How did Vetiver System Technology perform during the Summer of Disasters in Australia

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Abstract

The most obvious impact of climate changes in recent years has been exceptional weather events such as high intensity, prolonged and widespread rainfall, and cyclones, causing severe flooding, landslide and erosion.

The so called ***Summer of Disasters*** in Australia from December 2010 to March 2011, caused epic flooding in the nation history, covering at one time several millions of square kilometres of land repeatedly from the tropical north to the temperate south and west to the semi desert regions. On top of the intense and extensive rainfall, the tropical north suffered one of the most intense cyclones in history. Cyclone Yasi, category 5+, devastated the thousands of kilometre of the coastline and coastal towns, towns, manufacturing and agricultural industries.

This paper assess the effectiveness of Vetiver System Technology (VST) in preventing and mitigating landslides, floods and extreme erosion in Queensland, Australia,

1. INTRODUCTION

The most obvious impact of climate changes in recent years has been exceptional weather events such as high intensity, prolonged and widespread rainfall, and cyclones, causing severe flooding, landslide and erosion.

1.1 Extend of the flooding

The so called ***Summer of Disasters*** in Australia from December 2010 to March 2011, caused epic flooding in the nation history, covering at one time several millions of square kilometres of land repeatedly from the tropical north to the temperate south and west to the semi desert regions. But the most devastating effects occurred in Queensland, the second largest state of Australia with a land area of over 1.7 million km^2 or 250 million hectares and 78% of which, 1.35million km^2 or 135 million hectares were flooded at least once over the three month period. Queensland has the tropical climate in the North and subtropical in the South, so there is a wide range of climatic and soil conditions and erosion potential in the state.

Immediately prior to the flood, Queensland had suffered a prolonged seven year drought so the vegetation cover is almost nonexistent hence enormous potential for erosion.

Therefore the flood arrived at the worst possible time as far as surface erosion and landslides are concerned.

The destruction was of epic scale, unprecedented in the nation history with 9 200km road damaged and numerous infrastructures destroyed resulted for prolonged high velocity flows (Fig 1).

Fig 1. ***Wivenhoe dam, the main water supply for Brisbane, capital of Queensland during the peak period.***

To put it in perspective the size of the area flooded over the period from December 2010 to March 2011:

- December 2010 flooded area equivalent to France and Germany combined
- January 2011 flooded area equivalent to Western and Southern Europe combined
- February-March 2011 flooded area equivalent to one third of USA
- In March 2011, the coastal zone in the north was hit by Yasi, a massive cyclone, a category 5+ monster, at least as big as hurricane Katrina in the US, its wind and tidal surges devastated the thousands of kilometre of the coastline and coastal towns, manufacturing and agricultural industries up to 100km inland

In addition, some regions were repeatedly flooded on several occasions during the flooded period

1.2 Application of VST in the flood zone

VS has been used in Queensland in the last 20 years for both soil and water conservation in farm land including flood erosion control, land stabilisation and infrastructure protection, and pollution control.

Following the flood some of these sites were revisited to assess the damages/effectiveness of VST under flooding conditions. It must be pointed out that the

vetiver was not at its best at the time of flooding due to the prolonged drought mentioned earlier.

The followings are assessment of the effectiveness of VST in preventing and mitigating landslides and flood erosion under the extreme conditions in Queensland. In addition, how VST was used to rehabilitate the flood affected land.

2. HOW DID VST PERFORM DURING THE *SUMMER OF DISASTERS* IN AUSTRALIA?

2.1 Flood erosion control at Laidley.

A major drainage channel that runs across the town of Laidley in Queensland. In summer this channel often flows at full capacity due high runoff (up to 400 cumecs) from the hills east of the town. This often results in flash flooding. At the head of the channel, runoff water is first concentrated in an area of approximately one hectare. This area received very high velocity flows during summer storms and in times of flash flooding severe erosion occurred after every major flooding event.

Following a severe erosion occurred during the last flood the Laidley Shire decided to use the Vetiver System instead of conventional engineering structures to control flood erosion damage as these structures are not only too expensive but also not very effective in the past. Site construction started in 2000 and since the vetiver planting has successfully protected this area from several major and flash floods, especially the flood erosion during the January 2011 massive flood, with water level over topping the banks by several meters (Fig. 2, 3).

Fig 2. ***Strong current lifted this concrete fence post (left) and move this shipping container 23km from upstream (right)***

Fig 3. ***Very little damages to the vetiver rows and the catchment***

2.2 Flood erosion control at Logan

A major waterway draining a large catchment along the Logan Motorway was severely eroded due to erodible soil, large volume and high velocity flows during the wet season. Several attempts in the past using conventional engineering methods have failed, so a combined hard structures and bioengineering using vetiver was installed. The results was outstanding, while vetiver was very effective in controlling erosion both on the bank and floor of the drain, the hard structures, including gabions failed during normal high flows resulted from flash floods and record rainfall \ in the past three years. But more impressively, VST has provided excellent protection against flood erosion during the January 2011 massive flood, with water level almost topping the banks. (Fig. 4,5).

Fig 4. ***The drain before and after earth work prepared for vetiver planting***

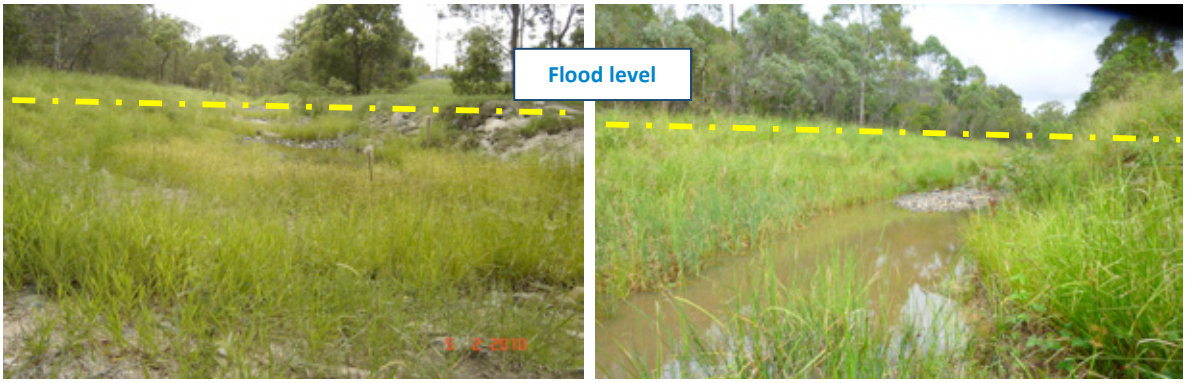

Fig 5. ***Vetiver planting before the flood (left) and no damages to the banks during flood (right) when flood level almost topping the banks***.

2.3 Flood erosion rehabilitation at Karalee

The flood level along the Brisbane River overtopped its banks up to 20m at several stretches of the river. The foundation of a power line tower at Karalee was severely damaged, and following reparation vetiver was planted to stabilise the foundation. The planting has provided a very effective protection against some recent record rains and flash flooding despite its young age. (Fig. 6,7).

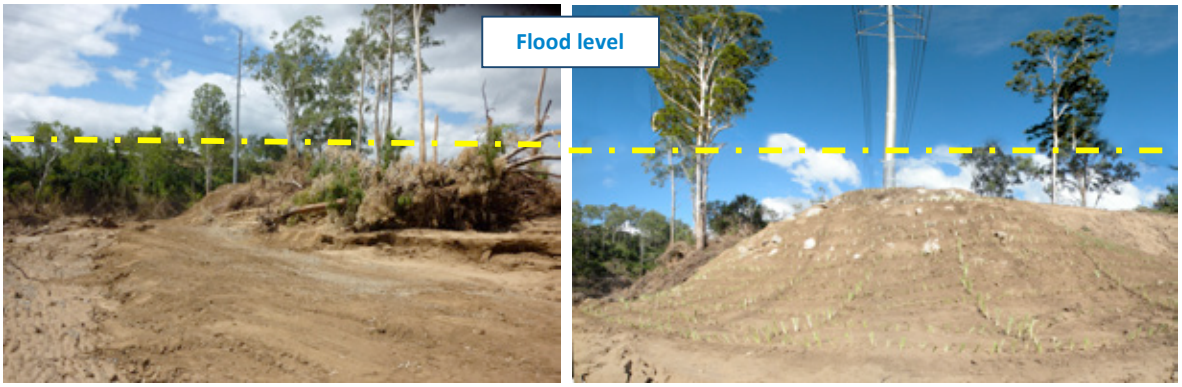

Fig. 6. ***Flood damaged power pole foundation (left)and after reparation and vetiver planting (right)***

Fig 7. ***Three months after planting and has adequate protection against some minor floods***

2.4 Flood erosion rehabilitation at Kenmore

A residential site fronting the Brisbane River was badly damaged by flood water in January 2011. The eroded site was first filled up with soil bags, then jutemesh before vetiver planting. (Fig. 8,9,10). The site remained stable during recent record rains and flash flooding.

Fig. 8: ***Eroded riverbank threatened the foundation of the house and soil bags were used to fill the hole***

Fig. 9: ***Jutemesh was used to give the bags temporary protection against rising water before vetiver was planted***

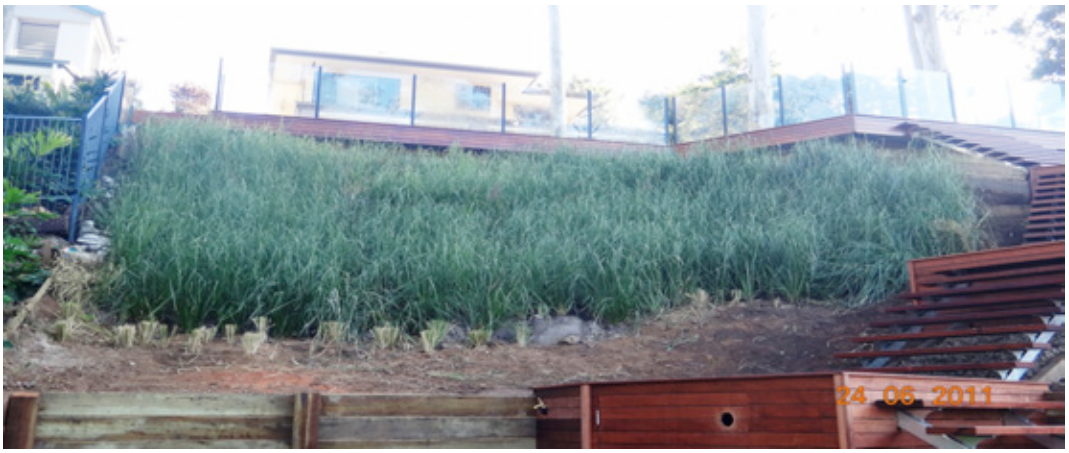

Fig.10: ***Four months after planting***

2.5 Landslide prevention at Samford Valley

A heavy down pour in 2008 caused this landslide on a house block on a very steep hill, vetiver was planted after site reparation. Due to the steep gradient of the slope it was first protected by jutemesh during vetiver establishment phase. Vetiver planting has successfully

stabilised this very steep and difficult site and protected it from further erosion in the next two years despite periods of record rainfall. The slope remained stable during the very high and intense rains in January 2011. (Fig.11, 12, 13, 14)

Fig. 11: ***Landslide threatened the foundation of this house on a very steep hill***

Fig. 12: ***The front slope after reparation and covered with jutemesh***

Fig. 13: ***Full protection two years after planting***

Fig. 14: ***The house was fully protected during the high and intense rain fall periods***

2.6 Land slide prevention at Tamborine Mountain

A major landslide occurred on the batter of a mountain road on a very steep hill during heavy down pour in 2008. Vetiver was planted on the slipped area after site reparation. Vetiver planting has successfully stabilised this very steep and difficult site and protected it from further erosion in the next two years despite periods of record rainfall. The slope remained stable during the very high and intense rains in January 2011. (Fig.15, 16, 17)

Fig. 15: ***Planting Vetiver following site repaprstion***

Fig. 16: ***The slope was fully protected during the high and intense rain fall periods in the next two years***

Fig. 16: ***The slope was fully protected during the high and intense rain fall Periods in January 2011.***

3. CONCLUSION

From the outcome presented here, there is no doubt that with good design and proper implementation, VST is the most effective, low cost and environmentally friendly solution for flood erosion control and landslide prevention and rehabilitation.