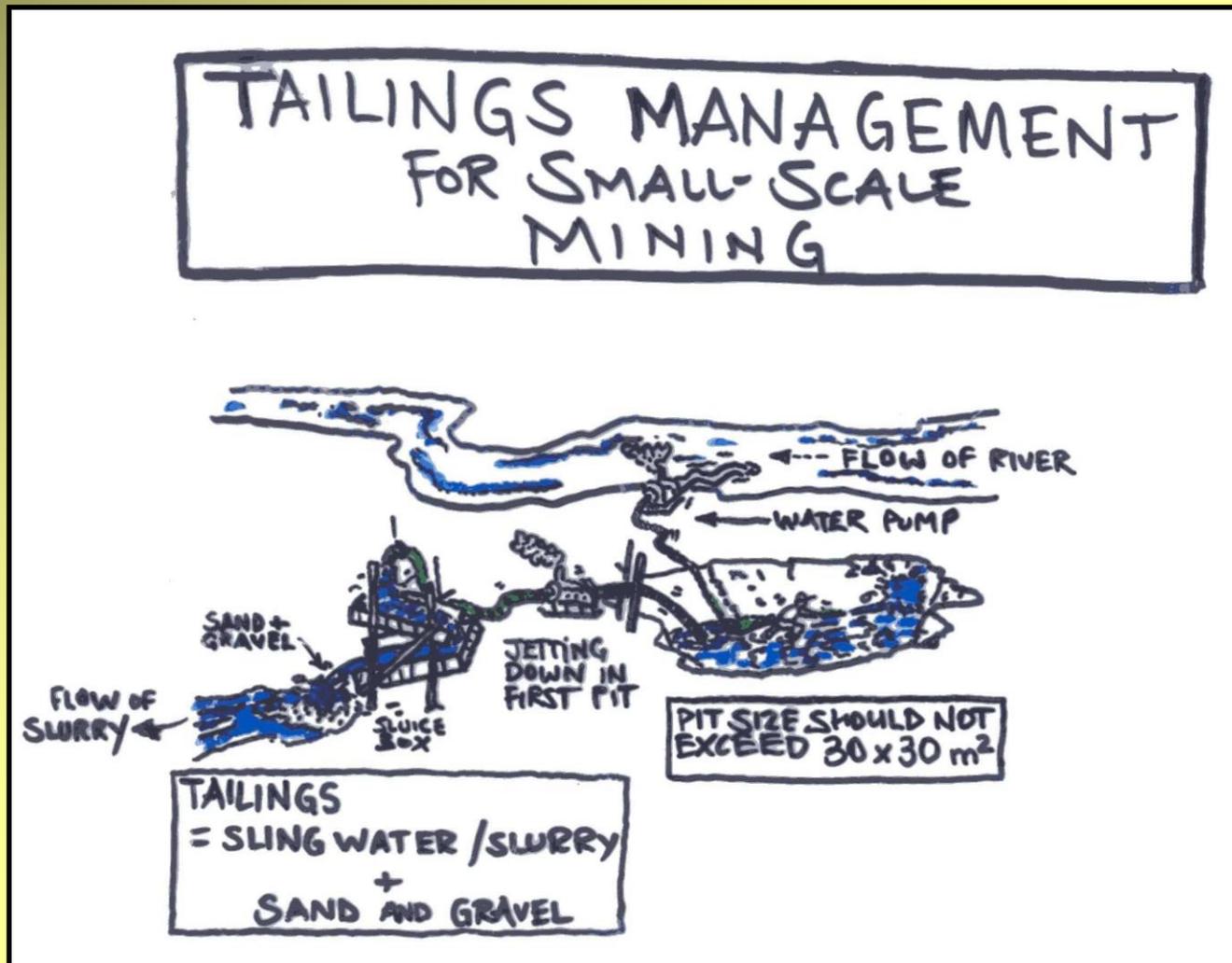


Excavators allow for better tailings management, Kamwatta Ck, above Eyelash landing, NWD



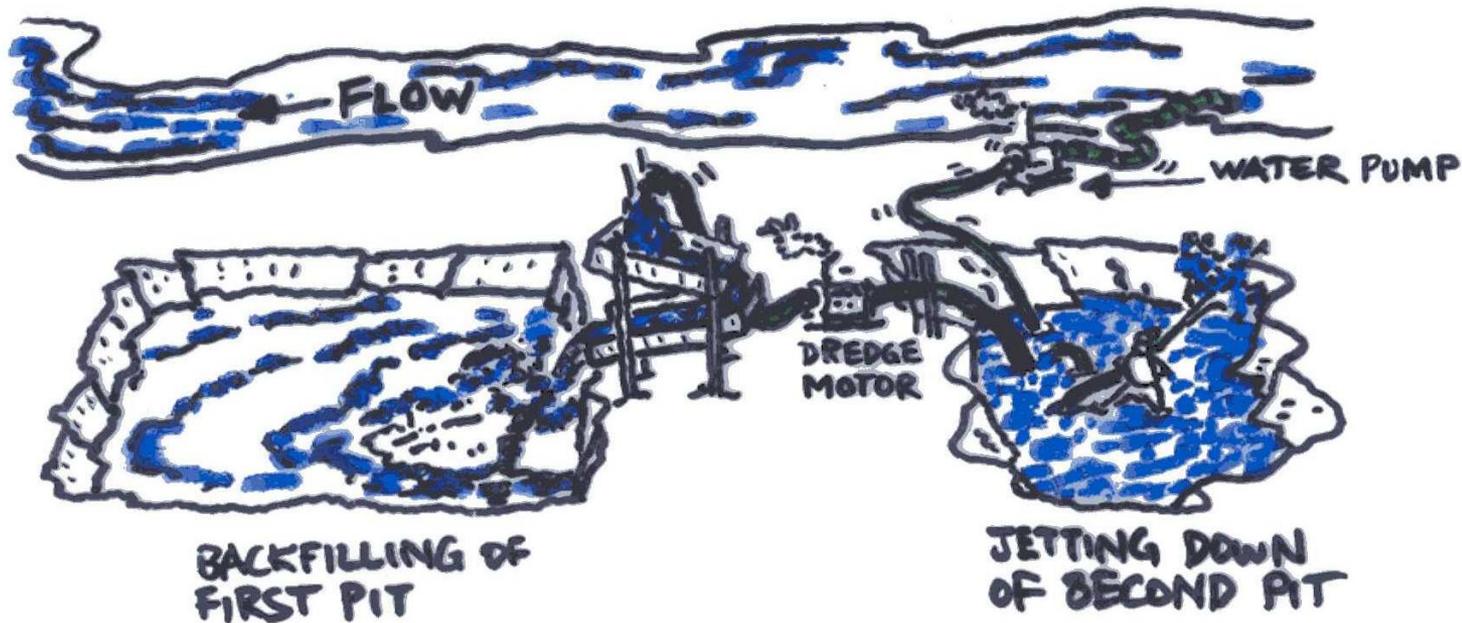
Excavation of overburden reduces tailings volume, Kamwatta Ck, NWD

Closed Circuit Theory 1



Closed Circuit Theory 2

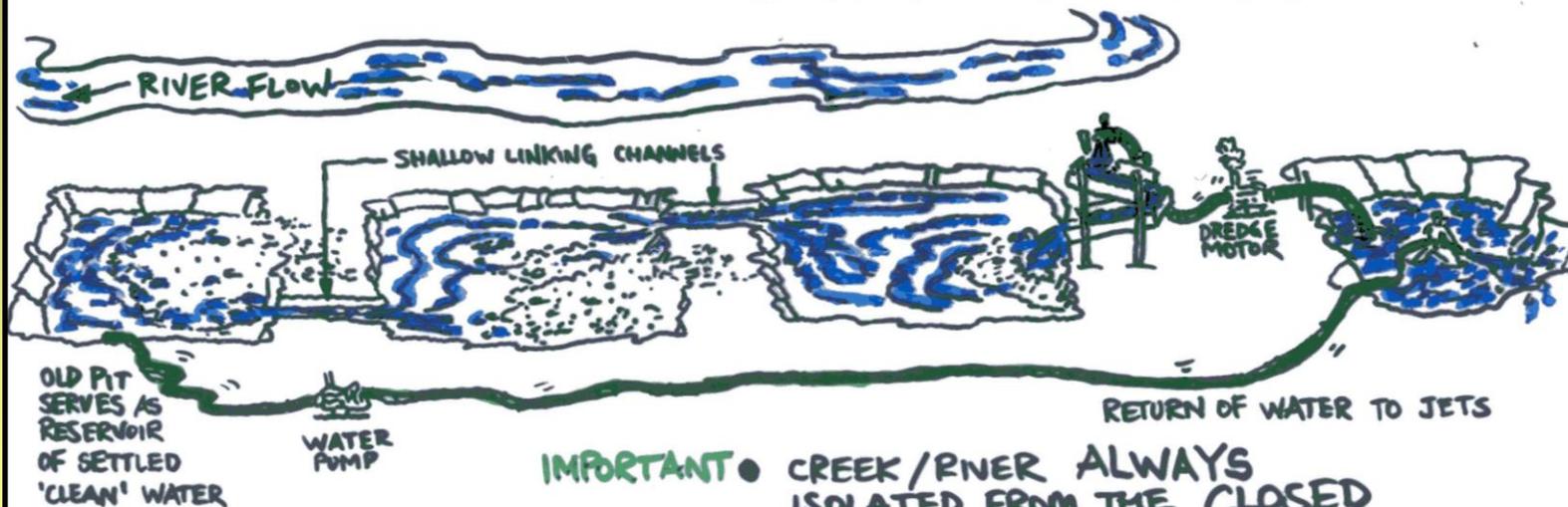
EVOLUTION OF THE CLOSED CIRCUIT SYSTEM



Closed Circuit Theory 3

CLOSED CIRCUIT

- REGULAR 'JUMPING' OUT OF PITS AND BORING DOWN ANEW
- CONSTANT BACKFILLING
- RECYCLING OF WATER

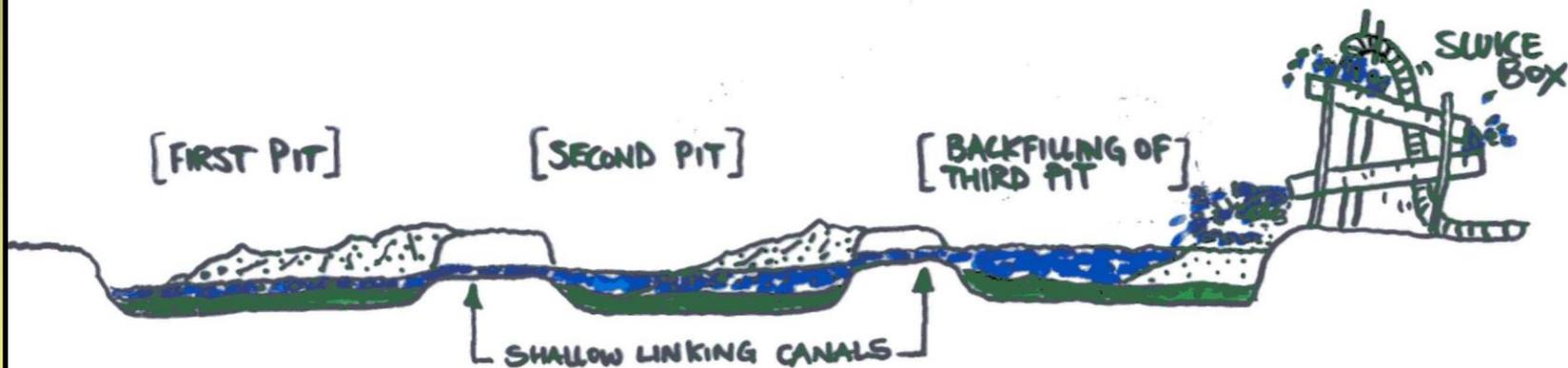


IMPORTANT ● CREEK/RIVER ALWAYS ISOLATED FROM THE CLOSED CIRCUIT SYSTEM

Closed Circuit Theory 4

CLOSED CIRCUIT

LINKING OF OLD PITS WITH SHALLOW CHANNELS



- IMPORTANT**
- NEVER OVERFILL PITS WITH TAILINGS
 - ALWAYS LEAVE ENOUGH DEPTH FOR SLURRY TO STAND
 - KEEP CREEK OUT OF ALL PITS

**The Closed Circuit
Theory in the Context of
100% Hydraulic Mining
Requires Further
Analysis**



SWOT Analysis of the Tailings Management Project

Strengths:

- Greater awareness of environmental impacts in NWD and Upper Mazaruni (90% of operators contacted)
- Greater willingness to make initial attempts at modifications

Weaknesses:

- Lack of resources to implement solutions
- Inability of operators to comply with requests
- Mines Officers lack skills & time to do follow-up
- Insufficient workshops being run
- Lack of visual educational material

Opportunities:

- More workshops
- Established relationships
- Research into closed-circuit systems, including rapid filter systems and modified gravel/slurry pumps
- Practical exploration techniques

Threats:

- Subsistence mining
- Lack of human resources
- Capacity strengthening requirements

Where To From Here?

- 1. Workshops**
- 2. Human resources**
- 3. Closed Circuit research:** Backfilling vs. Purpose-built
- 4. Investment:** Market vs. Subsidy
- 5. Service-industry jobs**
- 6. Regulation that is ahead of the Industry**



A Final Word

Backdams like *Eyelash* and *Arakaka* in a fully-financed integrated project would require 6-8 months of intense remedial works before real improvements could be claimed.



The Choice Must Never Be:

SOCIAL CRISIS



VS.

ECOLOGICAL CRISIS

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