REPORT ON THE APPLICATION OF VETIVER SYSTEM IN THE CITARUM RIVER BASIN, INDONESIA

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1. BACKGROUND AND INTRODUCTION

The Asian Development Bank (ADB) is involved in a number of strategic project activities concerning the upgrading of the quality and performance of the 13,000+sq. km. Citarum River Basin, the main source of water supply for the cities of Jakarta and Bandung. Located along the Basin are major industrial centers in Bandung, Indonesia's fourth biggest city, three major dams and three large multipurpose reservoirs which supply about 80% of the Capital, Jakarta's, raw water. The Basin is also used for crop irrigation and industries on the north Java plain, and for communities within the basin. ADB's remedial activities are earmarked to take place over the next several years.

It has been realized that one method of assisting necessary improvements to the basin, particularly in its upstream reaches, is in the application of vetiver grass (*Chrysopogen zizanioides*). Two important proven uses of vetiver grass are its ability to stabilize and protect uncovered slopes from erosion and in the cleaning up of dirty/polluted lakes and ponds, existing in the vicinity of many rural communities. In this way vetiver grass can play an important role in initiating sustainable upland farming systems.

Another key problem has been deforestation of the Basin's upper slopes over the last 20 or so years to accommodate planting of potatoes, carrots and other vegetables, precipitating severe erosion and chemical fertilizers and pesticides washing down to the Citarum River, key contributors to the to the high Citarum river pollution levels.

Vetiver grass has had wide and successful worldwide applications in sustainability in over 100 countries since its introduction by the World Bank in the 1980's, although its use in Indonesia to date has been rather limited. However, the East Bali Poverty Project (Ekoturin Foundation) introduced vetiver grass in March 2000 as an essential means of stabilizing verges of steep dirt roads open and enabling terracing on steep, volcanic ash highland slopes in northeast Bali to facilitate the cultivation of nutritious organic vegetable crops to feed the many seriously impoverished and malnourished communities. Results across the board have been impressive, the part played by the vetiver grass being the key to success.

David Booth of The East Bali Poverty Project (EBPP) was appointed in 2003 as the "Indonesian Vetiver Network (IDVN) Coordinator" by The Vetiver Network International (TVNI). Since 2000, he has conducted much applied research for Indonesian problems in many regions, as well as consulting for Indonesia's Ministry of Public Works for stabilizing highway slopes and model sanitary landfill projects in Bali. EBPP's experience has, in turn, led to the preparation and setting out of this pilot demonstration activity within the overall ADB program for the Citarum Basin.

A request by ADB to undertake the Pilot Demonstration Activity (PDA) was made leading to submission of a draft proposal on 13 December 2007, with a view to commence the project during the 2007/8 rainy season. Administrative delays postponed the initial launch and this report covers the implementation phase between June 2008 and August 2009.

2. OBJECTIVES AND SCOPE

The objectives of the Citarum Basin Vetiver Grass Project have been set out to involve coordinating and empowering stakeholders and relevant NGOs working in the upper reaches of the Citarum Basin in the understanding of the application and then through transfer by training key stakeholders of appropriate vetiver technology towards establishing sustainable farming systems. Originally this was intended to be done within an initial period of six months and goals of wider replication to follow over a longer period to:

- control runoff and soil loss,
- protect natural resources,
- introduce sustainable farming systems,
- thereby improving livelihoods and increase income

This report details the implementation phase of the following two pilot/demonstration sites:

- Upper Citarum River Basin, Kampung Jirihieun, Desa Pangauban, Kec.Pacet
- Septic Tank Site on the Bank of the Citarum River at Desa Rancamanyar, Kec. Bale Endah

3. SITE INSPECTIONS SUMMARY

3.1 Upper Citarum River Basin, Kampung Jirihieun, Desa Pangauban, Kec.Pacet

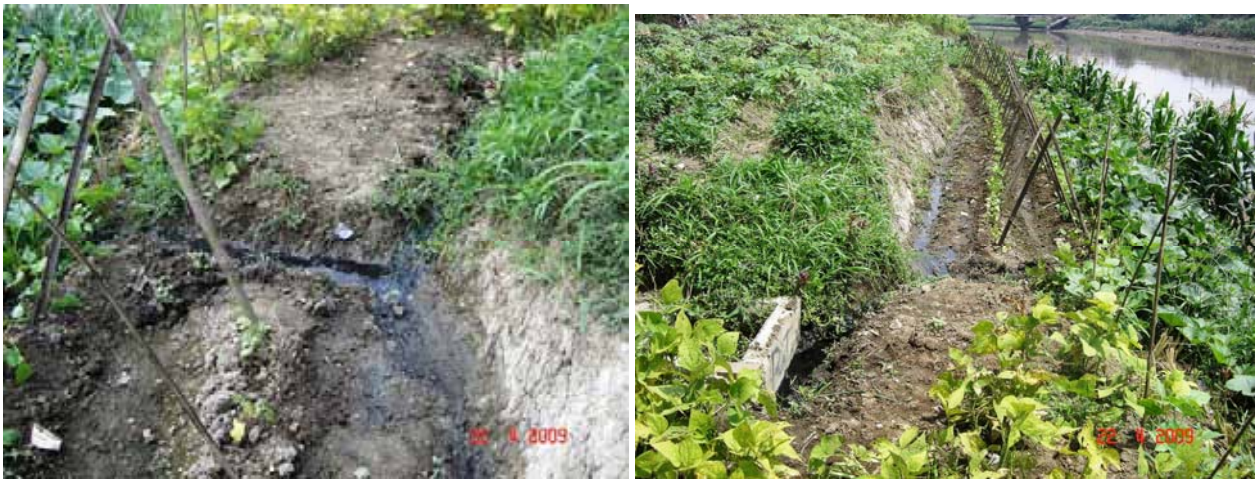
The agriculture production of the Upper Citarum River Basin relies almost entirely on earthen terraces, which are either unprotected or inadequately protected by any erosion control measures. Therefore they are highly erodible and very vulnerable to collapsing during the wet season. The maintenance of these steep and unprotected terraces is very costly, which often requires reconstruction at least every six months.

Typical topography and landscape of the Upper Citarum River Basin with unprotected and steep terraces

To make the matter even worse, the common local practice is to plant root crops such as cassava or sweet potato on the edge of the terraces. Cassava is known to be the most erosive crop on sloping land, as when harvested the disturbed soil is most vulnerable to erosion. Once a year the Cassava crop is harvested and the harvest practically destroys the terrace batter, which often left untouched resulting in extreme erosion. If the eroded sediment is not retained within the field, it will be washed down the slopes to the stream and eventually the Citarum River. The sediment will not only silt up the streams and reservoirs a long the way, it will also bring with it nutrients and agro-chemicals used for crop production. This is the main source of non point pollution of the basin.

3.2 Septic Tank Site on the Bank of the Citarum River at Desa Rancamanyar, Kec. Bale Endah

This site is located at the outlet of the community septic tank, serving over 150 families, on the south bank of the river. A part of the effluent from the septic tank discharged directly to the river and some were diverted to irrigate the vegetable crops growing on the bank. The planting site was fully farmed and it is expected to be cleared of all crops and vegetation before vetiver planting.



The effluent is partly discharged directly to the river and partly to irrigate the vegetable crop

4. IMPLEMENTATION PHASE

The implementation phase started with a series of site visits with the local partner NGO, WPL, to identify the most appropriate representative Pilot sites and establish a working group of the local stakeholders to empower them to eventually train other Citarum farmers. EBPP introduced Vetiver System with presentations in March and early April 2009 presentations to community stakeholders and local officials at each site, followed by detailed presentations by Dr Paul truong in late April 2009.

4.1 Introductory Workshop for Community Stakeholders and local environmental NGOs

On 12th March, EBPP gave their first Vetiver Workshop to illustrate the Vetiver System (VS) and the opportunities for improved sustainable social and economic development with an interactive PowerPoint presentation entitled "**An Introduction to VETIVER GRASS Technology for ADB Citarum River Basin PDA Project**". Samples of vetiver plants with 2 metre long roots, newly harvested vetiver clumps and vetiver slips ready for planting from EBPP Bali projects, clearly illustrated the VS potential to conserve soil and water and prevent the type of erosion commonplace to the Citarum Basin. Over 40 stakeholder and local NGO representatives attended and by the end of the one day workshop, they understood the potential future benefits of VS and a foundation was clearly established for full motivation and participation of all stakeholders to implement the Citarum River Basin PDA.This eagerness to implement VS to ensure sustainable improvement in their land and livelihoods encouraged EBPP team to implement hands-on 'field trials' so that the stakeholders connected the technology examples in the PowerPoint presentation to the reality in the field.

4.2 Trial planting of Vetiver slips in the 2 selected pilot project locations

The hands-on field trials in early April 2009 described below generated enthusiasm and motivation of all participants in the two key sites: Septic tank site on Citarum river bank and Upper Citarum Basin farmland:

- **2nd April 2009, Septic Tank Site:** 300 vetiver slips planted with local community members (including women and children) and the 2 stakeholder team leaders. Vetiver was planted at the rate of 10/linear metre on the key terraces that were then fed by the septic tank effluent;
- **3rd April 2009, Upper Citarum Basin farmland:** This trial planting of 200 vetiver slips with the local farmers was to provide examples of VS along eroding terraces in planned PDA location farmer's land. They were very supportive and enthusiastic. We noticed that presently, farmers plant cassava on the edge of the terrace and we explained that cassava is not good for terraces because when harvested, it will cause severe erosion on the terrace.

The full stakeholder and community participation was very encouraging and inspiring, verifying their acceptance of VS and their eagerness to plant vetiver hedges throughout their land clearly dispelling the myth ***they held for years*** that "Vetiver causes erosion". They were already

planning for their families' futures when they could have better crop harvests, sell vetiver slips to local farmers and use dried vetiver grass for roof thatching and handicrafts.

4.3 Dispelling the myth that "Vetiver causes erosion"

A key problem David Booth encountered in getting acceptance of VS for erosion control and conserving soil and water was the historical background of Vetiver in East Java, introduced almost 100 years ago specifically for producing the essential oil from vetiver roots on Volcanic East Java mountain slopes for export sales. Clearly, vetiver had never been promoted as a 'tool' for land conservation.

Shortly after ADB approved EBPP proposal and budget for the Citarum River Basin PDA in March 2008, David Booth encountered much resistance on the Vetiver System efficacy during initial discussions with Indonesian Government regional representatives and Citarum environmental NGO's. Their recent experience of farmers in West Java ripping out vetiver grass due to poor income generation from the previously lucrative vetiver 'essential oil' business, and the resultant massive landslides that followed, created the belief that vetiver grass caused erosion. Unfortunately, this rejection of VS continued until early 2009 when EBPP could explain, verify and illustrate optimum vetiver planting and maintenance practices for land conservation that would ensure total land stability AND, for farmers in the vetiver oil business, better root growth/quality to give far better results and higher potential returns from the distillation process. After dispelling the 'erosion' myth, Citarum farmers, local NGO's and local government officials embraced the Vetiver System, enabling implementing the PDA Citarum project and full participation in planning the important stages ahead for the Citarum Basin Vetiver System Pilot Demonstration Activity (PDA).

4.4 Dissemination of VS by Enthusiastic Citarum Stakeholder Groups

The success of the vetiver workshops, trial plantings and visible results of vetiver growth in the community land encouraged the stakeholder farmers to make long term plans and promote VS throughout their region. Their goal is to produce vetiver designed T-shirts and caps as their new identity and method of promoting VS to all other subsistence farmers in the region. They are proud to be the first recipients in the Citarum River Basin of Vetiver System Technology.

4.5 Citarum Stakeholders VS Solution for Deforested Upper Citarum Slopes

A key motivation for the Upper Citarum farmers to embrace VS was a solution to protect the higher mountain slopes that had been deforested in the last 20 or so years and replaced with potato, carrot and other crops. They were fully aware of the deterioration they had witnessed in their own lifetime and committed to ensure a better future for their own children and descendants. They pointed to steep erodible mountain slopes and ridges that no longer had foliage and they planned to plant vetiver hedges throughout and introduce more productive crops such as coffee and multi-beneficial trees. They saw vetiver grass as their children's future.

4.6 Presentation for community, NGO and officials

A PowerPoint presentation entitled ***Vetiver System for Crop Production Improvement*** was conducted to introduce VS to the various Government Departments, community leaders, local officials and farmers in the morning. This title was chosen to attract the mainly farming communities because farmers are more interested on the productivity of their land rather than soil conservation *per se*, but the emphasis was on soil erosion and sediment control and crop protection.

The presentation showed the special features of vetiver grass and how the Vetiver System, when applied correctly, is the most effective, low cost and environmentally friendly method of soil and water conservation and sediment control. Examples of successful applications in Australia and several countries in Africa, Asia and Latin America were presented and discussed. To draw the local interest, photos of a selected number of sites taken on the previous site visits, were used to demonstrate how the Vetiver System will be implemented on their lands. In addition to these measures, the beneficial effect of vetiver planting in protecting some crops from insect pests received great interest from the participants.

In the afternoon a second PowerPoint presentation entitled ***Vetiver System for the Treatment and Disposal of Contaminated Water and Land*** was conducted, with special reference to domestic and municipal sewage effluent treatment and disposal. The presentation showed the special features of vetiver grass and how the Vetiver System, when applied correctly, is the most effective, low cost and environmentally friendly method of treatment and disposal of polluted water, under domestic, municipal and industrial context. Examples of successful applications in Australia and several countries in Africa, Asia and Latin America were presented and discussed. To draw the local interest, Indonesian case studies of sewage effluent disposal scheme in Banda Aceh and Bali were used to demonstrate how the Vetiver System will be implemented on their sites.

4.7 On-Site discussion/ presentation

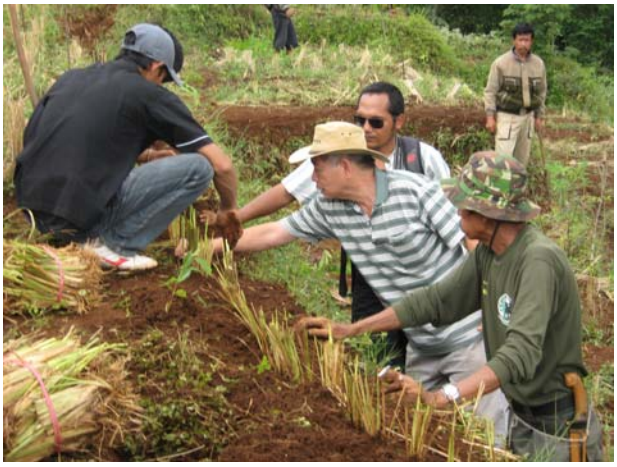
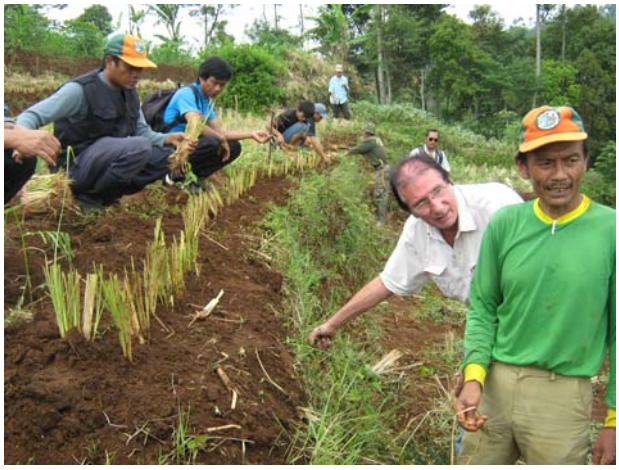
For the benefit of local farmers and stakeholders, who could not attend the community presentations earlier, on-site discussion and a simplified version PowerPoint presentations was carried out at each site. It was stressed to them that the overall objectives of the Citarum River Basin Vetiver Project is to coordinate and empower stakeholders and NGO's through transfer of appropriate vetiver technology within an initial period of six months and the goals of wider replication over a longer period to control soil erosion, reduce sedimentation, protect natural resources and introduce sustainable upland farming systems that will improve livelihoods and increase income.

4.8 Planting at the upland rice terrace demonstration farm Upper Citarum

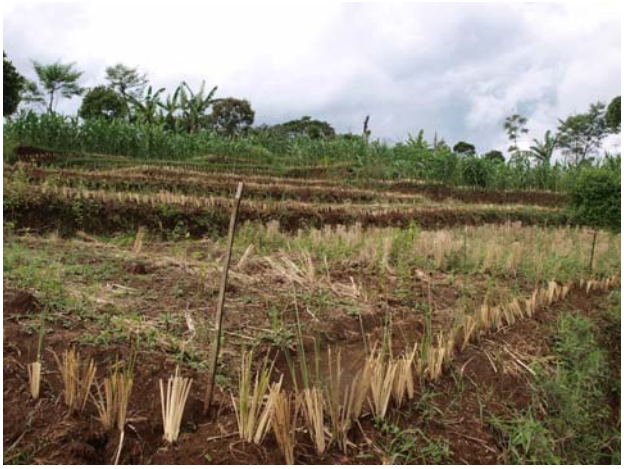
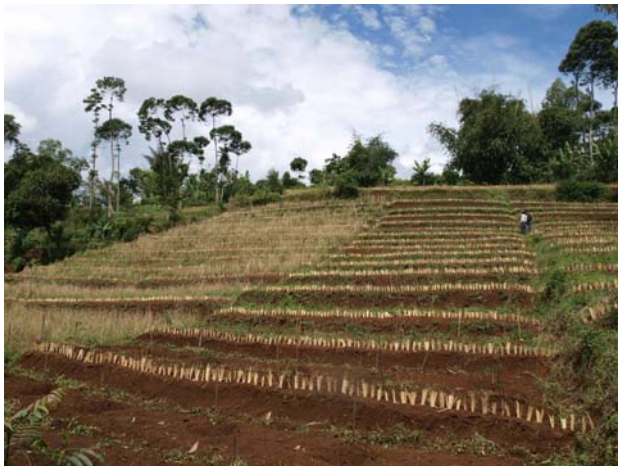
The aims of this pilot implementation phase are to incorporate the soil erosion and sediment control measures into the local farming practices. This involves:

- Stabilising the earthen terraces, waterways and drainage channels
- Minimising the movement of eroded materials from the field.

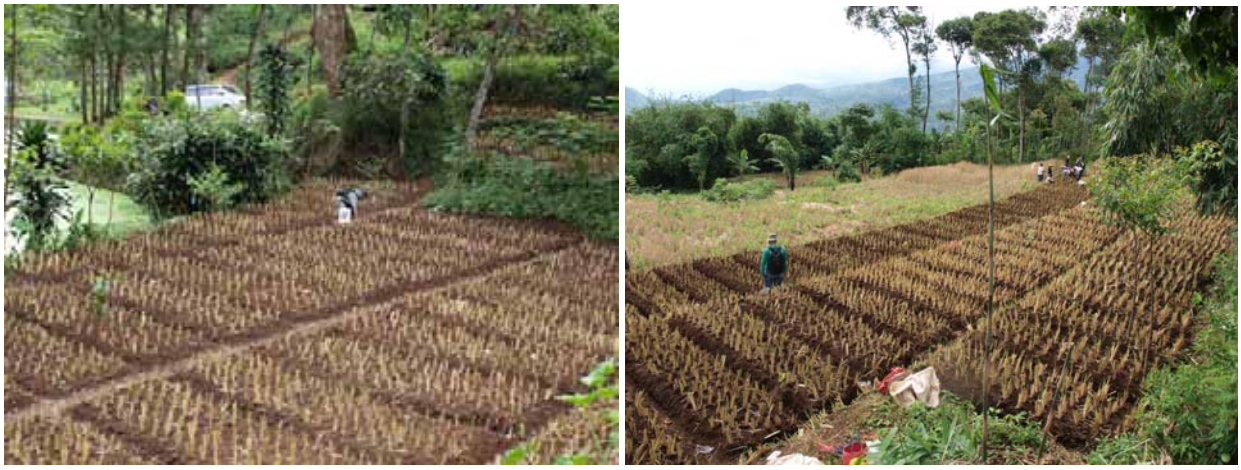

Highly erosive existing practice of terracing for rice and cash crop

Paul Truong and David Booth showed farmers how to plant vetiver on the terraces

These upland rice terraces are now well protected by vetiver hedges



Two nurseries were established, one for local community and one at the upland rice terrace demonstration farm for the farmer to implement the scheme on his whole farm

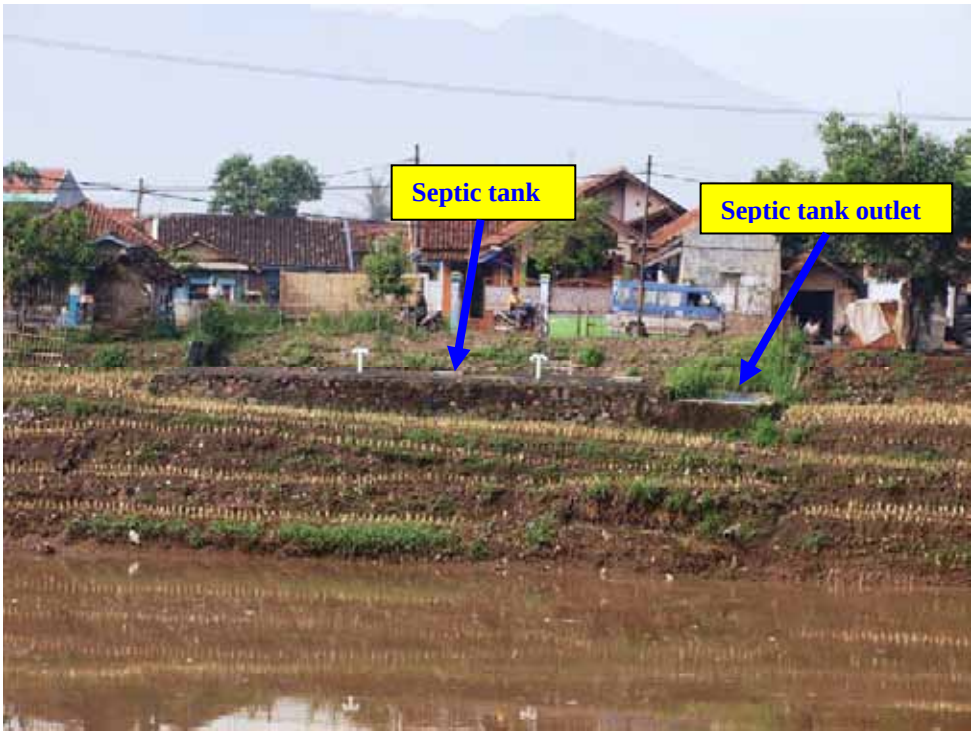
4.9 Planting at the Septic tank site on the bank of the Citarum River

This site is located at the outlet of the community septic tank on the bank of the river. It is currently planted and cropped by local people. The vegetable crop was removed before planting started.

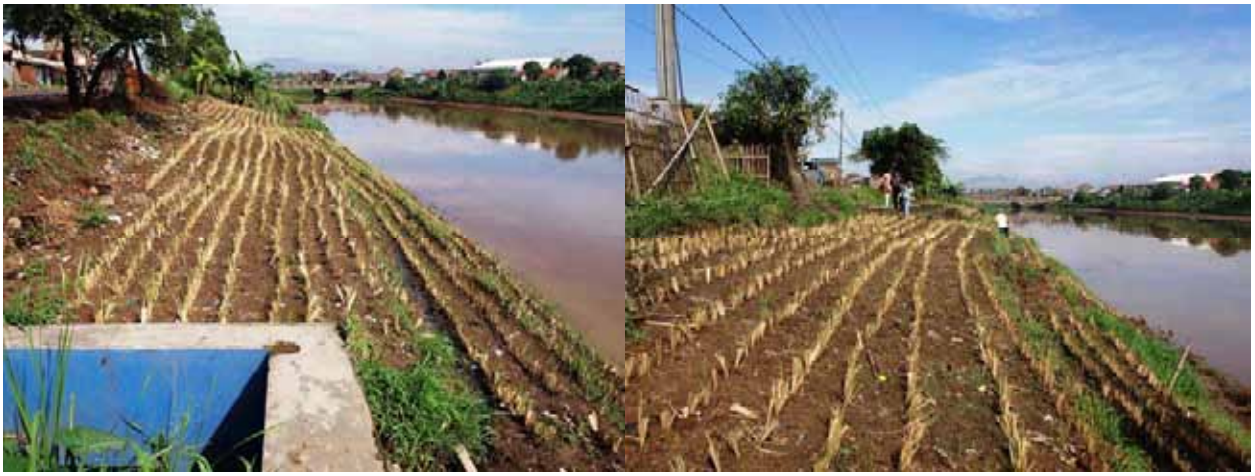
The objectives of this demonstration site were:

- Firstly to demonstrate the ability of vetiver grass as highly efficient in absorbing the sewage effluent discharged from the septic tank
- Secondly to show that vetiver can be used concurrently for erosion control of the steep river bank along the river. This erosion is the source of sediment deposited along the river at Desa Andir, Kec. Bale Endah
- Thirdly to demonstrate vetiver grass as a perennial crop, providing permanent and continuous pollution control. In contrast to planting crops such as maize, which needs to be replanting twice a year, and providing no pollution and erosion control measures between cropping cycle.

Vetiver was planted in rows parallel to the bank on at least 3 terraces at density of 8-10 plants/m2. Planting will also be done on the “cliff face” for erosion and pollution controls. The last row was planted on the high water mark of the river. An area of approximately 800m^2 will be planted with vetiver grass. According to the original proposal, the modified MEDLI model estimated that this area is sufficient to treat effluent discharge from 100 households. However at the time of planting 150 households use this community septic tank and the number is increasing.



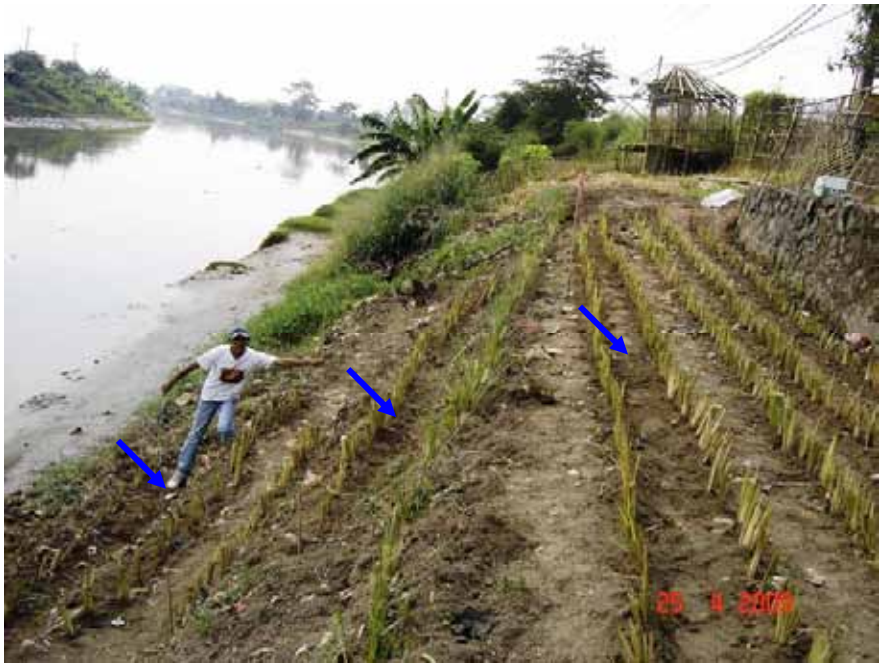
Planting on the area below the septic tank to treat effluent discharge as well as erosion control on this very steep riverbank. The whole planting area is 50m on both sides of the tank



Left side of the tank ***Right side of the tank***

A completed section showing the overall planting pattern, right down to the water edge for erosion control

Two sets of monitoring bores will be installed to monitor the quality of the effluent and to demonstrate the effectiveness of VS in disposing the sewage effluent. Each set consists of three bores running down the bank batter to the water edge.

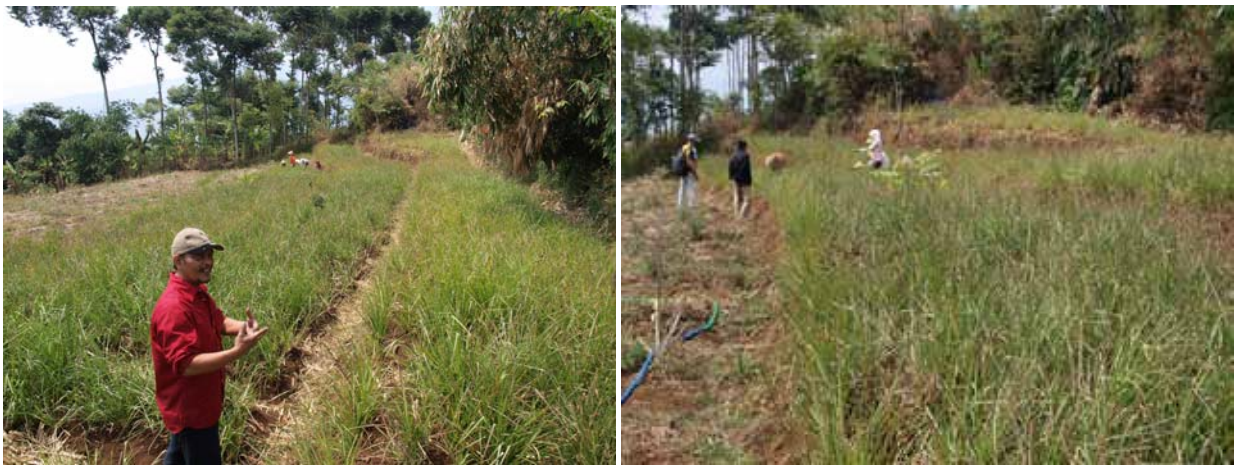


Locations of one set of monitoring bores

5. PROGRESS REPORT

5.1 Upper Citarum

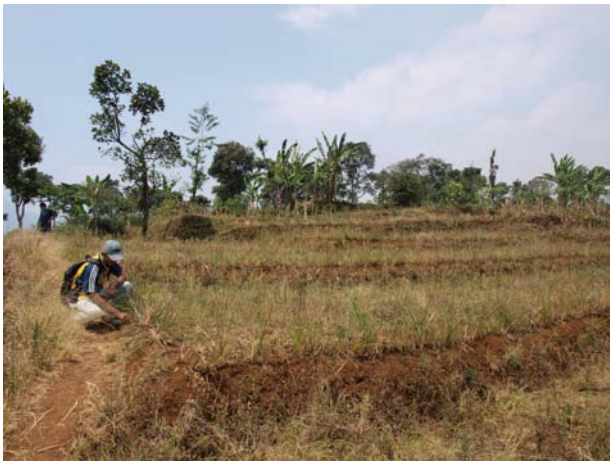
- **Nursery**



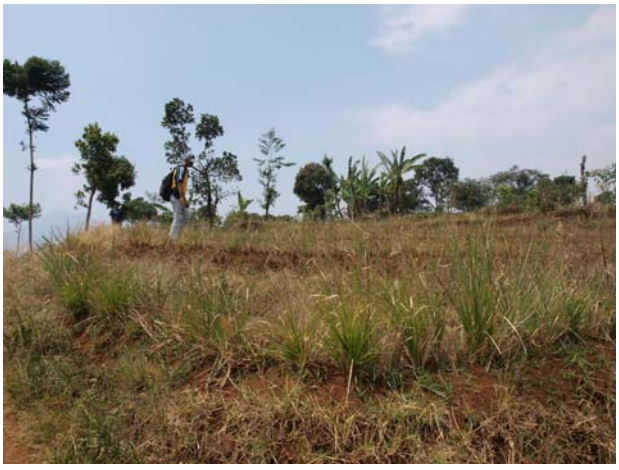
Relatively good growth on community nursery four months after planting

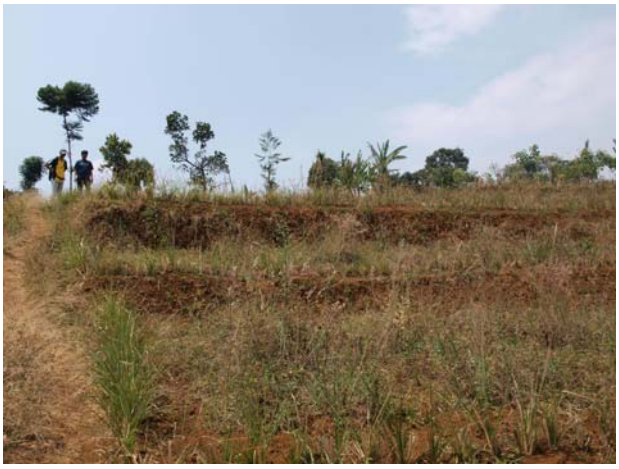
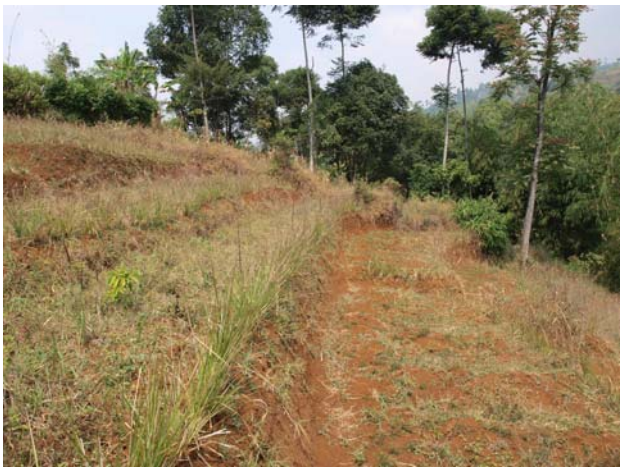

Relatively poor growth on community nursery without fertilisers (left) and good growth on farmer private nursery with fertilisers, four months after planting

- **Terraces**

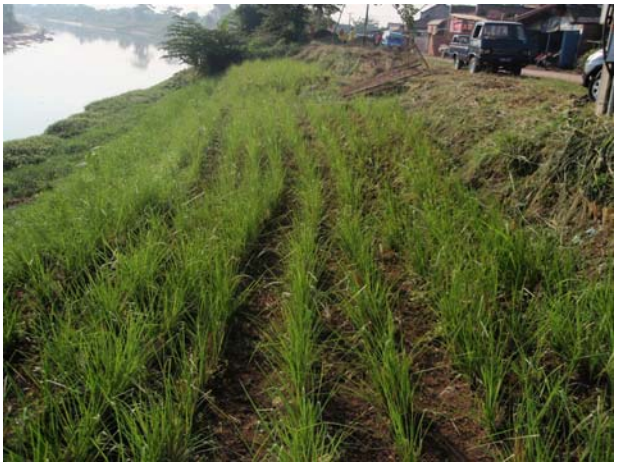
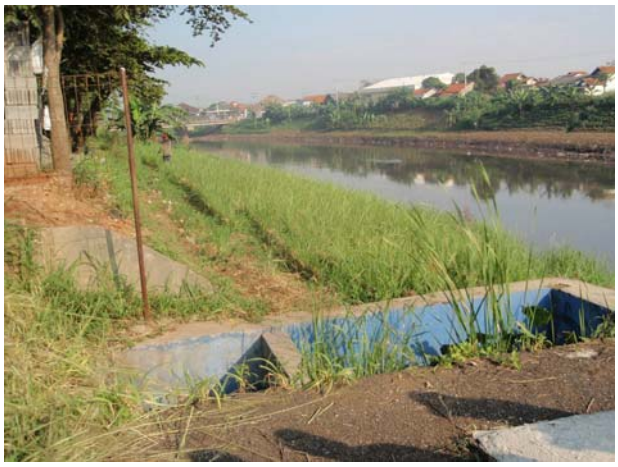
Relatively good establishment on the demonstration site during the dry season, with little fertilisers, four months after planting



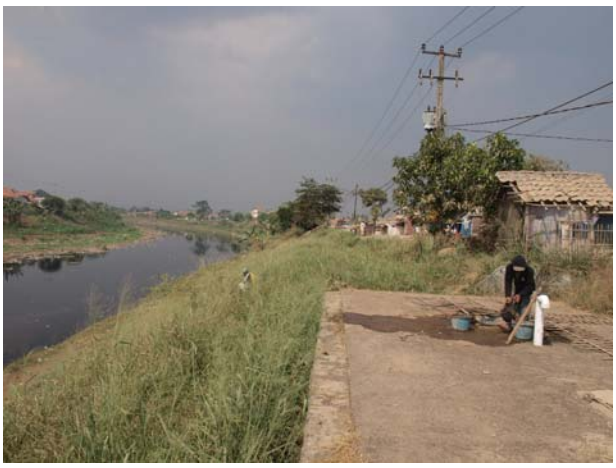
5.2 Septic tank

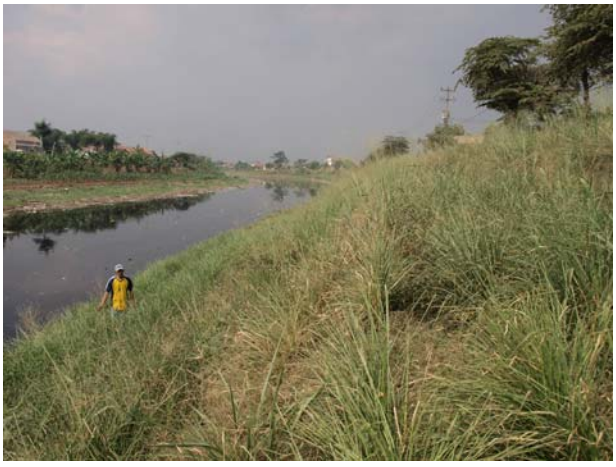
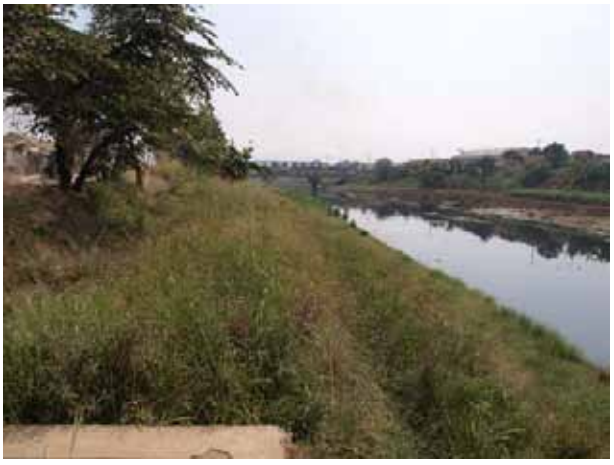
Two months after planting

Very good establishment and growth on the demonstration site. This is in sharp contrast to the poor growth on the terraces. The difference is due to the nutrient load discharged from the community septic tank

Four months after planting



Excellent establishment and growth on the demonstration site, four months after planting

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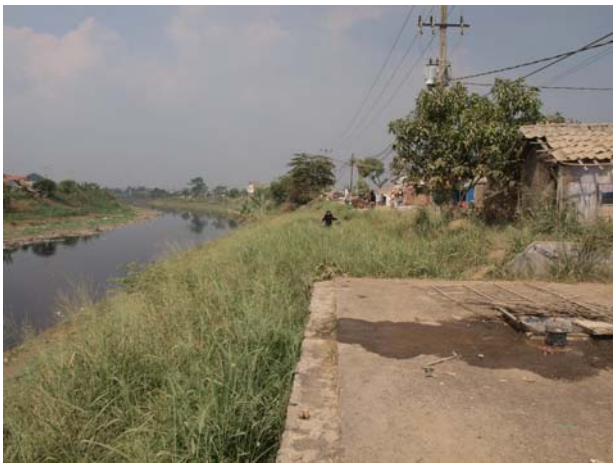


Although the level of nutrients discharged from the septic tank were monitored. With this vigour and biomass of the vetiver planting indicating that most if not all the discharged nutrients were taken up by Vetiver, preventing it running into the Citarum river.

6. CONCLUSION

Due the excellent community involvement program, the implementation phase went very smoothly and received overwhelmed support from the stakeholders, who were very enthusiastic and had taken every opportunity to learn the procedures and to discuss the pros and cons of various methods applied. With this background there is no doubt that the outcome of this program will convince the community to forge ahead to upscale the program to cover the major part of the Citarum River Basin.