

Vetiver system:
The Green Tool Against Erosion
A mainstreaming effort

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Awareness

Design standardization

Field demonstration

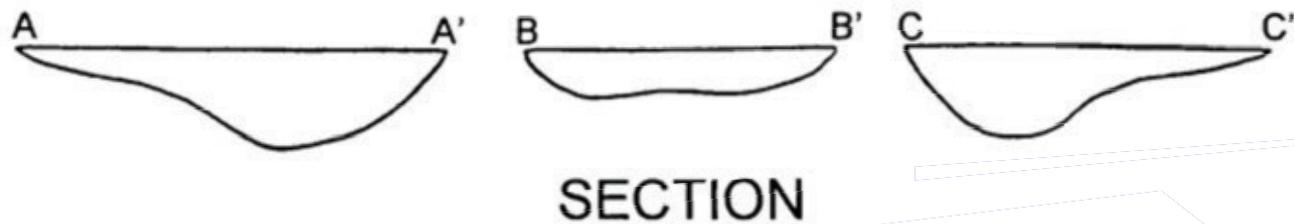
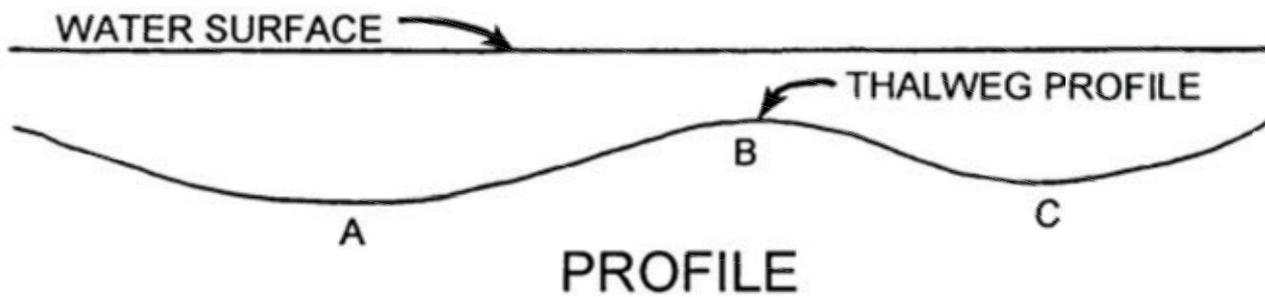
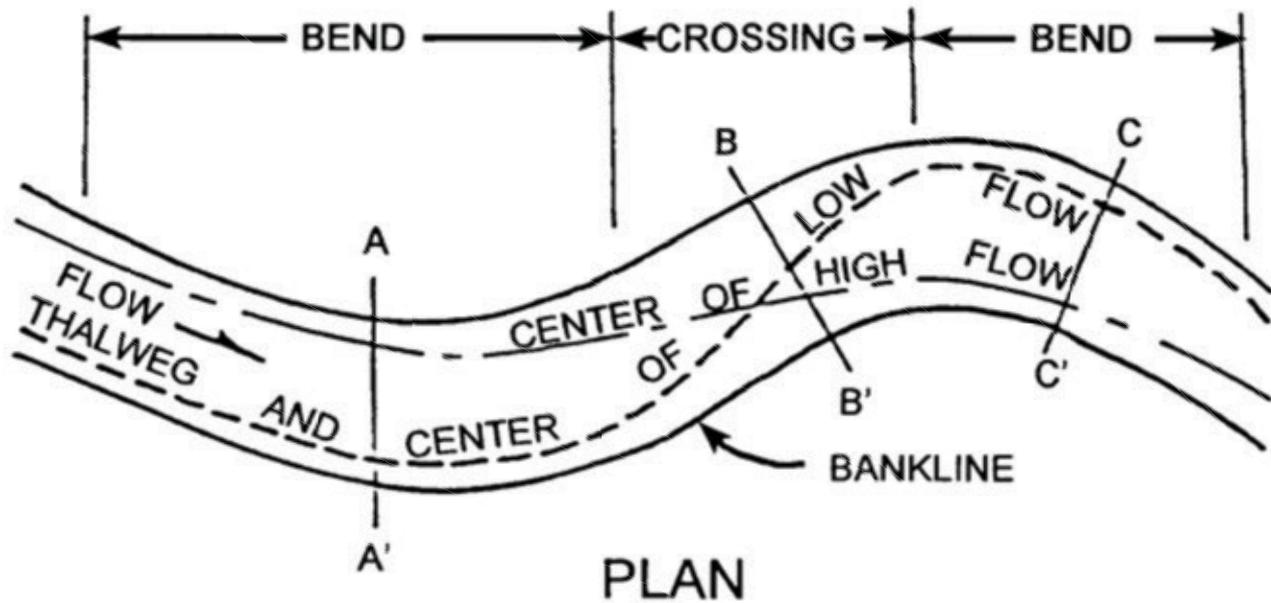
Mainstreaming

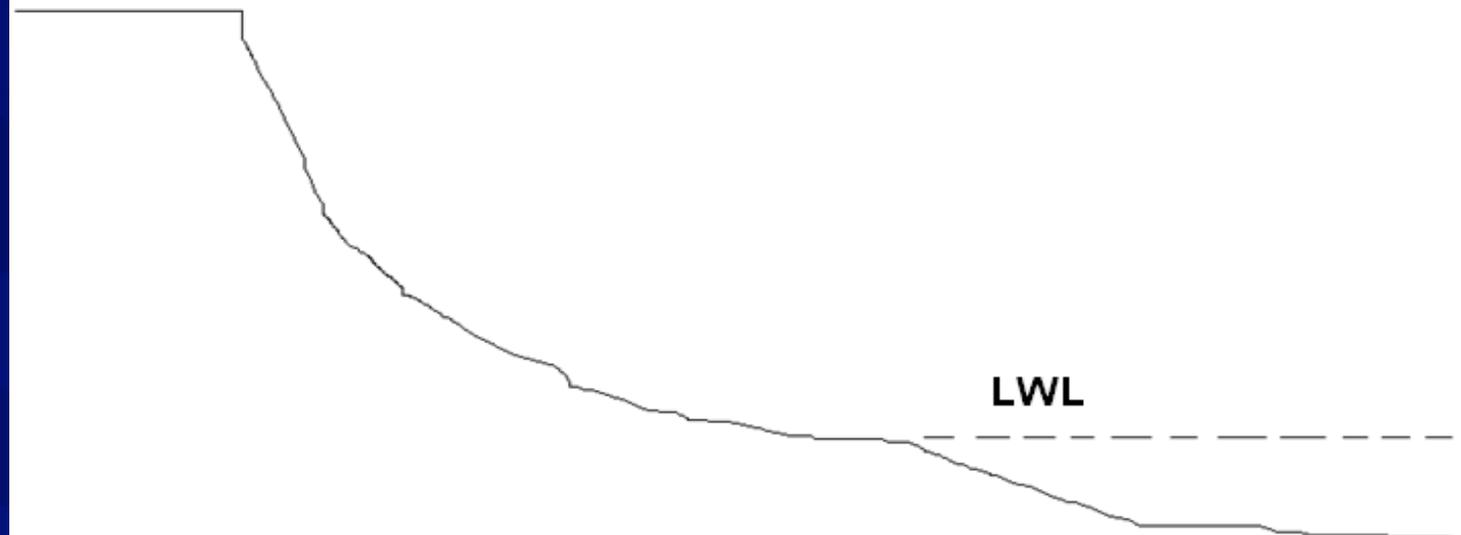
Difficulty in standardization

- Riverbank protection is almost impossible to standardize. Many variables.
- Embankments can be standardized
- Hill slopes to some extent can be standardized.

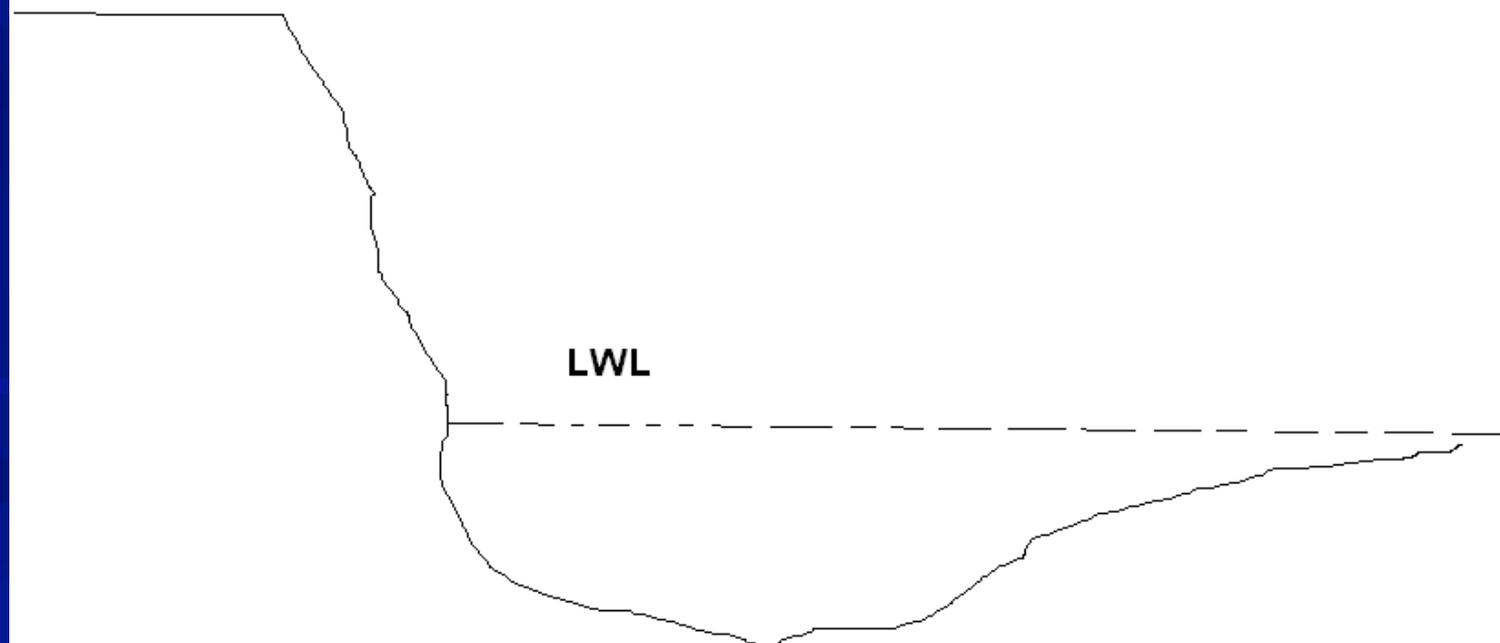
Riverbank protection

- Replace boulder pitching by Vetiver on slopes
- Plant in grids of 1m x 2m
- Check bed profile. Apply Vetiver on superficial bank migration where there is no erosion near the toe but the bank retreats.





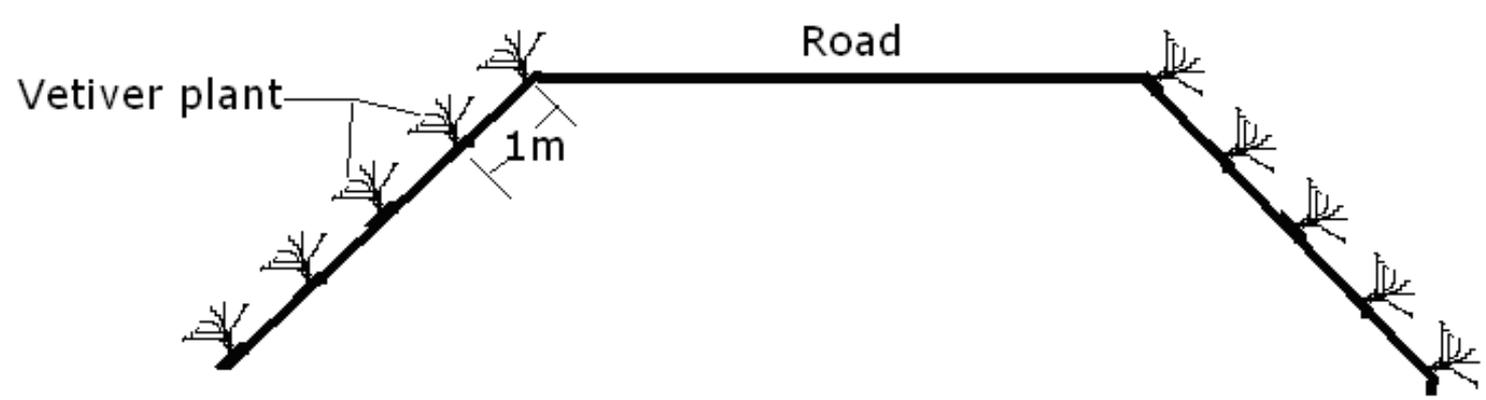
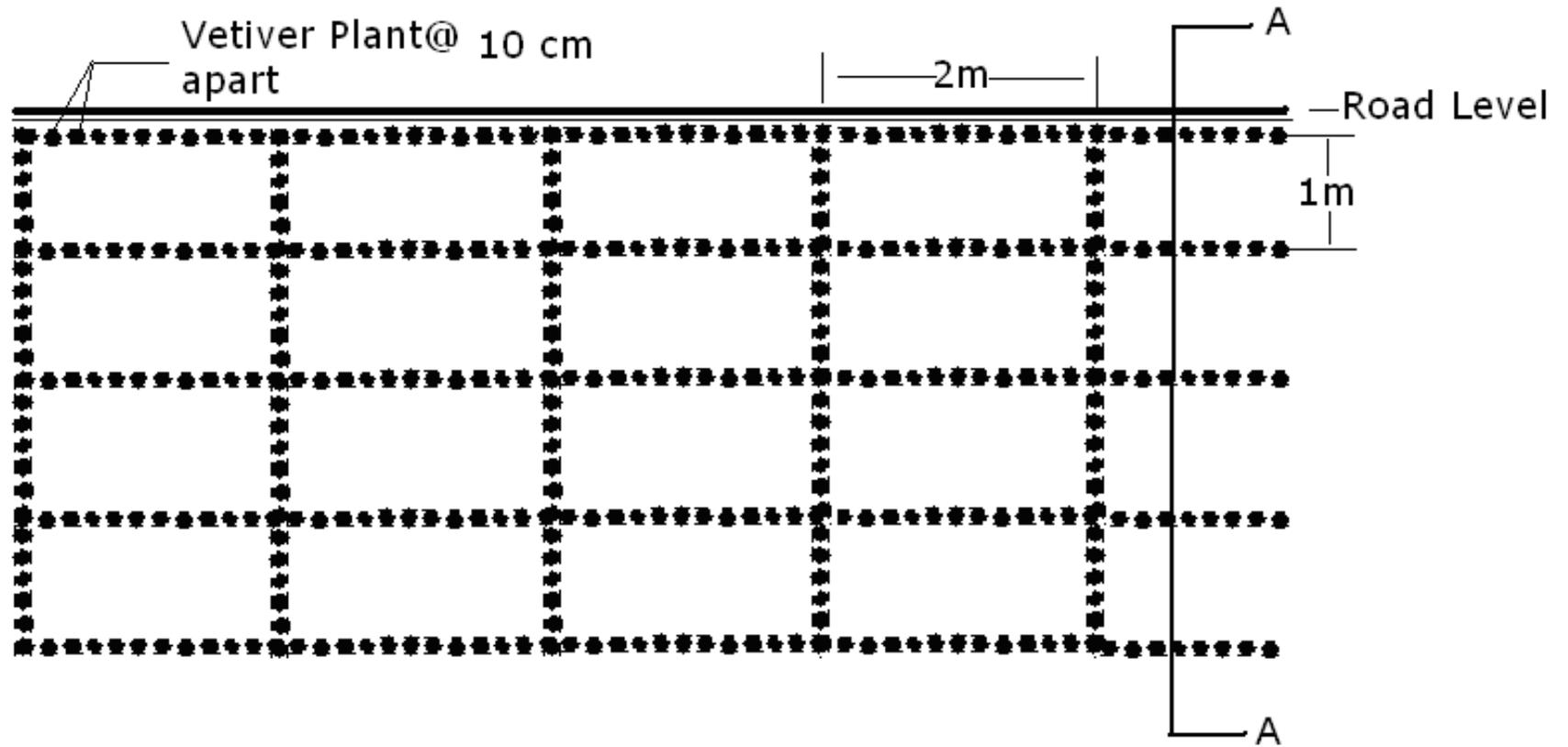
Toe of the slope exposed during lean period. Vetiver should work fine alone.



Toe never exposed. Undercutting near the toe. Vetiver will NOT succeed alone

Road embankment

Case 1: If the stretch is impacted by flowing river, the plantation is to be done in grid pattern. Longitudinal rows are to be planted @ 1 m apart and vertical rows (perpendicular to the flow of water) @ 2m apart.

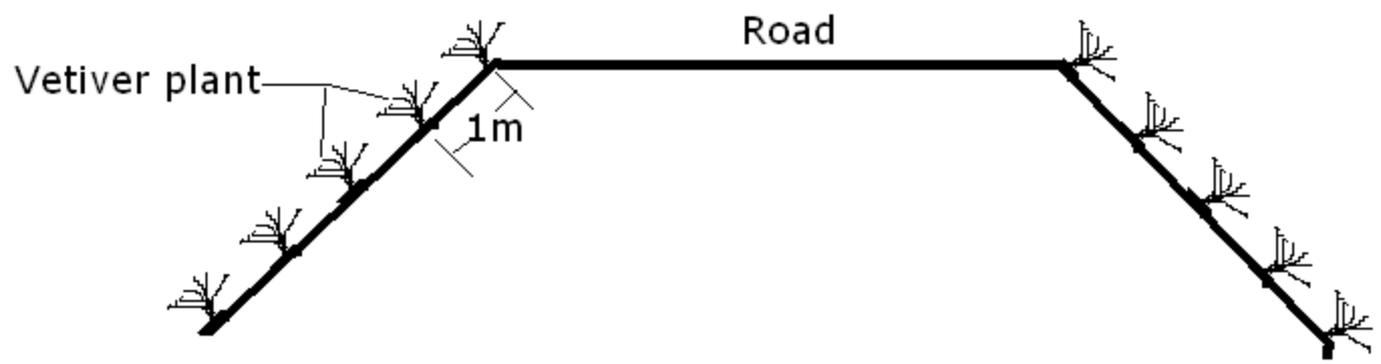
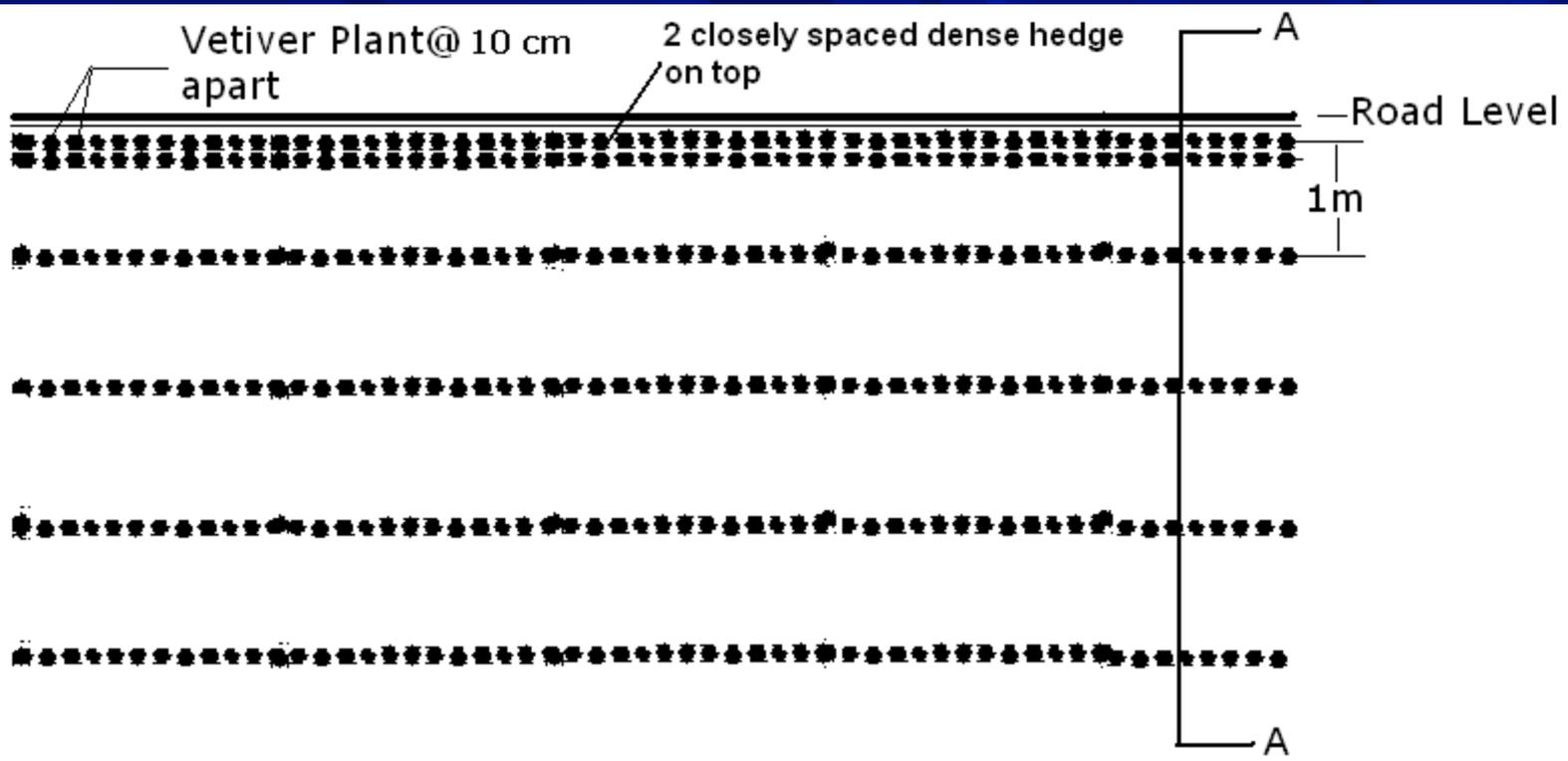


Section A-A

Case 2:

If the stretch is not impacted by river, only the water level rises & falls and also in case of arresting rain cuts, the plantation is to be done in parallel rows. Longitudinal rows along contour lines are to be planted @ 1 m apart

To spread the runoff and to prevent rill formation, plant 2 dense rows with little spacing between them at the top.



Section A-A

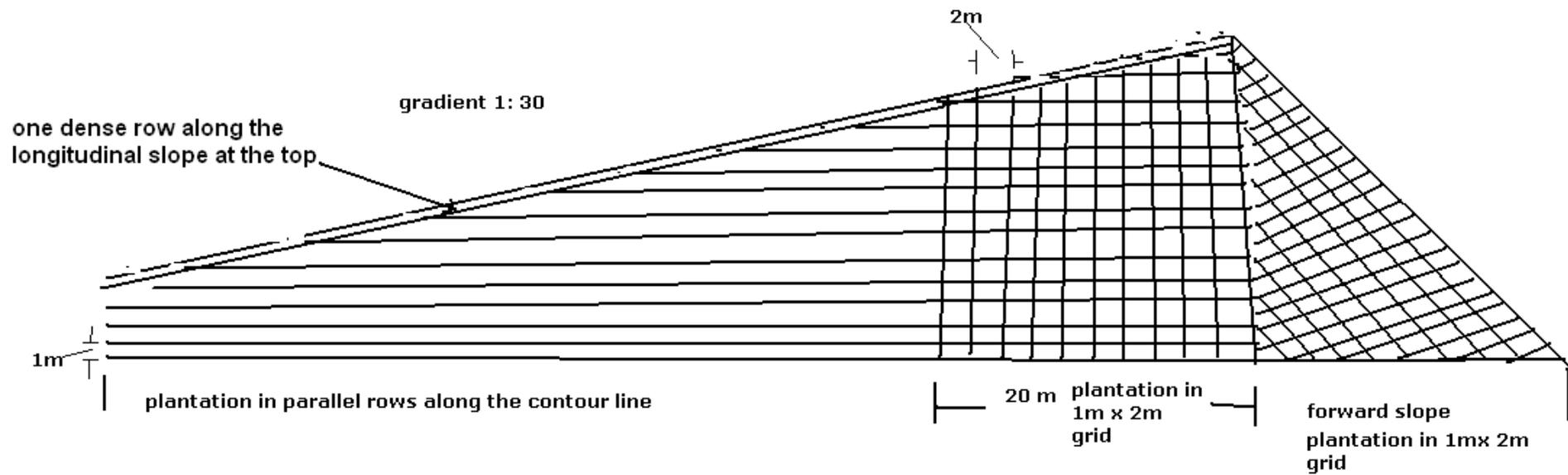
Bridge approach:

On bridge approaches, go for grid planting on the forward slope and the first 20 m .The rest can be row plantation as shown in the sketch.

But if a river impacts the approach badly, then the river side face/ slope of the bridge approach will need grid plantation all along.

The countryside as shown in the sketch.

The toe of the forward slopes of highly vulnerable approaches should be buttressed with caged boulder.



Elevation (identical on both side). Not to scale

Hill slopes: Simple cut slopes.

- Trim to 45 deg

- Plant Vetiver along the contour lines or just across the face

- Row to row distance 1 m.

- Buttress the slope, if possible

- provide drainage depending upon the site condition.

- Make a bench every 8m along the slope, if possible

Riverbank Erosion control



Performance comparison with
geosynthetic mattress

Brahmaputra river

Disangmukh, Assam, India

Disang river

Indicative location of erosion control work
1000 m with Geo-synthetics with porcupine
500m with Vetiver and porcupine

© SPOT IMAGE

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A.T.Rd

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Eye alt 15.64 km

Imagery Dates: Sep 29, 2009 - Dec 1, 2009

27°02'27.71" N 94°32'31.03" E elev 91 m

Type of Erosion:

-Both slab failure and rotational failure.

-Sloughing (slumping) accompanied with rapid drawdown also seen

- Total 1500 M pf the severely affected stretch was intervened.

- 1000 m on the upstream side was applied geosynthetic mattress

- Immediately downstream a 500 m stretch was applied the vetiver system

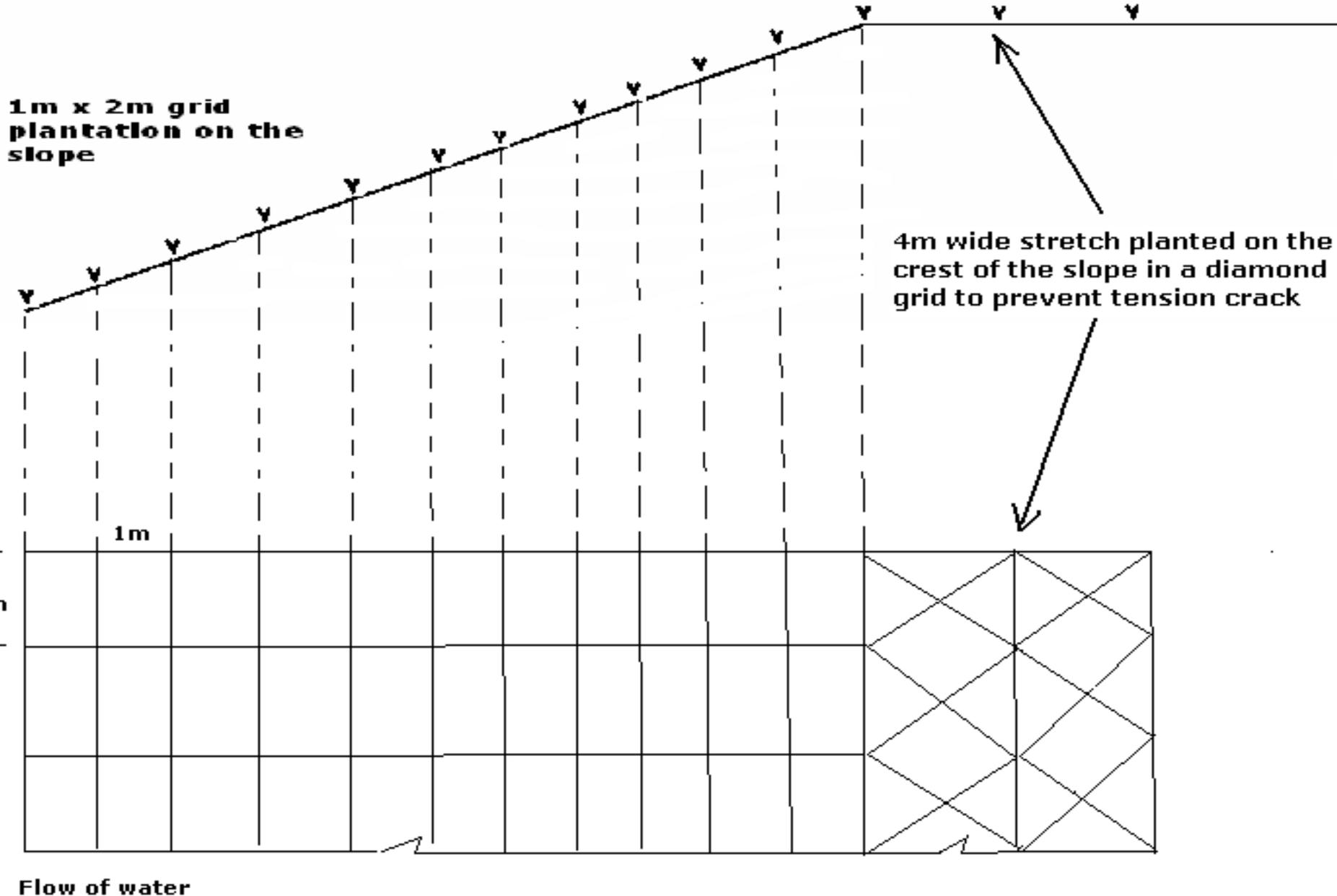
The bank before intervention



The crack before slumping



Intervention at the riverbank



Planting started on 28/2/2010 and ended 25/3/2010
Heavy rain started from 1st week of March



Rain cuts

Rising water, bottom rows are inundated



Complete inundation on 17/4/2010



The geomat failed to prevent the slumping









Vetiver proved a great success. The slope in November, 2010



The slope in December, 2010



January, 2011



Erosion continues downstream. January, 2011



Another picture of erosion downstream. January, 2011



The Vetiver protected slope, end of April, 2011 Pictures by WRD during their inspection tour







Vetiver work along rivers Na- Dihing (locations- Pawoi/ Chumoni)



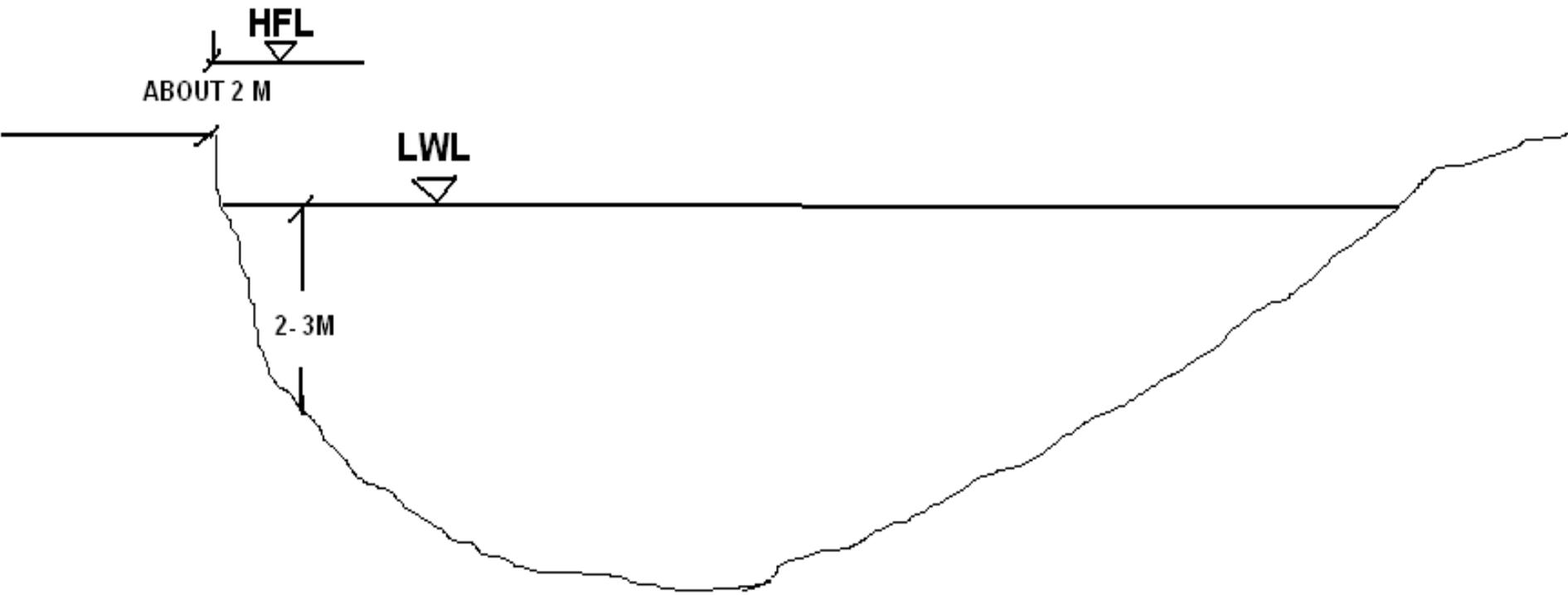
Stone spurs

Severe erosion (see photograph) both fluvial and sloughing



The crack before slumping at rivers Na- Dihing





Typical section at Pawoi

Flexible mattress made of empty cement bags filled with sand and nylon net was stitched around each bag to control under water scouring



The mattress controlling the under water erosion and
vetiver in grid pattern stabilizing the slope



The mattress was pinned to place with the help of bamboo stakes



The well protected bank after several floods. Look at the toe profile after heavy siltation



The river bank after the flood season (5/11/2010)



The riverbank in July, 2011, fighting the second flood season



River Demow, toe protected with reeds





REEDS

Road embankment / bridge approach protection



Doria bridge approach in Majuli; during construction

The nursery at site. Plants are established in poly pouches before transplanting



Starting the plantation



The footmarks say all about the consolidation.
Sandbags were used to prevent sliding





The plantation in the 3rd month



The bamboo fence is to keep away animal from grazing



The forward slope with toe protection



The forward slope toe protected with caged boulder



Same bridge approach now.



The other side of the approach



Bridge approach protection
Sesa-pani bridge near Merapani



Same bridge approach

PMGSY (Rural) Road



NH- 52



NH- 52, Deep rain cuts



Filling the gullies, no compaction



Stabilization of National Highways, NH- 52



NH- 44



Hill slope protection



EROSION

**Navagraha hill, Guwahati.
Note the eroded surface**



**3 months after plantation.
A few heavy showers caused no erosion**



Close up at Navagraha



Severe land slide on Noonmati- Kharghuli Road



Plantation of Vetiver on the same slope



Vetiver plantation in the 3rd month



Another view



Another view



**VETIVER
NO LAND SLIDE**

**NO VETIVER
LAND SLIDE CONTINUES**

Vetiver on hill slope in South Sikkim. Under Rural Management and Development department, (Robikhola- Khoringq road)



During plantation on the same slope (end of November, 2009)



Same slope during monsoon (July, 2010)



Soil Type on the Slope

The same slope after the rainy season (November, 2010). The plantation is not healthy because of the soil. but there is no erosion



The same slope in August, 2011



The same slope. Look at local vegetation



Disadvantages

- Vetiver's intolerance to shading, particularly within the establishment phase. Partial shading stunts its growth.
- The Vetiver System is effective only when the plants are well established. Effective planning requires an initial establishment.
- Vetiver hedges are fully effective only when plants form closed hedgerows. Gaps between clumps should be timely re-planted.
- It is difficult to plant and water vegetation on very high or steep slopes.
- Vetiver requires protection from livestock during its establishment phase.

Measures for decision-making, planning

■ **Timing:** Important because it takes time for the plants to establish themselves and to be effective.

■ **Maintenance and repair:** Planning and budgeting should anticipate replacement, replanting, watering, manuring at the early stage.

■ **Procurement:** All inputs can and should be procured locally (labour, manure, planting materials, maintenance contracts). Employment opportunity provides an incentive for the local community to protect the plants during their infancy and adolescence, and to maintain the quality and sustainability of the works.

■ **Community involvement:** As much as possible, local communities should be included in the design, materials procurement, and maintenance stages.

■ **Integration:** Policy makers *should recommend Vetiver System* as part of a comprehensive approach to infrastructure protection, applied on a scale large enough to ensure a tangible increase in expertise and a gradual, spreading effect.

CONCLUSIONS

- **There are now enough evidences that VS is a very effective, economical, community-based and environmentally friendly sustainable bioengineering tool that protects infrastructure.**
- **However, it must be stressed that the most important keys to success are good quality planting material, proper design, correct planting techniques.**
- **Apart from erosion control, VS can help in poverty alleviation, reducing global warming and develop rural economy in a green way.**



Thank you