

The Vetiver System in Panama

❖ **Part I:** Rehabilitation of Major Landslide in Finca Isabel, using The Vetiver System

❖ **Part II:** Introducing The Vetiver System to La Mina de Cobre (Copper Mine) in Panama ~ Construction Phase

Part I: Rehabilitation of Major Landslide in Finca Isabel, using The Vetiver System



Dec 2008

Construction and conformation of slopes (2009)





Mani Forrajero
(*Arachis Pintoi*)



2010

2012



13.08.2012 07:47



2013



2013



2013



2013







Nursery areas in Finca Isabel

Among the guava
trees





Vetiver Grass Handicrafts





Part II: Introducing The Vetiver System to La Mina de Cobre (Copper Mine) in Panama ~ Construction Phase

- Colon Province, towards center of Panama. Size of project concession is currently 5,900 hectares, zone of majority primary and secondary rainforest
- Many years of geological exploration, and about 4-5 years of ecological study (flora and fauna), geotechnical and hydrological studies.
- Construction began in 2011
- Open Pit Copper Mine, potential to become the largest copper mine in this part of the world. Very large scale deforestation and earthworks in area of very high rainfall (5000 mm per year).

- Project in Construction Phase for next 4 years (Roads, Camps, Infrastructure, Waste Water Systems, Mine Strip, Tailings Dams)
- Joined project in 2012 as geotechnical engineer. Introduced The Vetiver System concept to senior environmental and geotechnical engineers in March 2012.
- Researched local personnel involved with vetiver in Panama. Found some names through the TVNI and Red Latina, but almost no responses. Was contacted by Marietta de Landis.
- Arrived on site in Panama in May 2012.
- Marietta advised of local landscaping company with vetiver grass. Visited them and found they had vetiver grass, to date used for landscaping and decoration, but no knowledge of The Vetiver System.

- Was very difficult to introduce the concept of Vetiver Grass to decision makers on the project.
 - Little support from superiors, apart from curious interest
 - Engineers had little confidence in its stabilization capability
 - Resistance from client environmental personnel because not Native to Panama. Fear of Invasiveness, even though shown evidence of sterility – certified non-invasive by the USDA.
 - Not attractive due to labour intensive installation – preference for hydroseeding and geomats due to fasted installation.
- Yorleny Cruz (TVNI Costa Rica) made a visit to the project and gave a presentation to the client, engineers and contractors.
- Finally had success in getting a small order approved (20,000 slips), for some cut and fill slopes stabilization in July/Aug 2012.

- Personnel from landscaping company had no previous training, were trained on site following techniques I obtained in the Vetiver Manuals. No harnesses used, slopes approximately 1.5H:1V.
- Slips brought to site cut about 15 cm long, in back of pick-up truck, and planted the same day. Some slips were pre-soaked several days. It was found that pre-soaked slips had almost 100% survival rate, whereas un-soaked slips had about 80% survival.
- Successful planting over a period of about 6 weeks, however no watering system in place, and a 2-week dry spell caused some of the first plants to fail.
- After this dry spell, rainfall was pretty consistent. In one area, very poor water management caused major erosion within 2 days of planting, and major slope destruction and slip washout.





No Water Management on upper platform considered. Major erosion and slips washout within 2 days of heavy rains



However, remaining Vetiver grew well and performed its function.





■ One of the slopes planted well following The Vetiver System did undergo partial failure. This was a fill slope, with gradient about 1.5H:1V. This may be in cause due to poor water management, and saturation of the slope.



- Soil type is **Saprolite**; Very clayey and silty, residual soils with low nutrients. Traditional hydroseeding grows well at first with fertilizer, but turns yellow and begins to die after a few months to 1 year after planting, if not fertilized. Although vetiver growth in the soils was not very fast, grows well and stays green and healthy without any fertilizer.
- Both hydroseeding and vetiver have **similar risk of failure in the very short term (weeks)** - because vetiver like hydroseeding does not yet have a deep root system.
- During the first few weeks to about 3 months, the failure is primarily governed by the short term stability of the slope itself due to its geotechnical properties. High saturation increases the risk of failure in most cases. Excellent **water management and water diversion** at the moment of construction is critical to reducing slope failures.
- **Fill vs Cut** slopes
- Not the majority, but some hydroseed slopes (mostly cuts) that were months old failed (long term failure). Vetiver would prove superior to hydroseeding in the long term, since its deep roots would **prevent long-term slope failure**, and also its capacity to survive in these low-nutrient soils would mean it is a permanent measure.



WASTE WATER TREATMENT

- The concept of Vetiver for waste water treatment and contaminated land rehabilitation was introduced to the client.
- Vetiver grass was planted as secondary treatment to traditional waste water treatment systems
- Below photos: Vetiver planted over gravel/rock filter, downstream of biodigester, for laundry grey water
- Potential for future use in mine waste water and tailings clean-up.



■ CONCLUSIONS

- ✓ The Vetiver System (VS) has been introduced to the project, for slope stabilization and rehabilitation purposes, and can be observed by anyone on the project interested in knowing more and seeing its long term performance.
- ✓ Short term stability is a large concern, and any type of revegetation system is at risk of failure. Good geotechnical design, and excellent water management from the moment of construction, are necessary to avoid failures.
- ✓ The soil stability conditions on this project are very sensitive, and we are of the opinion that offering the service of vetiver planting is not sufficient to guarantee success. Involvement is necessary to ensure sound construction and water management practices. The use of coconut mats in conjunction with vetiver for temporary erosion control is also being considered by us as Vetiver Panama S.A.
- ✓ The principles of vetiver for water treatment have been introduced to personnel and managers on the project, and several example installations are present and can be observed there today. This can open doors for future proposals to the client for vetiver use in mine waste water and tailings rehabilitation.

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